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BOGGABRI COAL
OPERATIONS PTY LTD

**EPBC ACT OFFSET
MANAGEMENT PLAN**

wsp

MARCH 2020

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EPBC Act Offset Management Plan




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REV	DATE	DETAILS
A	11 February 2013	Draft
B	October 2018	Update following Revised Biodiversity Offset Strategy and Leard State Forest Regional Biodiversity Strategy Stage 2 – Strategy Report
C	29 November 2019	Update following Department of Environment and Energy review comments received 16 August 2019
D	6 March 2020	Update following Department of Agriculture, Water and the Environment review comments received 10 February 2020

	NAME	DATE	SIGNATURE
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DECLARATION OF ACCURACY

I, Daniel Martin, of Boggabri Coal Operations Pty Limited, being the approval holder for the Boggabri Coal Mine as assessed under Section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (to construct and operate an extension to the Boggabri Open Cut Coal Mine, including associated infrastructure) at Boggabri in New South Wales, have read and understood this Offset Management Plan. I understand the implications of the recommendations and management measures made in accordance with the Project's Conditions of Approval (EPBC 2009/5256).



6 March 2020

Environmental Superintendent



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GLOSSARY

ANZCCART	Australian and New Zealand Council for the Care of Animals in Research and Teaching
APVMA	Australian Pesticides and Veterinarian Medicines Authority
ARA	Appropriate regulatory authority
BACI	Before After Control Index
BBAM	BioBanking Assessment Methodology
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW) (formerly TSC Act)
BCOPL	Boggabri Coal Operations Pty Limited
BCP	Biodiversity Corridor Plan
BCPL	Boggabri Coal Pty Limited
Benchmark	BBAM benchmarks or appropriate monitoring analogue reference sites
Biodiversity Corridor	500 m vegetated biodiversity corridor between the Project Boundary and the Maules Creek Coal Mine lease.
BMP	Biodiversity Management Plan
BNCCA Act	<i>Brigalow and Nandewar Community Conservation Area Act 2005</i> (NSW)
BOAs	Biodiversity Offset Areas
BOS	Biodiversity Offset Strategy
Box Gum Woodland	White box - Yellow box - Blakely's Red Gum grassy woodlands and derived native grasslands CEEC
BTM Complex	Collective term for the Boggabri Coal Project, Tarrawonga Coal Project and Maules Creek Project
CCC	Boggabri Coal Community Consultative Committee
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CHPP	Coal Handling and Preparation Plant
CMA	Catchment Management Authority
DBH	Diameter at breast height
DNG	Derived Native Grassland
DoE	Commonwealth Department of the Environment (now DoEE)
DoEE	Commonwealth Department of the Environment and Energy (formerly DoE and SEWPAC)

DP&I	NSW Department of Planning and Infrastructure (now DP&E)
DP&E	NSW Department of Planning and Environment (formerly DP&I)
DPI	NSW Department of Primary Industries
DPI&E	NSW Department of Planning, Industry and Environment (now assuming the functions of the previous OEH and the DP&E, including the DRG)
DRG	NSW DP&E – Resources and Geoscience (formerly NSW Trade and Investment - Division of Resources and Energy and now administered by the DPI&E)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
EEC	Endangered Ecological Community
EPL	Environment Protection Licence
ha	Hectares
LFA	Landscape Function Analysis
LGA	Local Government Area
LLS	Local Land Services
MNES	Matters of National Environmental Significance
MOP	Mining Operations Plan
Mtpa	Million Tonnes Per Annum
NSW	New South Wales
OMP	Offset Management Plan
OEH	NSW Office of Environment and Heritage (functions now assumed by the DPI&E)
Part 3A	Part 3A of <i>Environmental Planning and Assessment Act 1979</i> (NSW)
PCT	Plant Community Type
POEO Act	<i>Protection of the Environment (Operations) Act 1997</i> (NSW)
SDS	Safety Data Sheet
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now DoEE)
SWMP	Surface Water Management Plan
RHDV	Rabbit Haemorrhagic Disease Virus
RLP Act	<i>Rural Lands Protection Act 1998</i> (NSW) (now repealed)

RMP	Rehabilitation Management Plan
RM	Remediation Plan
ROM	Run of Mine
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW) (now repealed)
WIRES	Wildlife Information and Rescue Service
WoNS	Weed of National Significance

1 INTRODUCTION

This Offset Management Plan (OMP) has been developed for the Boggabri Coal Project (the Project) on behalf of Boggabri Coal Operations Pty Ltd (BCOPL), a wholly owned subsidiary of BCOPL Australia Resources Pty Limited (80%), Chugoku Electric Power Australia Resources Pty Ltd (10%) and NS Boggabri Pty Limited (10%).

This report addresses Condition 12, 13 and 14 of the approval issued for the Boggabri Coal Mine Extension (EPBC 2009/5256) under section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on 11 February 2013 (EPBC Act Approval). Specifically, Condition 12, 13 and 14 of the EPBC Act Approval, require BCOPL to prepare and implement an Offset Management Plan.

Management measures, performance criteria and procedures contained in this OMP provide a framework for managing biodiversity values within the Biodiversity Offset Areas (BOAs) throughout the operation of the Project.

This OMP is a working document subject to regular reviews made in consultation with key environmental stakeholders, including the Commonwealth Department of the Environment and Energy (DoEE), NSW Department of Planning, Industry and Environment (DPI&E), North West Branch of the Local Land Services (LLS) (formerly Namoi Catchment Management Authority (CMA)) and the Boggabri Coal Community Consultative Committee (CCC).

1.1 BACKGROUND TO THE PROJECT

The Project comprises an open cut coal mine located approximately 15 km north-east of the township of Boggabri in north-western NSW. Exploration and development studies commenced in the vicinity of the Boggabri Coal Mine in 1976. Approval for mining operations was initially granted on 22 August 1989 under Part 4 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act). Major development of the mine site began in the mid 2000's, with coal mining commencing in 2006 using truck and shovel methods. Infrastructure constructed for the mine before production of coal included:

- 17 km bitumen sealed private coal haul road from the mine to the Boggabri Coal Terminal rail
- loading facility, including bridges over the Namoi River and Kamilaroi Highway
- ROM and product coal stockpiles
- coal crushing plant
- conveyor and truck load out facility
- three km rail loop and turnout
- mine infrastructure area including workshop and offices.

In 2009, the predecessor of BCOPL, Boggabri Coal Pty Ltd (BCPL) lodged a major project application under the now-repealed Part 3A of EP&A Act. This continuation is known as the Boggabri Coal Project and it includes:

- production of up to seven Million tonnes per annum (Mtpa) product coal
- construction of an additional Coal Handling and Preparation Plant (CHPP)
- a 17 km rail spur line and rail load-out facility running from the main line to the CHPP
- upgraded mining fleet, including use of a dragline
- upgrades of other ancillary infrastructure.

The Boggabri Coal Project was approved under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2009/5256), which was awarded on 11 February 2013. Impacts associated with the Boggabri Coal Project were assessed through the Continuation of Boggabri Coal Mine Environmental Assessment December 2010 (Hansen Bailey, 2010) (the 2010 EA).

BCPL subsequently applied for modifications of the Project Approval, to modify the Project's Approval boundary for additional activities and ancillary infrastructure. Environmental assessments in accordance with the EP&A Act have been completed for Modification 3, 4 and 5.

The Project and locality are illustrated in Figure 1.1.

The following definitions apply throughout this document:

- **Project Boundary** — the 3,399 ha area adopted to assess biodiversity values directly or indirectly affected by the construction and/or operation of the Project. This includes the active pit and emplacement areas of Coal Lease 368, infrastructure areas occupied by the private haul road, rail spur and power-line easement and the Boggabri Coal Terminal. This area encompasses Boggabri Existing and Boggabri Extension.
- **Boggabri Existing Boundary** — the 1,176 ha area approved for mining under the original Development Consent (DFN 79/1443(z)2). The consent allowed for the mining of up to 5 Million tonnes per annum (Mtpa) product coal for a period of 21 years until 14 November 2011.
- **Modification 2 Boundary** — the 118 ha area adopted to assess biodiversity values directly or indirectly affected by the Modification.
- **Modification 3** — construction of permanent mine access from the Kamilaroi Highway, temporary storage of processed mine over burden material at existing rock quarry and reuse of material for construction of the rail spur embankments and reuse of the Daisymede laydown compound.
- **Modification 4** — adjustment of project boundary, alterations to existing infrastructure, construction of security fence and the use of addition portable fuel storages within operational areas.
- **Modification 5** — Construction and operation of production bores and associated infrastructure on the Heathcliffe, Cooboobindi, Roma, Belleview and Victoria Park properties including 11 kV power lines, above and below ground pipelines and access tracks.
- **Boggabri Extension** — the 658 ha area approved by DP&I for mine expansion on 18 July 2012. In essence, Boggabri Extension comprises the development which is not described in the original project Environmental Impact Statement (EIS) approved in 1987.
- **Biodiversity Offset Areas (BOAs)** — the revised Continuation of Boggabri Coal Biodiversity Offset Strategy (Biodiversity Offset Strategy) (WSP, 2017) incorporates approximately 23 properties within four management zones and ten distinct offset areas:
 - Eastern Offsets
 - Sunshine (738.0 ha).
 - Nioka North (857.6 ha).
 - Braefield (1,400.7 ha).
 - Central Offsets
 - Mallee BOA (2,066.2 ha).
 - Myall Plains BOA (473.3 ha).
 - Wirrilah BOA (884.2 ha).
 - Goonbri BOA (231 ha).
 - Namoi Offsets
 - Namoi BOA (3,214.9 ha).
 - Jerralong BOA (570.1 ha).
 - Western Offsets
 - Merriendi BOA (483.2 ha).
- **Regional East-West Wildlife Corridor** — an important environmental corridor that historically linked Leard State Forest with the Nandewar Range, Namoi River and large vegetation remnants to the west. The Biodiversity Offset

Strategy (Parsons Brinckerhoff, 2010b) and Revised Biodiversity Offset Strategy (WSP, 2018) aims to recreate habitat linkages within this corridor.

1.2 ADDITIONAL BIODIVERSITY OFFSETS

A revision to the original approved BOS (Parsons Brinckerhoff, 2010b) was required for the Project to address:

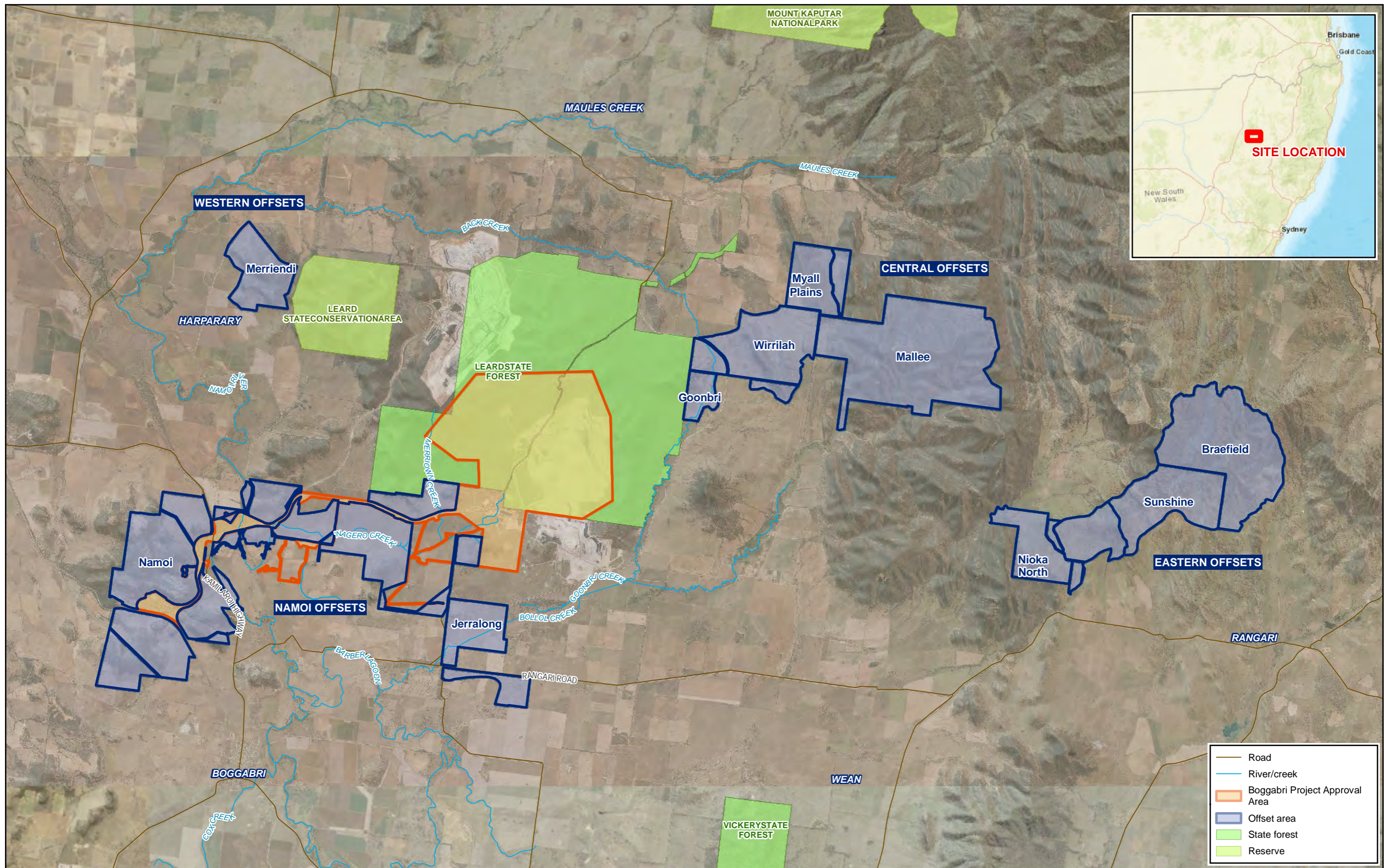
- additional residual offset commitment required under Condition 7 (and described in Attachment B of the Project’s EPBC Act Approval), incorporating 1,000 ha of offset for the protection of 650 ha of Box Gum Woodland and restoration of 350 ha of Box Gum Woodland Derived Native Grassland (DNG)
- minor modifications to the project boundary and the relocation of Goonbri Road within the previously identified biodiversity offsets
- changes to the type and extent of vegetation/habitats within identified offsets resulting from the independent verification under Condition 9 of the EPBC Act Approval).

To meet the Project's residual offset requirements under Condition 7, Boggabri Coal have acquired five additional BOAs. Each of the additional BOAs are within the study area of the Leard State Forest Regional Biodiversity Stage (2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017), contribute to the Regional East-West Wildlife Corridor and fulfil the Project Approvals, which require offsetting an additional 1,000 ha of Box Gum Woodland. These additional BOAs are summarised below in Table 1.1.

Table 1.1 Additional BOAs acquired to fulfil biodiversity offset requirements

BOA	BOA AREA (HA)	AREA OF REMNANT BOX GUM WOODLAND TO BE PROTECTED (HA)	AREA OF BOX GUM WOODLAND DNG TO BE RESTORED (HA)
Sunshine	738.0	240.5	248.8
Nioka North	857.6	291.5	265.2
Goonbri	231.0	72.3	88.3
Jerralong	570.1	0	0
Braefield	1,400.7	194.3	55.4
Total (ha)	3,797.4	798.6	757.7

A description of the values within each of the BOAs are provided in Section 3.2.



	Road
	River/creek
	Boggabri Project Approval Area
	Offset area
	State forest
	Reserve

Scale 1:125,000
 Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery: BCPL (2018); Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri
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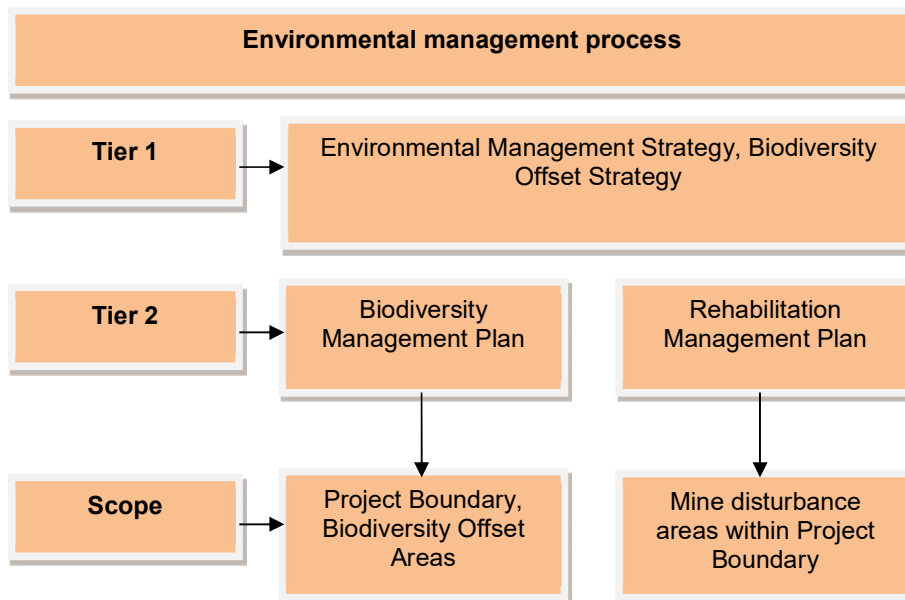
FIGURE 1.1
 LOCALITY PLAN
 TITLE:

1.3 PLAN CONTEXT

This OMP forms part of Boggabri Coal’s environmental management process, which manages environmental issues associated with the Project. The process consists of a Tier 1, Environmental Management Strategy document that details the overall approach to environmental management, and a series of Tier 2 documents, including:

- a Mining Operations Plan (MOP)
- an overarching Construction Environmental Management Plan (CEMP)
- various Environmental Management Plans (EMPs).

Inset 1 summarises the process for managing biodiversity across the Project.



Inset 1 Biodiversity management across the Project

The implementation of the Biodiversity Offset Strategy (BOS) (WSP, 2018) and management of biodiversity values for the Project are directed by the following documents:

- Offset Management Plan – this document which directs the management actions, monitoring requirements and performance and completion criteria for the management of biodiversity values across all BOAs thereby addressing EPBC Act Approval Conditions 12, 13 and 14.
- Biodiversity Management Plan (BMP) – a management plan which directs the management actions, monitoring requirements and performance and completion criteria for the management of biodiversity values associated with the Project (including management of BOAs) in accordance with the Project’s State conditions of approval.
- Rehabilitation Management Plan (RMP) – management plan which directs the rehabilitation of mine disturbance areas and associated monitoring, reporting and closure requirements in accordance with EPBC Act Approval Condition 21, 22, 23, 24 and 25 and Schedule 3 Condition 49, 71 and 72 of the Project’s State conditions of approval.
- Biodiversity Corridor Plan (BCP) – management plan which directs the management actions, monitoring requirements and performance and completion criteria for the management of biodiversity values associated with the Biodiversity Corridor in accordance with EPBC Act Approval Condition 3.

- Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017)– provides a framework for the development, implementation and management of biodiversity offset programs resulting from future mining proposals and other significant land use changes in the region.

1.3.1 PURPOSE OF THIS OMP

This OMP has been prepared specifically to address EPBC Act Approval Conditions 12, 13 and 14 (EPBC/2009/5256) (refer to Section 2). The document provides practical instruction for the management and control of risks to biodiversity associated with the implementation of the Project’s BOS (WSP, 2018).

1.3.2 CONSULTATION AND BACKGROUND OF BIODIVERSITY MANAGEMENT PLANS

The Boggabri Coal environmental management process has evolved with the expansion of the Project, with regulatory review and input provided at each key milestone and approval event. Regulatory authorities and other key stakeholders have been engaged to provide input on biodiversity issues and their management throughout this process. These have included DoEE (formerly DoE), DPI&E (formerly DP&E, DP&I, OEH and DRG), DPI, North West Branch of the LLS (formerly Namoi CMA), Forests NSW and the CCC.

Preparation of and the continual adaption of the BMP, and subsequently this OMP, has been undertaken in consultation with departments now represented by the DPI&E (formerly OEH), Forests NSW, DoEE, the former DP&I and the Namoi CMA, as detailed below:

- on 12 July 2012 BCPL engaged DoEE by phone to discuss the scoping requirements of this BMP with regard to the EPBC Act
- on 18 July 2012 BCPL and Parsons Brinckerhoff (now WSP) met with David Kitto from the former DP&I) to discuss the Projects Approval conditions specifically in relation to the BMP and request comments on the BMP and BOMP previously prepared for Modification 2
- on 19 July 2012 BCPL and Parsons Brinckerhoff met with Peter Christie and Rob Taylor from the former OEH to discuss the requirements of the BMP and request comments on the BMP and BOMP previously prepared for Modification 2.

Initial comments on the BMP for Modification 2 were received from the former DP&I and former OEH on 10 September 2012. These comments were considered in the preparation of the BMP (Rev No. 1). BCPL undertook further consultation with representatives of the CCC, DoEE, the former DP&I, the former Namoi CMA and the former OEH in the preparation of the BMP (Rev No. 1) as detailed below:

- on 24 September 2012 BCPL and Parsons Brinckerhoff met with Peter Christie from the former OEH and Steve O’Donoghue from the former DP&I to discuss regulators comments on the BMP
- on 25 September 2012 BCPL and Parsons Brinckerhoff met with David Kitto from the former DP&I to discuss further comments provided on the BMP and the potential for an interim staged approval of the document focusing on the management of biodiversity and the operation impacts of mining over the 18 months prior to the completion of the revised regional biodiversity offset strategy
- on 16 October 2012 BCPL presented the BMP to the CCC. This presentation included a detailed questions and answers. Key issues raised included:
 - feral animal control
 - providing community consultation on the integrated land management
 - cumulative effects of mining
 - conflicts between land use changes for conservation offsets and agriculture.

BCPL sent the revised BMP (Rev No. 1) for comment and review to the former Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC), former DP&I and OEH, and the former Namoi CMA. Feedback provided by the former DP&I and former OEH was provided on 4 October 2012.

The former SEWPAC provided the following written correspondence on 14 October 2012:

“As discussed, the department will start reviewing this plan but is unable to provide comments prior to a decision on the Boggabri Coal Project Extension. If the project is approved, the department will assess the Biodiversity Management Plan against any relevant conditions that are attached to that approval”.

The Boggabri Coal Project Extension (i.e. the Project) has been approved and now the DoEE will be able to complete the review of the BMP.

The former Namoi CMA provided comments on the BMP on 2 October 2012 and identified that:

“Namoi CMA has reviewed the Draft BMP and found it to be consistent with the following Namoi CMA’s plans and policies:

- Namoi CMA’s CAP 2010-2020
- Namoi CMA — Extracted Industries Policy
- Namoi CMA — Biodiversity Offset Strategy

Namoi CMA is satisfied with the management measures and procedures contained in the Draft BMP.”

In 2015 BCOPL further consulted with representatives of the CCC, DoE, the former DP&I, former Namoi CMA and former OEH in the preparation of preparation of the BOS as detailed below:

- on 21 April 2015 BCOPL and Parsons Brinckerhoff met with Peter Christie from the former OEH to present the revised BOS properties and implementation plans for threatened biodiversity
- on 23 April 2015 BCOPL and Parsons Brinckerhoff met with Dennis Boschma from the North West Branch of the LLS to present and discuss the additional properties for inclusion in the BOS and implementation plans for threatened species
- on 4 June 2015 BCOPL and Parsons Brinckerhoff met with Steve O’Donoghue from their former DP&E and former OEH to inspect the recent biodiversity offset acquisitions
- detailed ecological reports on the biodiversity offset properties were also provided to the former DP&E in June 2015
- on 26 October 2015 BCOPL and Parsons Brinckerhoff met with their former DP&E to further discuss the submitted BOS and implementation plans for threatened biodiversity
- on 19 November 2015 a summary of the key changes were presented to CCC members during the meeting.

In 2017 BCOPL further consulted with representatives of the former OEH, former DP&E and DoEE regarding the revised BOS and BMP as detailed below:

- on 1 June 2017 BCOPL and WSP met with Steve Cox, Renee Shepherd from OEH and Steve O’Donoghue from DP&E to discuss finalising the revised BOS and updates to the BMP
- on 13 June 2017 BCOPL and WSP met with representatives from the DoEE regarding finalising the revised BOS and updates to the BMP
- on 7 December 2017 Idemitsu submitted a revised version of the BMP to the former OEH seeking comment and review
- on 13 April 2018 BCOPL received from the former OEH detailed review comments on the submitted BMP.

Additional recommendations were also made on the BMP in the Independent Biodiversity Audit (IBA) by Umwelt Pty Ltd on 15 May 2018.

2 STATUTORY REQUIREMENTS

2.1 COMMONWEALTH STATUTORY REQUIREMENTS

The following Commonwealth statutory requirements associated with managing the BOAs have been considered during the development of this OMP.

2.1.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act protects Matters of National Environmental Significance (MNES), including migratory species and threatened species/ecological communities. Previous surveys and assessments have identified that the Project will impact upon EPBC Act listed ecological communities and native vegetation which provides potential habitat for threatened species including the Swift Parrot, Regent Honeyeater and Corben's Long-eared Bat (Table 2.1 and (Hansen Bailey, 2010)).

The Project's EPBC Act Approval is subject to several conditions imposed by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (now Minister for the Department of Environment and Energy (DoEE)) (refer Table 2.1).

Based on the potential impacts to MNES, the Project was determined to be a controlled action under the EPBC Act, with impact assessment and regulatory approval provided through a bilateral process (Part 3A of the EP&A Act), requiring approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

In regards to biodiversity offsets, the principles for the use of environmental offsets under the EPBC Act are outlined in the current *Environment Protection and Biodiversity Conservation Act 1999 Environmental Biodiversity Offsets Policy* (EPBC Act Offsets Policy). The objective of the EPBC Act Offsets Policy is to ensure the best environmental outcomes are achieved through the consistent, transparent and equitable application of offsets under the EPBC Act.

As the Project involves actions that affect MNES, offsets must be targeted to the aspect of the environment that is being impacted. An improved conservation outcome will be achieved by:

- improving existing habitat for the protected matter
- creating new habitat for the protected matter
- reducing threats to the protected matter
- averting the loss of a protected matter or its habitat that is under threat.

The BOS has been designed with reference to the EPBC Act Offsets Policy and in consultation with DoEE. It is noted that assessment under the EPBC Act is only required for impacts resulting from Boggabri Coal Project granted under the Project approval, as all impacts associated with Boggabri Existing were historically approved under the *Environment Protection (Impact of Proposals) Act 1974* (Cth), which did not necessitate the provision of biodiversity offsets.

Table 2.1 EPBC Act Conditions of Approval relevant to offset areas, reporting and auditing

APPLICABLE CONDITION	REQUIREMENT	OMP REFERENCE
Offset areas – Mechanism to secure offsets		
Condition 7	<p>The person taking the action must register a legally binding conservation covenant over the offset areas of 5,866.1 ha of ‘equivalent or better’ quality of threatened species habitat defined as native vegetation communities. This must include no less than 1537.4 ha ‘equivalent or better’ quality of White Box – Yellow Box – Blakely’s red Gum Grassy Woodland and Derived Native Grassland ecological community.</p> <p>The offset areas are those defined at Attachment B of these conditions, or alternative areas agreed in writing by the Minister.</p>	Section 3.2.1.1
Condition 8	The conservation covenant/s, listed in condition 7, must provide protection in perpetuity for the offset area and be registered within 5 years of the date of this approval.	Section 2.1 Section 5.3
Condition 9	<p>The person taking the action must verify through an independent review by 30 December 2013, the quantity and quality of habitat or potential habitat for the regent honeyeater, swift parrot and greater long-eared bat of all proposed offset areas.</p> <p>The review will:</p> <p>validate the quantity, quality and ecological characteristics of the offset areas in line with the requirements of the departments <i>Environment Protection and Biodiversity Conservation Act 1999</i> Environmental Offsets policy October 2012.</p> <p>Be undertaken by ecological experts who have been agreed in writing by the department.</p>	Section 3.1.2 Section 3.2
Condition 10	<p>If the independent review finds that the minimum quantities of threatened species habitat and ecological community required under condition 7 do not meet the ‘equivalent or better’ quality, or the criteria required under condition 9a, then additional areas must be protected until all the relevant criteria under condition 9 are met.</p> <p>Note: the 1537.4 ha of White Box Yellow Box Blakely’s Red Gum Grassy Woodland and Derived Native Grassland ecological community may be inclusive of the 5866.1 ha of habitat for the woodland species, as long as it meets the listing criteria for the EPBC-listed critically endangered ecological community as defined in the EPBC listing advice for that community and the quantity and quality is validated through the independent review.</p>	Section 3.1 Section 3.2
Offset areas – Offset management plan		

APPLICABLE CONDITION	REQUIREMENT	OMP REFERENCE
Condition 12	<p>To offset the impacts to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland and the habitat of the regent honeyeater, swift parrot and greater long-eared bat, the person taking the action must submit to the Minister for approval an Offset management plan for all of the offset areas, specified in condition 7, within 6 months of the date of this approval. The approved Offset management plan must be implemented prior to the commencement of new mining operations.</p> <p>Note: for consistency, the person taking the action may develop a Biodiversity Management plan that includes the requirements set for managing offsets as set out in these conditions, to align with the requirements of the NSW state government Project Approval dated 18 July 2012 (application number 09 0182) and this approval.</p>	This OMP, Section 3.2 and Section 6.3 and Appendix D (Threatened biodiversity implementation plans)
Condition 13	<p>The <i>Offset management plan</i> must include, but not be limited to, the following information:</p> <p>A) objectives to clearly identify baseline conditions of the offset sites, establish performance indicators and discuss methods for adaptive management</p>	Section 3.2 Section 7.1 Section 7.2 Appendix C (2015 BOA Baseline Survey)
	<p>B) a text description and map to clearly define the location and boundaries of the offset areas. This must be accompanied by the offset attributes and shapefiles.</p>	Section 3.1 Section 3.2 Appendix C (2015 BOA Baseline Survey)
	<p>C) a detailed survey and description (prior to any management activities, hence a baseline) of the current condition of the extant vegetation of each offset area. This must be consistent with the State and Transition Model, including but not limited to:</p> <ul style="list-style-type: none"> — location of survey points (GPS reference) — vegetation condition mapping — photo reference points 	Section 3.2 Appendix C Appendix C (Appendix B – Summary of monitoring sites) Section 3.2; Appendix C Appendix C (Appendix F – Replicate monitoring site photographs)
	<ul style="list-style-type: none"> — tree age class representation 	Appendix C

APPLICABLE CONDITION	REQUIREMENT	OMP REFERENCE
	<ul style="list-style-type: none"> — percentage tree canopy cover 	Appendix C (Appendix E – Vegetation benchmark data)
	<ul style="list-style-type: none"> — number of native plant species in ground layer 	Appendix C (Appendix C – Flora data) (Appendix E – Vegetation benchmark data)
	<ul style="list-style-type: none"> — percentage of nativeness of total plant groundcover (herbaceous plants and small shrubs, 1 m tall), measured using basal area 	Appendix C (Appendix E – Vegetation benchmark data) Appendix E (Appendix C–Flora data)
	<ul style="list-style-type: none"> — description of fauna habitat including condition, type and connectivity 	Section 3.2
	<ul style="list-style-type: none"> — surveys of the regent honeyeater, swift parrot and greater long-eared bat 	Appendix C (Chapter 11 – Targeted Regent Honeyeater and Swift Parrot surveys) (Chapter 12 – Targeted Corben’s Long-eared Bat survey)
	<p>D) Plans to improve upon the baseline condition (identified in the surveys required by condition 13c) consistent with the State and Transition Model, EPBC listing advice, and threatened species habitat defined as native vegetation communities, including but not limited to:</p>	Section 3.2 Section 6.3
	<ul style="list-style-type: none"> — a map showing areas to be managed 	Section 3.2 Section 6.3 Appendix C
	<ul style="list-style-type: none"> — management actions for each area and details of management methods to be used 	Section 6.2 Section 6.3
	<ul style="list-style-type: none"> — timing of management activity for each area 	Section 6.3

APPLICABLE CONDITION	REQUIREMENT	OMP REFERENCE
	<ul style="list-style-type: none"> — performance criteria for each area — a set of measurable ecological indicators for detecting changes to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, including those that may be ascribed to ongoing water stress — a monitoring plan to assess the success of the management activities measured against the baseline condition. The monitoring must be statistically robust and able to quantify change in the condition of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This should include, but not be limited to, control sites and periodic ecological surveys to be undertaken by a qualified ecologist — a description of the potential risks to successful management against the performance criteria, and a description of the contingency measures that would be implemented to mitigate these risks — a process to report, to the department, the progress of management activities undertaken in the offset areas and the outcome of those activities, including identifying any need for improved management and activities to undertake such improvement — details of the various parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor. 	<p>Section 7.2</p> <p>Section 7.1 Appendix C</p> <p>Section 7.1 Appendix C</p> <p>Section 7.3 Section 7.4</p> <p>Section 8</p> <p>Section 9</p>
Condition 14	Unless otherwise agreed to in writing by the department, the baseline surveys (identified in the surveys required by condition 13c) must be conducted in accordance with the department's Survey guidelines for Australia's threatened birds and the survey guidelines for Australia's threatened bats. Subsequent monitoring must be carried out annually at the same time of year as the baseline surveys each year unless otherwise agreed to in writing by the department.	Section 7.1 Section 7.1.1.4 Appendix C
Leard Forest Mining Precinct Regional Biodiversity Strategy		
Condition 20	The person taking the action must implement the regional biodiversity strategy as required under conditions 40-46 of the NSW state government Project Approval dated 18 July 2012 (application number 09_0182). The required scoping report for the development of the strategy must be submitted to the Minister for approval on or before 31 July 2013. The approved strategy must be implemented.	Section 2.2

APPLICABLE CONDITION	REQUIREMENT	OMP REFERENCE
Reporting and auditing		
Condition 28	Within three months of every 12 month anniversary of the commencement of new mining activities, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any plans as specified in the conditions. Documentary evidence providing proof of the date of publication and no-compliance with any of the conditions of this approval must be provided to the department at the same time as the compliance report is published. The person taking the action must also notify any non-compliance with this approval to the department in writing within two business days of becoming aware of the non-compliance.	Section 8.3
Condition 29	Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	Section 8.7
Condition 30	If the person taking the action wishes to carry out any activity otherwise than in accordance with the plans, as specified in the conditions, the person taking the action must submit to the department for the Minister's written approval a revised version of that plan. The varied activity shall not commence until the Minister has approved the revised plan in writing. The Minister will not approve a revised plan, unless the revised plan would result in an equivalent or improved environmental outcome. If the Minister approves the revised plan that plan must be implemented in place of the plan originally approved.	Section 8.6.2
Condition 31	If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and communities or listed migratory species to do so, the Minister may request that the person taking the action make specified revisions to the management plan specified in the conditions and submit the revised plan for the Ministers written approval. The person taking the action must comply with any such request. The revised approved plan must be implemented. Unless the Minister has approved the revised plan then the person taking the action must continue to implement the originally approved plan, as specified in the conditions.	Section 8.6.2

2.2 ADDITIONAL STANDARDS AND GUIDELINES

The Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt, 2017) was developed to establish a long-term consistent framework of management, monitoring and land use security for all biodiversity conservation areas within the region; particularly those biodiversity offset areas related to open cut coal mines within and adjoining Leard State Forest.

As stated in Condition 20 of the EPBC Act Approval, BCOPL must implement the regional biodiversity strategy as required under Conditions 40-46 of the NSW State Government Project Approval dated 18 July 2012 (application number 09_0182). As such, the management and monitoring framework within this OMP have been aligned to those detailed in the Leard Forest Regional Biodiversity Strategy to ensure consistency with other biodiversity conservation areas within the region. Additional publications, standards and codes of practice applicable to biodiversity management associated with the Project are listed in Table 2.2.

Table 2.2 Additional guidelines

TYPE	DOCUMENT TITLE	REFERENCE
General guidelines	<i>Namoi Catchment Action Plan</i>	(Namoi Catchment Management Authority 2006)
Flora and fauna guidelines	<i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities</i>	(Department of Environment and Conservation, 2004)
	Survey and assessment guidelines for threatened birds, frogs, reptiles, bats and mammals	(Department of Environment Water Heritage and the Arts, 2011b, Department of Environment Water Heritage and the Arts, 2011a, Department of Environment Water Heritage and the Arts, 2010a, Department of Environment Water Heritage and the Arts, 2010b, Department of Environment and Climate Change, 2009)
	<i>National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Grassy Woodland)</i>	(Department of the Environment Water Heritage & Arts, 2010)
Biodiversity offset guidelines	<i>A Guide to Managing Box Gum Grassy Woodlands</i>	(Rawlings et al., 2010a)
	<i>Principles for the use of Biodiversity Offsets in NSW.</i>	(Department of Environment and Climate Change, 2008)
	<i>BioBanking – A Biodiversity Offsets and Banking Scheme. Conserving and restoring biodiversity in NSW, working paper</i>	(Department of Environment and Conservation, 2006)
	<i>BioBanking Assessment Methodology</i>	(Department of Environment Climate Change and Water, 2009) and (Office of Environment and Heritage, 2014)
	<i>EPBC Act Environmental Offsets Policy - Consultation Draft</i>	(Department of Sustainability Environment Water Population and Communities, 2011)
	<i>Cost Effective Feral Animal Exclusion Fencing for Areas of High Conservation Value in Australia</i>	(National Heritage Trust, 2004)

3 EXISTING ENVIRONMENT

Biodiversity values within the Project Boundary and BOAs are summarised in Section 3.1 and Section 3.2 respectively. A summary of the locality is provided in Table 3.1.

Table 3.1 Locality information

CRITERIA	LOCATION
Council	Narrabri and Gunnedah
CMA	Namoi
CMA sub-region	Liverpool Plains, Peel
Bioregion	Brigalow Belt South, Nandewar
Mitchell landscapes	<p>Project Boundary: Liverpool Alluvial Plains, Mooki - Namoi Channels and Floodplains, Bugaldie Uplands</p> <p>Mallee BOA: Tamworth - Keepit Slopes and Plains, Split Yard Plateau, Bugaldie Uplands</p> <p>Merriendi BOA: Bugaldie Uplands, Liverpool Alluvial Plains</p> <p>Myall Plains BOA: Tamworth - Keepit Slopes and Plains, Liverpool Alluvial Plains</p> <p>Namoi BOA: Liverpool Alluvial Plains, Mooki - Namoi Channels and Floodplains, Upper Namoi Swamps and Lagoons, Bugaldie Uplands, Cubbo Uplands</p> <p>Goonbri BOA: Bugaldie Uplands</p> <p>Jerralong BOA: Liverpool Alluvial Plains</p> <p>Wirrilah BOA: Tamworth — Bugaldie Uplands, Liverpool Alluvial Plains, Tamworth — Keepit Slopes and Plains</p> <p>Sunshine BOA: Liverpool Alluvial Plains, Tamworth – Keepit slopes and Plains</p> <p>Nioka North BOA: Liverpool Alluvial Plains, Tamworth – Keepit slopes and Plains</p> <p>Braefield BOA: Tamworth – Keepit slopes and Plains.</p>

3.1 PROJECT BOUNDARY

A large portion of the land within the Project boundary is located within Leard State Forest, which covers an area of 8,134 ha; the majority of which is natural vegetation. Surrounding land uses include mineral extraction and rural activities, including pasture improvement, cropping and cattle grazing.

The mining portion of the Project boundary lies within a large relatively intact patch of remnant vegetation surrounded by a landscape that has been modified significantly through anthropogenic disturbance associated with the above listed land uses. The biodiversity values of the Project boundary have been extensively assessed and documented from concept studies completed in 1976, to detailed surveys completed for the continuation of mining submission.

Ecological surveys have been completed within the locality as part of the following studies:

- Boggabri Coal Biodiversity Monitoring Programs, which include:
 - Annual Leard State Forest Biological Monitoring (2006 to 2019)
 - Annual Biodiversity Corridor Monitoring (2013 to 2019)
 - Annual Mine Rehabilitation Area Monitoring (2012 to 2019)
 - Annual BOA Monitoring (2012 and 2014 to 2019).

- Boggabri Coal – Biodiversity Survey Report for Braefield (Parsons Brinckerhoff, 2015a)
- Boggabri Coal – Biodiversity Survey Report for Sunshine and Nioka North (Parsons Brinckerhoff, 2015b)
- Project modification ecological assessments
- Goonbri Road Upgrade Ecological Assessment
- *Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment* (Parsons Brinckerhoff, 2010a).
- *Preliminary vegetation mapping and survey report for Boggabri Coal lease* (Parsons Brinckerhoff, 2009).
- *Flora and Fauna Summary of the Boggabri Coal Project* (Parsons Brinckerhoff, 2005).
- *Results of Fauna survey work undertaken by the NSW National Parks and Wildlife Service within Leard State Forest* (Pennay, 2001).
- *Report on the botany, wildlife and ecology of the Leard State Forest. Draft Environmental Impact Statement for Amax-BHP Joint Venture Boggabri Coal Project* (James B. Croft and Associates, 1983).
- *Boggabri Coal Mine Independent Biodiversity Offsets Audit* (Niche Environment and Heritage, 2014).

Biodiversity values within the Project boundary are described in Sections 3.1.1 and 3.1.2. This information is based on findings of previous studies noted above, particularly the results of seasonal surveys completed between December 2008 and September 2009 for the *Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment* (Parsons Brinckerhoff, 2010a).

3.1.1 FLORA

Flora values within the Project boundary are illustrated in Figure 3.1 below and described in the following sections.

3.1.1.1 VEGETATION COMMUNITIES

Sixteen distinct vegetation communities have been recorded in the Project boundary (Parsons Brinckerhoff 2010) (Figure 3.1).

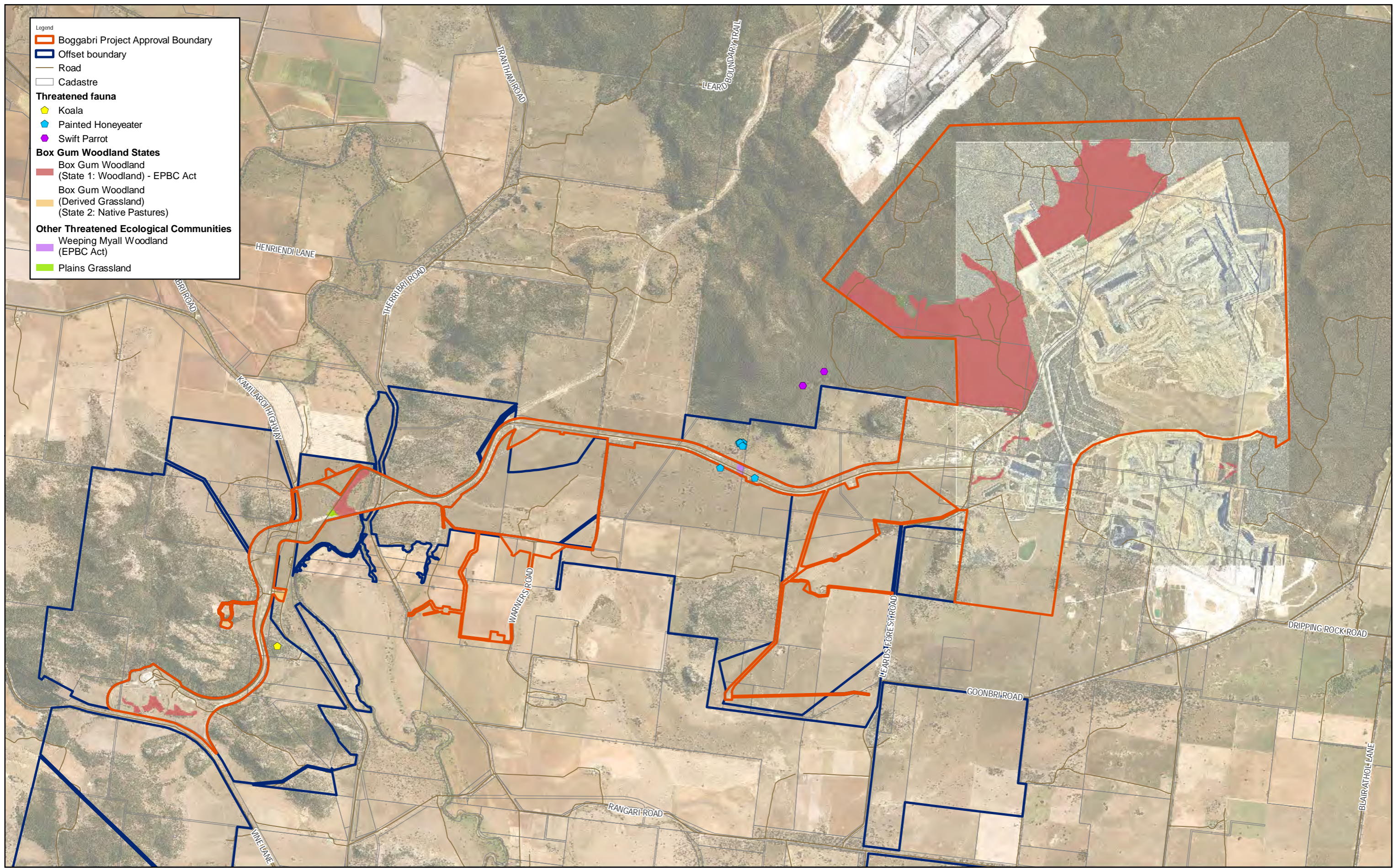
3.1.1.2 THREATENED ECOLOGICAL COMMUNITIES

Three ecological communities listed under the EPBC Act have been recorded within the Project Boundary (Parsons Brinckerhoff, 2010a) (Table 3.2).

Table 3.2 Threatened ecological communities and corresponding vegetation communities within the project boundary

THREATENED ECOLOGICAL COMMUNITY	CORRESPONDING VEGETATION COMMUNITY WITHIN THE PROJECT BOUNDARY ¹	AREA REMOVED WITHIN PROJECT BOUNDARY (HA)
EPBC Act		
White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered	White Box – White Cypress Pine grassy woodland White Box – Narrow-leaved Ironbark – White Cypress Pine grassy open forest Yellow Box – Blakely’s Red Gum grassy woodland	629.3
Weeping Myall Woodlands — Endangered	Weeping Myall grassy open woodland	0.4
Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld – Critically Endangered	Plains Grassland	0.5

(1) Refer to Figure 3.1.



Legend

- Boggabri Project Approval Boundary
- Offset boundary
- Road
- Cadastre

Threatened fauna

- ◆ Koala
- ◆ Painted Honeyeater
- ◆ Swift Parrot

Box Gum Woodland States

- Box Gum Woodland (State 1: Woodland) - EPBC Act
- Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)

Other Threatened Ecological Communities

- Weeping Myall Woodland (EPBC Act)
- Plains Grassland


0 0.5 1 Kilometres

Scale 1:50,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery: BCPL (2015) and

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REVIEW:	N.Cooper
DATE:	28/11/2019

3.1.1.3 THREATENED FLORA SPECIES

A review of biodiversity databases indicated that four threatened flora species have been recorded or are predicted to occur within 20 km of the Project boundary. One of these threatened flora species were recorded within the Project boundary during seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff, 2010a) (Figure 3.1):

- *Pultenaea setulosa* - listed as Vulnerable under the EPBC Act

An additional threatened species *Tylophora linearis* was identified within the Project boundary and 2014 clearing area during seasonal surveys undertaken between May and July 2014 (Parsons Brinckerhoff, 2014).

A further two threatened flora species have potential to occur in the Project Boundary with a moderate or greater likelihood:

- *Digitaria porrecta* – listed as Endangered under the EPBC Act
- *Diuris tricolor* – listed as Vulnerable under the EPBC Act.

3.1.1.4 INTRODUCED AND NOXIOUS WEEDS

Survey of the Project boundary has identified four species classified as a Weed of National Significance (WoNS) (Weeds Australia, 2011), including:

- *Lycium ferocissimum* (African Boxthorn)
- *Opuntia aurantiaca* (Tiger Pear)
- *Opuntia stricta* (Common Prickly Pear)
- *Rubus ulmifolius* (Blackberry).

A Weed and Pest Management Strategy for the Project Boundary is provided as Appendix B of this OMP.

3.1.2 FAUNA

MNES Fauna values within the Project boundary are illustrated in Figure 3.1 and described in the following sections.

3.1.2.1 FAUNA HABITAT TYPES

The suitability, size and configuration of the fauna habitats within the Project boundary correlate broadly with the structure and quality of the local and regional vegetation types. Fauna habitats, particularly those located in the Leard State Forest, provide moderate to good condition habitat for a range of woodland birds, mammals (particularly microchiropteran bats) and reptiles.

Habitat features recorded in the Project boundary generally include those associated with grassy woodlands on fertile soils, shrubby woodlands/open forest on skeletal soils, riverine woodland and derived/ exotic grassland.

Key aquatic habitats within the Project boundary are associated with the Namoi River and its floodplain. Additional aquatic habitat features include minor ephemeral streams within the proposed open cut disturbance area and permanent water sources associated with artificial drainage contours and dams.

3.1.2.2 HOLLOW TREE RESOURCES

A systematic quantitative assessment of hollow tree resources in the Project boundary was completed during the Continuation of Boggabri Coal Mine Biodiversity Impact Assessment (Parsons Brinckerhoff, 2010a). A combined total of 146 survey sites were sampled within the Project boundary and larger Leard State Forest remnant with an average of 170 and 139 hollows per hectare recorded from grassy woodlands on fertile soils and shrubby woodland/ open forest on skeletal soils fauna habitat respectively.

3.1.2.3 THREATENED FAUNA SPECIES

THREATENED BLOSSOM NOMADS (REGENT HONEYEATER, SWIFT PARROT AND GREY-HEADED FLYING-FOX)

While there are currently no known records for Regent Honeyeater from Leard State Forest or surrounding areas, Swift Parrots have been observed in Leard State Forest by WSP ecologists on a small number of occasions since the first observations made in 2012.

There is no knowledge of Grey-headed Flying-foxes using Leard State Forest and there are scant numbers of Grey-headed Flying-fox in the wider locality.

The absence of Regent Honeyeater records from woodlands associated with Leard State Forest, and the surrounding areas, is not taken as a lack of local habitat suitability for this species. Considering their numbers are seriously reduced, together with both their relatively quiet habits and nomadic behaviour, their detection is made very difficult even when they may occur locally.

The low number of Grey-headed Flying-fox records locally is considered most likely attributable to the considerable distance between local habitats and established roosting camps.

Of great importance to threatened blossom nomads are foraging resources throughout the year, with winter being a critical time for many species.

The majority of Swift Parrot observations made in Leard State Forest, were associated with strong *Eucalyptus albens* (White Box) blossoming events, and it is assumed that the winter timing of strong White Box blossom locally may also represent accessible resources for both the Regent Honeyeater and Grey-headed Flying-fox during seasons when other resources across their respective ranges are scant.

Although blossom represents an important food source for Swift Parrots, the species is more often observed using lerp. Lerp resources are not limited to those canopy species that are important for their blossom resources, but also to other myrtaceous native plants. *Eucalyptus crebra* (Narrow-leaved Ironbark), which is locally common in Leard State Forest and the BOA's, has been observed (WSP ecologist, pers. obs.) to provide lerp resources for Swift Parrots when infestations occur in *E. crebra*.

CORBEN'S LONG-EARED BAT

Corben's Long-eared Bat is known from several records within the Project Boundary and wider Leard State Forest remnant.

3.1.2.4 MIGRATORY SPECIES

Two species of bird (White-throated Needletail and Satin Flycatcher) listed under the migratory provisions of the EPBC Act were recorded during seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff, 2010a).

3.1.2.5 INTRODUCED FAUNA AND PEST SPECIES

Seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff, 2010a) recorded seven species of feral animal including Common Starling, Fox, Brown Hare, Rabbit, Black Rat, Common House Mouse and Pig.

A Weed and Pest Management Strategy for the Project Boundary is provided as Appendix B of this OMP.

3.2 BIODIVERSITY OFFSET AREAS

A Biodiversity Offset Strategy (BOS) was developed as part of the Continuation of Boggabri Coal Mine Environmental Impact Statement (Hansen Bailey, 2010). Five regionally significant Biodiversity Offset Areas (BOAs) were secured as part of the original BOS, including:

- Merriendi BOA – 483.2 ha
- Namoi BOA – 3,214.9 ha
- Wirrilah BOA – 884.2 ha
- Myall Plains BOA – 473.3 ha
- Mallee BOA – 2,066.2 ha.

Preliminary field survey and assessments were completed over the original five BOAs between 2009 and 2012 to describe existing biodiversity values and inform potential management actions (Parsons Brinckerhoff 2010a, (Hansen Bailey, 2010). Further, and in accordance with Condition 9 of the Project Approval (EPBC 2009/5256), the quantity and quality of habitat or potential habitat for the Regent Honeyeater, Swift Parrot and Corben’s Long-eared Bat (formerly Greater Long-eared Bat) in the offset areas was validated by independently approved ecological experts (Niche Environment and Heritage, 2014). This biodiversity offsets audit determined that the minimum direct offset (90 per cent) and the total direct offset (100 per cent) as required under the EPBC Act Offsets Policy has been met in relation to Regent Honeyeater, Swift Parrot and Corben’s Long-eared Bat (Niche Environment and Heritage, 2014). This expert report is available on Boggabri Coal’s website (<https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/>).

To meet the Project’s residual offset requirements under Condition 7 of the Project Approval (EPBC 2009/5256), Boggabri Coal acquired five additional BOAs in the Project’s Revised BOS (WSP, 2018) that contribute to and extend the Regional East-West Wildlife Corridor. The additional BOAs include:

- Jerralong BOA – 570.1 ha
- Goonbri BOA – 231.0 ha
- Nioka North BOA – 857.6 ha
- Sunshine BOA – 738.0 ha
- Braefield BOA – 1,400.7 ha.

Field surveys validating the vegetation communities, habitats and species associated with the Nioka North (Parsons Brinckerhoff, 2015b), Sunshine (Parsons Brinckerhoff, 2015b) and Braefield BOAs (Parsons Brinckerhoff, 2015a) was complete between March and April 2015, and the Goonbri and Jerralong BOAs between August and November 2016

In total, the 10 BOAs contain large parcels of remnant vegetation and high quality habitats adjoining existing vegetated lands. Based broadly on their location in the landscape and the management measures they require, four management areas were derived (Figure 3.2) and include:

- Eastern Offsets – Braefield, Sunshine, Nioka North BOAs
- Central Offsets – Mallee, Myall Plains, Wirrilah and Goonbri BOAs
- Namoi Offsets – Jerralong and Namoi BOAs
- Western Offsets – Merriendi BOA.

In addition to the above surveys, the 2015 monitoring program collected a baseline condition of vegetation and fauna habitat attributes within each BOA. This monitoring session was completed prior to the implementation of management measures and was the first year that the monitoring program encompassed all 10 BOAs. The methodology and results of the 2015 BOA monitoring program is provided in Appendix C.

A summary of the biodiversity values of each BOA is provided in Table 3.3 and illustrated in Figure 3.2. Specific descriptions of each BOA condition, MNES values, threats and disturbances are provided in below sections (Section 3.2.2, Section 3.2.3, Section 3.2.4, and Section 3.2.5)

3.2.1.1 VEGETATION COMMUNITIES

Table 3.3 details vegetation communities described from the BOAs. Of the 18 vegetation communities described, three occur as MNES, including White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland, Weeping Myall Woodlands and Natural Grasslands on Basalt and Fine-textured Alluvial Plains of Northern New South Wales and Southern Queensland (Table 3.3).

3.2.1.2 EXISTING FAUNA HABITATS IN THE BOAS

Four broad fauna habitat types have been recorded in the BOAs as described in Table 3.3 and detailed below.

GRASSY WOODLAND ON FERTILE SOILS

The Grassy Woodland on Fertile Soils habitat type occurs as stands of low to moderately disturbed vegetation on the mid to lower slopes and flats of the BOAs, with relatively low exotic species cover. The canopy cover averages 12.7%, reflecting the natural woodland structure within this habitat. The Grassy Woodland on Fertile Soils habitat in the BOAs provides a relatively high density of hollow-bearing trees (22 per ha) with numerous hollows providing nesting opportunities for birds, nesting dens for arboreal mammals and roosting habitat for microchiropteran bats. A diverse ground cover of grasses together with forbs and sedges are present, which is reflected in the high average native species diversity (34.5) recorded. Decorticating bark (*E. albens*) and fallen timber (327 m/ ha) provide microhabitat features for certain reptiles and birds.

SHRUBBY WOODLAND/ OPEN FOREST ON SKELETAL SOILS

The Shrubby Woodlands/ Open Forest on Skeletal Soils habitat type occurs predominately as undisturbed stands of vegetation on the mid to upper slopes of the BOAs. The average exotics species cover (1.3%) is generally very low throughout this habitat type. Canopy cover averages 16.3% and is dominated by the species *E. albens* and *E. crebra* with sub-dominant and sub-canopy species (in parts) including *E. dwyeri* and *Callitris glaucophylla*.

This habitat contains a relatively high density of hollow-bearing trees (22 per ha) with numerous hollows providing nesting opportunities for birds, nesting dens for arboreal mammals and roosting habitat for microchiropteran bats. A diverse shrub and ground cover of grasses and forbs is present, which is reflected in the high average native species diversity (38.5). Fallen timber is prevalent throughout the Shrubby Woodlands/ Open Forest on Skeletal Soils habitat type (527 m/ha) with some vegetation types containing in excess of 600 m/ ha. These resources provide important microhabitat features for certain reptiles and birds.

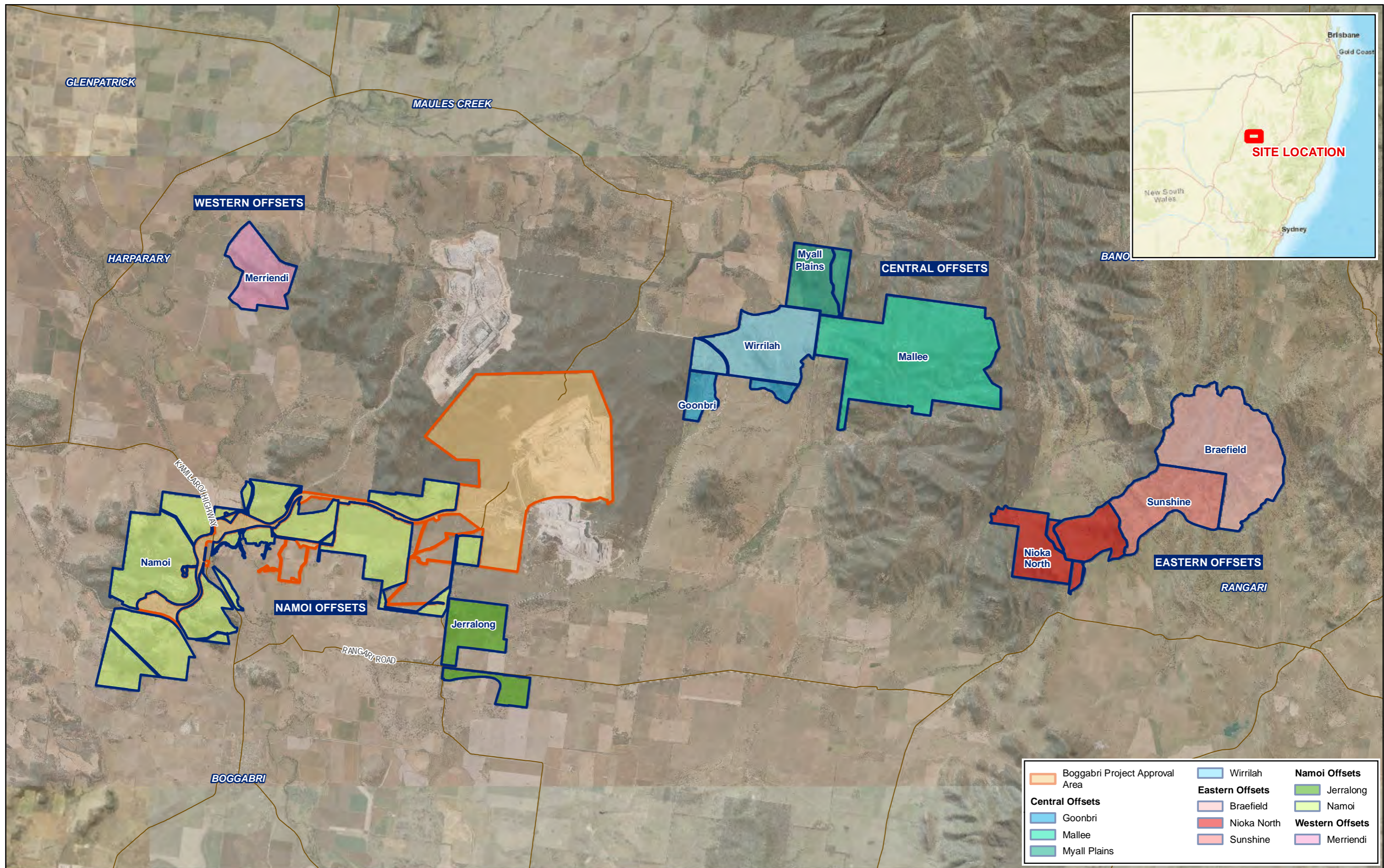
This habitat type also contains large areas of rocky cliff lines and caves potentially suitable for roosting microchiropteran bats.

RIVERINE WOODLAND

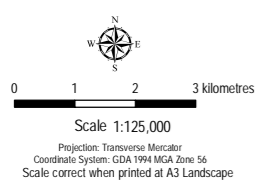
The Riverine Woodland habitat type occurs principally along the Namoi River and drainage lines such as Bollol and Mihi Creeks. While many of the gully lines and drainage lines in the locality were dry during field surveys, the Namoi River and its floodplain contained flowing water and wetlands respectively.

Riverine Woodlands along the Namoi River contain the highest levels of disturbances with significant incursion of exotic weeds and pests. The riparian zone of the Namoi River contains senescent River Red Gums in an otherwise modified agricultural landscape. However, River Red Gums provide significant densities of hollow-bearing trees (31 per ha) and fallen timber (290 m/ ha) for a range of birds, roosting habitat for microchiropteran bats and possible dens for arboreal mammals. In addition to the hollow resources, this habitat type contains a number of small to medium sized natural soaks, which provide important natural water sources for a range of woodland birds and other fauna.

Within the smaller riparian habitats along minor streams of the BOAs the condition of this habitat type is significantly less disturbed. These areas generally contain low levels of exotic species, and high native species diversity within a natural structure. In particular, riparian habitat in the northwest of Nokia North, which are associated with Mihi Creek, are of very high value.



Boggabri Project Approval Area	Wirrilah	Namoi Offsets
Central Offsets	Braefield	Jerralong
Goonbri	Nioka North	Namoi
Mallee	Sunshine	Western Offsets
Myall Plains		Merriendi



Imagery: BCPL (2018); Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri

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Table 3.3 Vegetation communities and fauna habitat types within the four BOA management areas

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE ¹	TOTAL PROJECT DISTURBANCE (HA) ²	EASTERN OFFSET (HA)	CENTRAL OFFSET (HA)	NAMOI OFFSET (HA)	WESTERN OFFSET (HA)	TOTAL (HA)
Threatened Ecological communities							
White Box Grassy Woodland (EEC - White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland ³)	White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (NA 226, PCT 1383)	626.1	349.4	260.7	308.5	176.1	1,094.7
	Derived Native Grassland	4.8	566.4	613.0	561.2	150.5	1,891.1
Yellow Box - Blakely's Red Gum grassy woodland (EEC - White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland ³)	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion (NA 237, PCT 1329)	3.2	73.3	38.4	17.9	–	129.6
	Derived Native Grassland	0.0	–	36.7	28.9	–	65.6
White Box Blakely's Red Gum Rough-barked Apple riparian woodland (EEC - White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland ³)	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (grassy variant) (NA 197, PCT 1118)	0.0	303.6	–	–	–	303.6
	Derived Native Grassland	0.0	3.0	–	–	–	3.0
Weeping Myall Woodland (EEC – Weeping Myall Woodland ⁴)	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (NA 219, PCT 027)	0.4	–	–	30.2	1.6	31.8
	Derived Native Grassland	0.0	–	–	2.3	–	2.3

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE ¹	TOTAL PROJECT DISTURBANCE (HA) ²	EASTERN OFFSET (HA)	CENTRAL OFFSET (HA)	NAMOI OFFSET (HA)	WESTERN OFFSET (HA)	TOTAL (HA)
River Red Gum Riparian woodland and forest (EEC – Natural Drainage System of the Lowland Catchment of the Darling River (River Red Gum Riverine Woodlands))	River Red Gum riparian tall woodland/ open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion (NA 193, PCT 078)	2.8	–	–	68.6 ¹⁰	–	68.6 ¹⁰
	Derived Native Grassland	0.0	–	–	94.0	–	94.0
Plains Grassland (EEC – Plains Grassland ⁵)	Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion (NA 181, PCT 102)	0.5	–	–	20.3	–	20.3
Sub-total threatened ecological communities		637.8	1,295.7	948.8	1,131.9	328.2	3,704.6
Other Vegetation communities							
Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland	Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (NA 179, PCT 88)	46.9	–	–	417.3	–	417.3
	Derived Native Grassland	38.1	–	–	832.4	4.4	836.8
Narrow-leaved Ironbark – pine – Brown Bloodwood shrub/grass open forest	Narrow-leaved Ironbark – pine Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion (NA 163, PCT 1380)	14.8	NA ¹¹	NA ¹¹	NA ¹¹	NA ¹¹	0
Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA 228, PCT 1313)	532.3	–	2,040.3	178.8	–	2,219.1
	Derived Native Grassland	0.0	–	23.5	23.8	–	47.3
	Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion (NA 165, PCT 1381)	184.0	438.3	237.1	444.4	20.4	1,140.2

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE ¹	TOTAL PROJECT DISTURBANCE (HA) ²	EASTERN OFFSET (HA)	CENTRAL OFFSET (HA)	NAMOI OFFSET (HA)	WESTERN OFFSET (HA)	TOTAL (HA)
White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (shiny bush) Regrowth – White Cypress Pine	Derived Native Grassland	0.0	–	103.5	7.0	–	110.5
Belah alluvial woodlands	Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region (NA 102, PCT 055)	0.0	–	–	2.7	–	2.7
	Derived Native Grassland	0.0	–	–	65.3	–	65.3
Silver-leaved Ironbark heathy woodland	White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion (NA 224, PCT 1307)	3.7	6.8	20.6	203.8	–	231.2
	Derived Native Grassland	0.0	4.4	–	3.5	–	7.9
Dwyer's Red Gum Woodland (including regrowth White Cypress Pine)	Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range (NA 2415, PCT 610)	0.3	43.6	91.4	125.4	130.2	390.6
	Derived Native Grassland	0.0	–	–	29.2	–	29.2
White Box – White Cypress Pine shrubby open forest (including White Cypress Pine)	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA 225, PCT 1308)	0.0	896.7	–	–	–	896.7

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE ¹	TOTAL PROJECT DISTURBANCE (HA) ²	EASTERN OFFSET (HA)	CENTRAL OFFSET (HA)	NAMOI OFFSET (HA)	WESTERN OFFSET (HA)	TOTAL (HA)
Pine regrowth and Shiny Bush)							
Rough-barked Apple Riparian Forb/Grass Open Forest	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA 197, PCT 1118)	0.0	163.1	16.8	7.9	–	187.8
River Oak Riparian Open Forest	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (NA 191, PCT 84)	0.6	17.0	14.7	4.6	–	36.3
Tumbledown Red Gum grassy woodland Myrtle Shrubland (+/- White Pine/Tumbledown Red Gum)	Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion (NA 410, PCT 427)	0.0	26.4	142.9	–	–	169.3
New England Blackbutt Rough-barked Apple shrubby open forest	Nandewar Box – Western New England Blackbutt – Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion	0.0	1.3	–	–	–	1.3
Intensive Agriculture ⁶ Exotic Grassland	Miscellaneous Ecosystem – highly disturbed areas with no or limited native vegetation	0.0	102.0	15.1	30.3	–	147.4
Farm dams	Miscellaneous Ecosystems - water bodies, rivers, lakes, streams (not wetlands)	0.0	1	–	–	–	1.0
Sub-total other vegetation communities		820.7	1,700.6	2,705.9	2,376.4	155.0	6,937.9
Total vegetation communities		1,458.5	2,996.3	3,654.7	3,508.3	483.2	10,642.5
Fauna habitats							
Grassy Woodland on fertile soils		677.5	422.7	299.1	776.6	177.7	1,676.1
Shrubby Woodland/ Open Forest on skeletal soils		735.1	1,413.1	2,532.3	952.4	150.6	5,048.4

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE ¹	TOTAL PROJECT DISTURBANCE (HA) ²	EASTERN OFFSET (HA)	CENTRAL OFFSET (HA)	NAMOI OFFSET (HA)	WESTERN OFFSET (HA)	TOTAL (HA)
Riverine Woodland		2.5	483.7	31.5	81.1	0	596.3
Grassland		43.4	573.8	547.2	1,669.7	154.9	2,945.6
Intensive agriculture and farm dams		NA	103.0	244.6	28.5	0	376.1
Total		1,458.5	2,996.3	3,654.7	3,508.3	483.2	10,642.5

- (1) Plant Community Type is a NSW classification established to provide unambiguous master community-level classification for use in vegetation mapping programs, BioMetric-based regulatory decisions, and as a standard typology for other planning and data gathering programs.
- (2) Total Project disturbance includes impacts associated with the Continuation of Boggabri Coal Environmental Assessment, Modification 3, Modification 4, Modification 5, inadvertent clearing outside Project Boundary and Goonbri Road Upgrade.
- (3) Critically Endangered Ecological Community White Box – Yellow Box – Blakey’s Red Gum Woodland and Derived Native Grassland listed under the EPBC Act.
- (4) Endangered Ecological Community Weeping Myall Woodlands listed under the EPBC Act.
- (5) Critically Endangered Ecological Community Natural Grassland on Basalt and Fine-textured Alluvial Plains of Northern New South Wales and Southern Queensland under the EPBC Act.
- (6) Identified for corridor enhancement (intensive management).

GRASSLAND

The majority of the Grassland habitats within the BOAs comprise moderate condition derived native grasslands with high native diversity and low exotic weed incursions. However, these areas have been disturbed from grazing and other agricultural practices that have removed native overstorey and groundcover vegetation. This habitat includes the natural grassland community (Plains Grassland) and higher quality areas of Derived Grassland associated with more recent clearing.

CONDITION OF FAUNA HABITAT IN THE BOAS

The condition of the fauna habitats, whilst variable, has been observed to be in generally good condition due to the high number of native species and low weed densities. Importantly, all of the fauna habitats within the BOAs contain similar native species diversity to the habitats within the Project Boundary. The per cent canopy cover is also comparable for the majority of the habitat types between the BOAs and Project Boundary. Only the Shrubby Woodland/ Open Forest on Skeletal Soils habitat type has been recorded as having a reduced per cent canopy cover within the BOAs, which is likely to reflect the presence of heathy vegetation where the canopy layer was naturally low.

Native regeneration and shrub cover is slightly lower within the BOAs when compared to the Project Boundary. However, such attributes are likely to improve through restoration as detailed in Section 7.

Hollow-bearing tree resources and fallen timber are two microhabitats critical for ecological processes, breeding resources for fauna and overall habitat condition. The BOAs contain a relatively high density of hollow-bearing trees, with surveys indicating a similar or greater abundance in comparison to the Project Boundary.

ATTRIBUTES OF FAUNA HABITAT TYPES IN THE BOAS

Habitat attributes of the four habitat types recorded in the Project Boundary and BOAs are presented in Table 3.4.

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Table 3.4 Attributes of fauna habitats in the Project Boundary and BOAs

FAUNA HABITAT	NO. OF SAMPLE SITES		NATIVE SPECIES DIVERSITY		AVG. CANOPY COVER (%)		AVG. SHRUB COVER (%)		NATIVE CANOPY REGEN. (%) ¹		HOLLOW TREES (HA) ²		FALLEN TIMBER (M/HA) ³		AVG. EXOTIC SPECIES (%)	
	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs	Project Boundary	BOAs
Grassy Woodland on Fertile Soils	28	27	32.5	34.5	10.5	12.7	14.4	7.3	70	30	18.3	22	323	327	16.2	10.3
Shrubby Woodlands/ Open Forest on Skeletal Soils	29	43	34	38.5	22.5	16.25	19.2	4.72	100	50	11.5	22	543.4	527	0.2	1.33
Riverine Woodland	4	7	22	33.9	27.4	30.61	18	10.3	100	50	12.5	31	156.3	290	51.5	44
Grassland	1	15	20	27	6	1	6	3.9	100	20	10	7	50	115	4	18.3

Attributes detailed in Table 3.4 correspond to averaged BioBanking plot data collected within the Project Boundary and Biodiversity Offset Areas for each fauna habitat type.

- (1) Native canopy regeneration (%) is measured as the proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5 cm.
- (2) Hollow trees (ha) equates to a living or dead tree that has at least one hollow. A tree is considered to contain a hollow if:
 - the entrance can be seen
 - the minimum entrance width is at least 5 cm across
 - the hollow appears to have depth.
- (3) Fallen timber (m/ha).

3.2.2 EASTERN OFFSETS

The Eastern Offsets is comprised of the Nioka North, Sunshine and Braefield BOAs. These BOAs lie within and to the east the Nandewar Range and form the eastern extent of the Regional East-West Wildlife Corridor. A summary of the Eastern Offset locality is provided below in Table 3.5.

Table 3.5 Summary of Eastern Offsets

CRITERIA	LOCATION
Council	Gunnedah Shire Council
Bioregion	Nandewar Brigalow Belt South
Catchment Management Area (CMA)	Namoi CMA Peel sub-catchment Liverpool Plains sub-catchment
Botanical Subdivision	North Western Slopes (NWS)
Mitchell landscapes	Liverpool Alluvial Plains Tamworth - Keepit Slopes and Plains
Noxious weed control area	Gunnedah

3.2.2.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Eastern Offsets contain approximately 1,295.7 ha of Box Gum Woodland of which 726.3 ha aligns with State 1 (woodland) and 569.4 ha which aligns to State 2 (native pastures) (Table 3.6). The 726.3 ha of State 1 Box Gum Woodland is consistent with the White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.

Table 3.6 Summary of Box Gum Woodland CEEC within the BOAs

BIODIVERSITY OFFSET AREA	STATE OF BOX GUM WOODLAND	
	State 1 – Woodland (ha)	State 2 – Native pastures (ha)
Nioka North	291.5	265.2
Sunshine	240.5	248.8
Braefield	194.3	55.4
Total	726.3	569.4

The Swift Parrot, Corben’s Long-eared Bat, Large-eared Pied Bat and the Grey-headed Flying-fox have been recorded within the Eastern Offsets within the Nioka North BOA (Figure 3.5). The Eastern Offsets also provide suitable habitat for the Regent Honeyeater, Painted Honeyeater, Koala, White-throated Needletail and Superb Parrot.

A key justification for acquiring the Eastern Offset properties for fauna conservation purposes was not only the excellent areas of existing habitats for threatened fauna, but that rehabilitation of open country throughout the existing lower slope patches will result in a broad corridor of high conservation value native vegetation communities that link the large blocks of forest in Braefield and Sunshine’s north through the more westerly Eastern Offsets, to the Nandewar Range, Leard State Forest, Namoi floodplain and beyond.

High quality riparian habitats occur in the northwest of Nioka North where stands of old growth Yellow Box (*Eucalyptus melliodora*), White Box, Rough-barked Apple (*Angophora floribunda*) and occasional Narrow-leaved Ironbark (*E.*

crebra) occur along the riparian fringes of Mihi Creek and its tributaries. The habitat supports a diversity of State threatened woodland birds and blossom events attract a high diversity of nectarivorous birds.

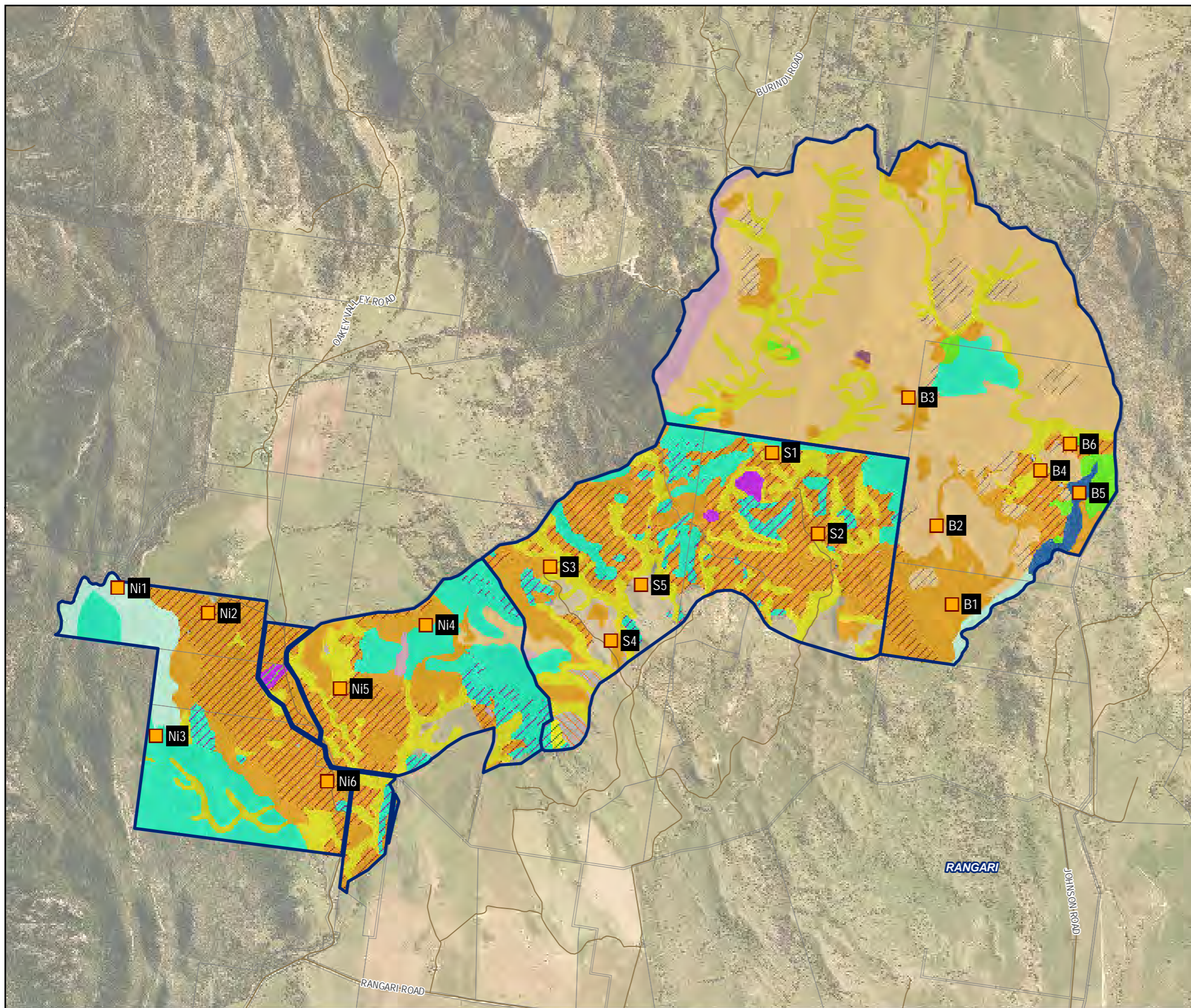
Large areas of White Box dominated woodland occur where tableland slopes extend into the northern sections of Braefield and Sunshine BOA's. While much of the southern section of the Sunshine BOA has only sparse areas of White Box dominated woodland the lower slopes of both Nioka North and Braefield retain patches of Box Gum Woodland.

The large patches of high quality woodlands that occur in the northwest of Nioka North and to the north of Sunshine and Braefield BOA's provide unbroken woodlands with diverse and structurally complex understorey habitats, which provide a diversity of niche opportunities for invertebrate populations, which are the favoured prey group of microchiropteran bats. Both the Large-eared Pied Bat (*Chalinolobus dwyreri*) and Corben's Long-eared Bat (*Nyctophilus corbeni*) have been recorded within the Nioka North BOA in its north-west riparian forests and is considered likely to occur in the large, but less accessible, areas of White Box dominated woodlands in the north of the Braefield and Sunshine BOA's.

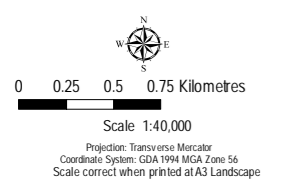
3.2.2.2 THREATS AND DISTURBANCES

Existing threats and disturbances within the Eastern Offsets include:

- Clearing and fragmentation — a large proportion of the lower slopes within these BOAs has been historically cleared and are now dominated by low condition woodland, derived native grassland and exotic dominated pasture.
- Livestock grazing — the Eastern Offsets are currently grazed by livestock. The existing grazing regime is likely to be reducing the potential for native species regeneration and increasing nutrient loads across the property, thereby promoting weed growth.
- Weedy exotic plants and pest animals – the Eastern Offsets contain areas of low to high pasture weed invasions within the grassland areas, particularly within the Sunshine BOA where grazing was intensified. Weed control will be required throughout the pasture areas. Without management intervention, weed densities within these area may increase and potentially spread into low density weed areas throughout the property. Pest animals were observed throughout the Eastern Offsets including Goats, rabbits, pigs and foxes.
- Invasion of native shrub species (i.e. *Dodonea viscosa*, *Beyeria viscosa*, *Oleria elliptica*). Dense thickets of these three species occur on the cleared hill tops and upper slopes throughout the Eastern Offsets. A specific management intervention will be required to prevent further spread of these shrubs throughout the property.
- Invasion of native *Callitris* species (i.e. *Callitris glaucophylla*). There are several areas within the Eastern Offsets which contain thickets of *Callitris* species. Management of these areas will be required to prevent further spread of this species and increase native diversity.
- Alteration of abiotic factors (hydrology, nutrients and soil) - The Eastern Offsets contain several large ephemeral drainage lines. In the absence of management intervention, erosion within these areas is likely to intensify through natural processes such as flooding or inappropriate land use activities. There are a number of locations within the Sunshine BOA which show a high level of erosion.
- Pesticides and herbicides — areas of remnant native vegetation within the property may be subjected to spray drift or chemical run-off from adjoining agricultural land from the south east and the north west.



- Legend**
- Monitoring location
 - Offset boundary
 - Road
 - Cadastre
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range**
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]
- Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion**
- Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427/NA410]
- Nandewar Box - Western New England Blackbutt - Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion**
- Nandewar Box - Western New England Blackbutt - Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion**
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]
 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165]
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions**
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191]
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion**
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion - Derived Native Grassland [PCT1118/NA197]**
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion - Derived Native Grassland [PCT1118/NA197]
- White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions**
- White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1308/NA225]
 - White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions - Derived Native Grassland [PCT1308/NA225]
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion**
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]
 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion**
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
 - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion - Derived Native Grassland
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion**
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237]
- Miscellaneous**
- Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Not applicable (crop land)
 - Miscellaneous Ecosystems - water bodies, rivers, lakes, streams (not wetlands), Not applicable

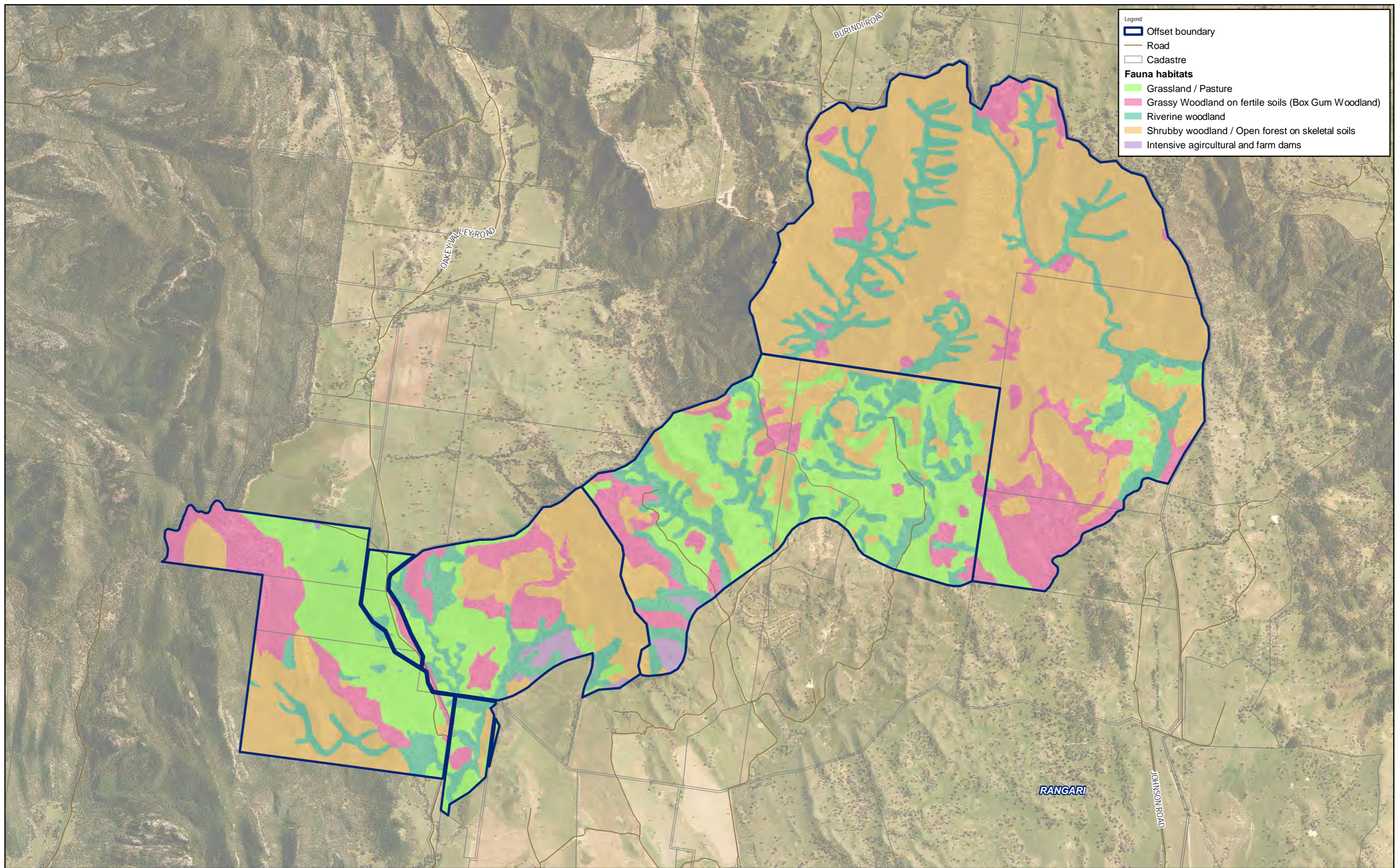


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REVIEW: N.Cooper
DATE: 28/11/2019



Legend

- Offset boundary
- Road
- Cadastre

Fauna habitats

- Grassland / Pasture
- Grassy Woodland on fertile soils (Box Gum Woodland)
- Riverine woodland
- Shrubby woodland / Open forest on skeletal soils
- Intensive agricultural and farm dams


0 0.25 0.5 0.75 Kilometres

Scale 1:35,000

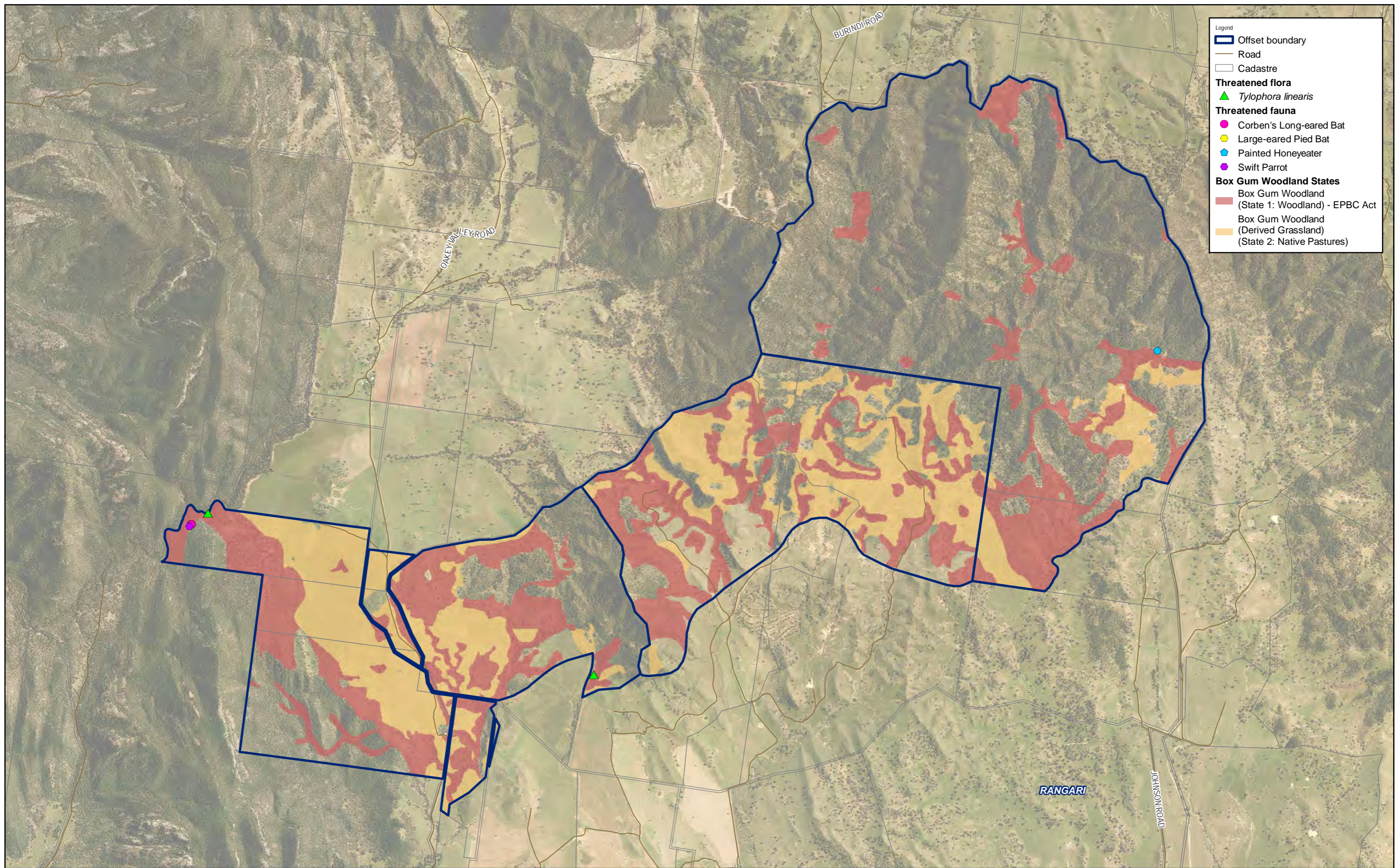
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 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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DATE:	28/11/2019



Legend

- Offset boundary
- Road
- Cadastre

Threatened flora

- ▲ *Tylophora linearis*

Threatened fauna

- Corben's Long-eared Bat
- Large-eared Pied Bat
- Painted Honeyeater
- Swift Parrot

Box Gum Woodland States

- Box Gum Woodland (State 1: Woodland) - EPBC Act
- Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)


0 0.25 0.5 0.75 Kilometres

Scale 1:35,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery: BCPL (2015) and

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3.2.3 CENTRAL OFFSETS

The Central Offsets is comprised of the Goonbri, Wirrilah, Myall Plains and Mallee BOAs. These BOAs form the central extent of the Regional East-West Wildlife Corridor and connect Leard State Forest with the Nandewar Range. A summary of the Central Offset locality is provided below in Table 3.7

Table 3.7 Summary of the Central Offsets

CRITERIA	LOCATION
Council	Narrabri Shire Council
Bioregion	Nandewar Brigalow Belt South
Catchment Management Area (CMA)	Namoi CMA Peel sub-catchment Liverpool Plains sub-catchment
Botanical subdivision	North Western Slopes (NWS)
Mitchell landscapes	Tamworth - Keepit Slopes and Plains Tamworth - Bugaldie Uplands Split Yard Plateau Liverpool Alluvial Plains Bugaldie Uplands
Noxious weed control area	Narrabri

3.2.3.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Central Offsets contain approximately 948.8 ha of Box Gum Woodland of which 299.1 ha aligns with State 1 (woodland) and 649.7 ha which aligns to State 2 (native pastures) (Table 3.8). The 299.1 ha of State 1 Box Gum Woodland is consistent with the White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.

Table 3.8 Summary of Box Gum Woodland CEEC within the BOAs

BIODIVERSITY OFFSET AREA	STATE OF BOX GUM WOODLAND	
	State 1 – Woodland (ha)	State 2 – Native pastures (ha)
Goonbri	72.3	88.3
Wirrilah	146.1	517.5
Myall Plains	66.5	43.9
Mallee	14.2	0
Total	299.1	649.7

The Swift Parrot, Corben’s Long-eared Bat, Painted Honeyeater and Koala have been recorded from the Central Offsets (Figure 3.8). The Central Offsets also provide suitable habitat for the Regent Honeyeater, Superb Parrot, White-throated Needle-tail, Grey-headed Flying Fox, and Large-eared Pied Bat.

While large areas of lowland woodland across the Central Offsets have been cleared for agricultural purposes in the past, the key justifications for acquiring the Central Offset properties for fauna conservation purposes are the large areas of relatively undisturbed habitats they contain and that in their rehabilitation of lowland native box woodlands, they will

substantially add to the resources available to threatened blossom nomads locally, while providing a continuity of vegetation cover that will offer uninhibited vegetation corridors from the Eastern Offsets through the Nandewar Range to Leard state forest, the Namoi floodplain and beyond.

The lowland woodland landscapes associated with the Central Offset properties of Mallee, Myall Plains, Wirrilah and Goonbri are dominated by White Box, which is an important winter source of blossom for nomadic blossom foragers, both avian and mammalian. Lowlands of all four Central Offset BOA's have stands or scattered individuals of White Box, which attract nomadic nectarivorous birds, such as Noisy Friarbird, Musk Lorikeets, and influxes of smaller honeyeater species when it is strongly flowering.

The Central Offsets also encompass the western flanks of the Nandewar Range, the continuous canopies of which represent high quality linkages between the patches of White Box spread through the lowland areas between the Central Offsets and those in the Eastern Offsets.

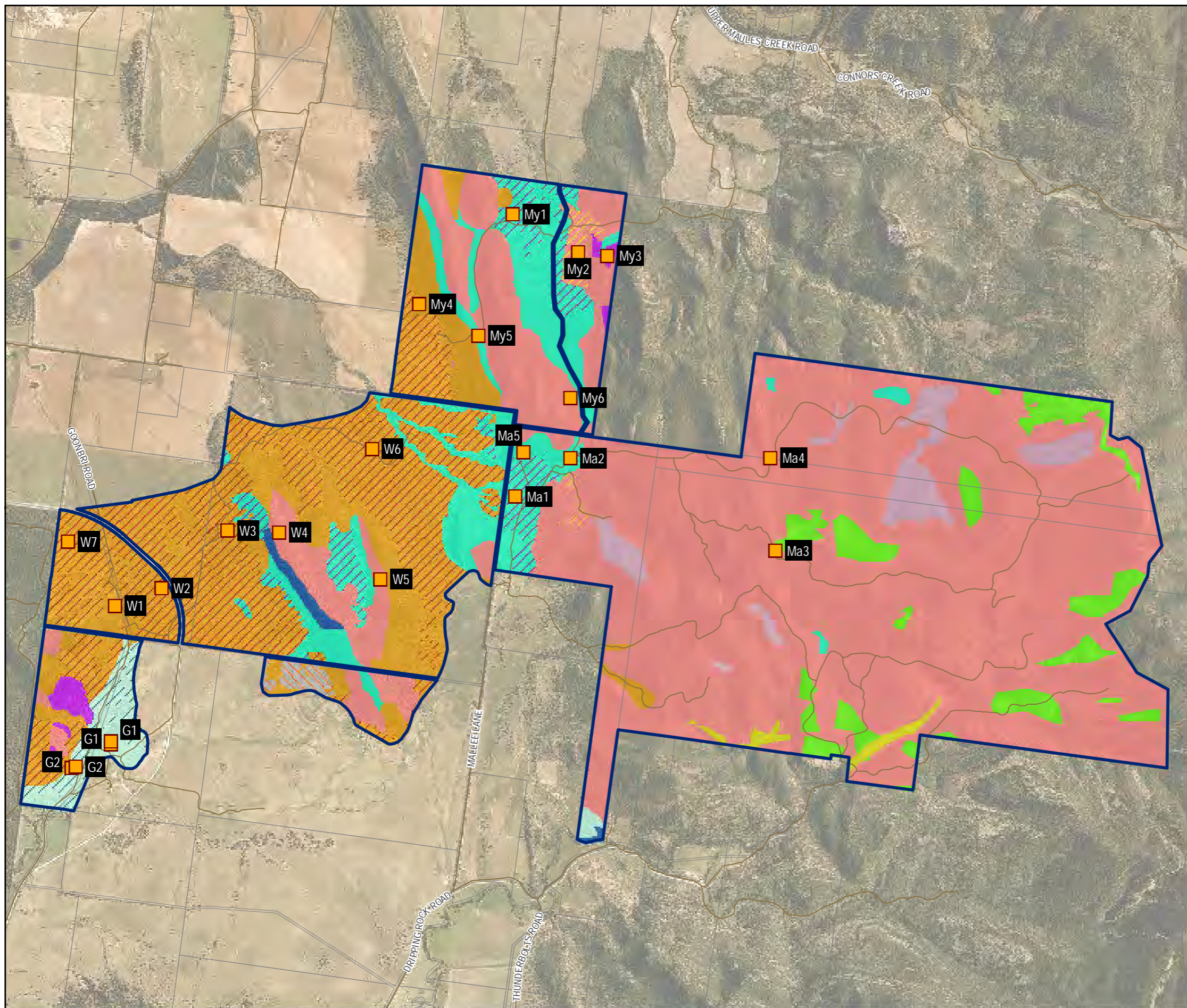
The upland slopes of the ridges across the Central Offsets are dominated by Narrow-leaved Ironbark interspersed with White Cypress Pine (*Callitris glaucophylla*), and occasional patches of White Box on the lower slopes. While the ironbark forests are not an important source of blossom for these species, their potential to support infestations of lerps, may support Swift Parrots when in the region.

The large continuous remnant woodland patches across the Central Offsets, provide an abundance of niches for a wide range of invertebrate species, which are the favoured prey group of microchiropteran bats. Corben's Long-eared Bat has been observed using the lowland woodland habitats of Myall Plains BOA and Leard Forest eastern footslopes on the western side of the Goonbri BOA. There is an abundance of suitable habitat for both Corben's Long-eared Bat and Large-eared Pied Bat throughout the ridgeline habitats of the Central Offsets due to the widespread occurrence of tree hollows and rocky crevice forming habitats respectively.

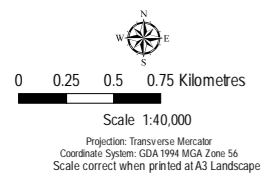
3.2.3.2 THREATS AND DISTURBANCES

Existing threats and disturbances within the Central Offsets include:

- Clearing and fragmentation — a large proportion of the lower slopes within these BOAs has been historically cleared and are now dominated by low condition woodland, derived native grassland and exotic dominated pasture.
- Livestock grazing — the Myall Plains BOA in the Central Offsets is currently subject to grazing incursions by livestock. The existing grazing regime is likely to be reducing the potential for native species regeneration and increasing nutrient loads across the property, thereby promoting weed growth.
- Weedy exotic plants and pest animals – the Central Offsets contain areas of low to moderate pasture weed invasions within the grassland areas, particularly within the Wirrilah, Goonbri and Myall Plains BOAs where grazing was intensified. Weed control will be required throughout the pasture areas. Without management intervention, weed densities within these area may increase and potentially spread into low density weed areas throughout the property. Pest animals were observed throughout the Central Offsets including goats, rabbits, pigs and foxes.
- Invasion of native *Callitris* species (i.e. *Callitris glaucophylla*). There are several areas within the Central Offsets which contain thickets of *Callitris* species. Management of these areas will be required to prevent further spread of this species and increase native diversity.
- Alteration of abiotic factors (hydrology, nutrients and soil) - The Central Offsets contain several large ephemeral drainage lines. In the absence of management intervention, erosion within these areas is likely to intensify through natural processes such as flooding or inappropriate land use activities.
- Pesticides and herbicides — areas of remnant native vegetation within the property may be subjected to spray drift or chemical run-off from adjoining agricultural land from the south east and the north west.



- Legend**
- Monitoring location
 - Offset boundary
 - Road
 - Cadastre
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly in the Nandewar Range**
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly in the Nandewar Range [PCT610/NA245]
- Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion**
- Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427/NA410]
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion**
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]
 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165]
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions**
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191]
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion**
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion**
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]
 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion**
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228]
 - White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion - Derived Native
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion**
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion**
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237]
 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion - Derived Native Grassland [PCT1329/237]
- Miscellaneous**
- Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Not applicable (crop land)



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AUTHOR: SuansriR

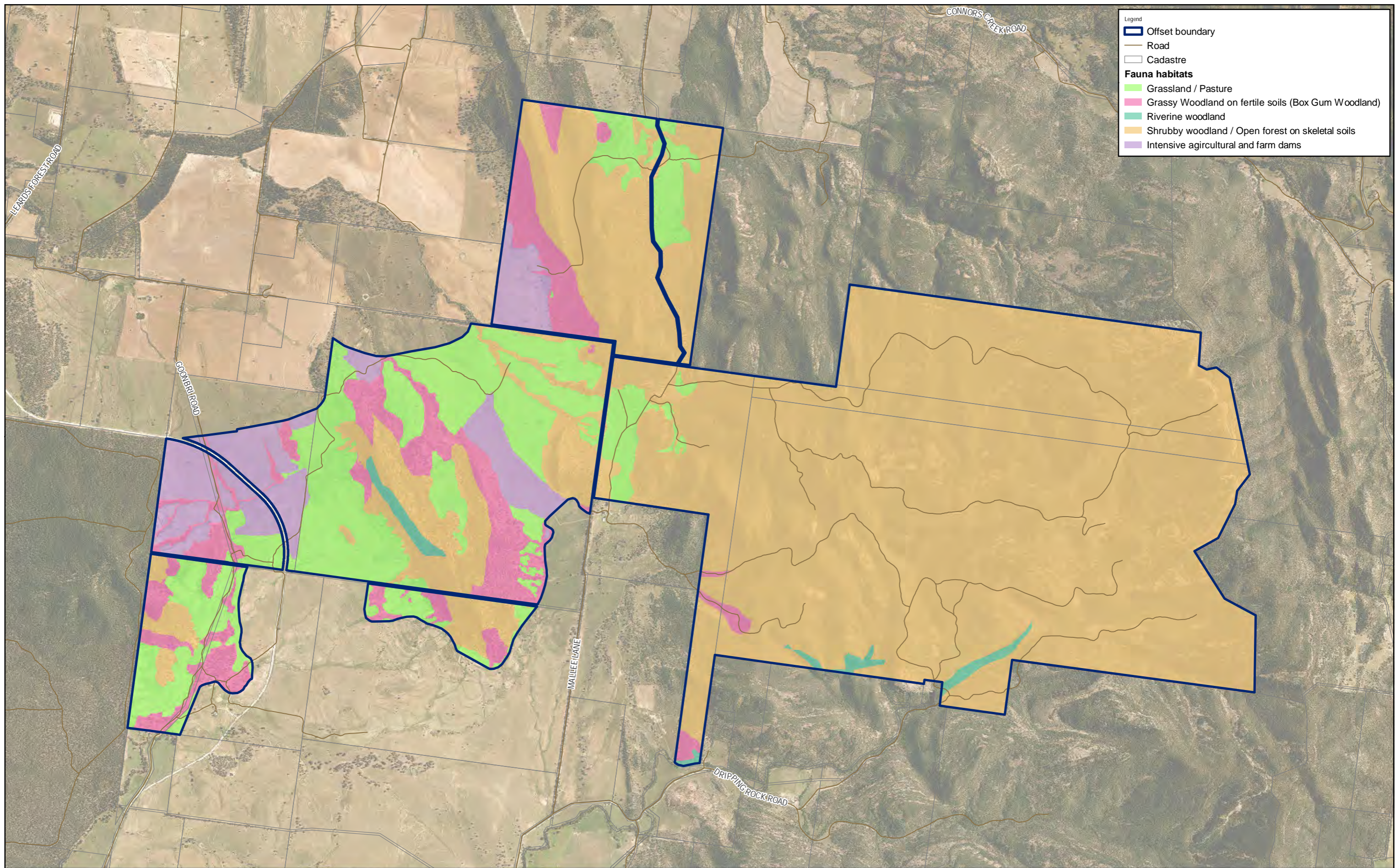
REVIEW: N.Cooper

DATE: 28/11/2019

APPENDIX

3.6

VEGETATION COMMUNITIES WITHIN
THE CENTRAL OFFSETS



Legend

- Offset boundary
- Road
- Cadastre

Fauna habitats

- Grassland / Pasture
- Grassy Woodland on fertile soils (Box Gum Woodland)
- Riverine woodland
- Shrubby woodland / Open forest on skeletal soils
- Intensive agricultural and farm dams

0 0.25 0.5 0.75 Kilometres

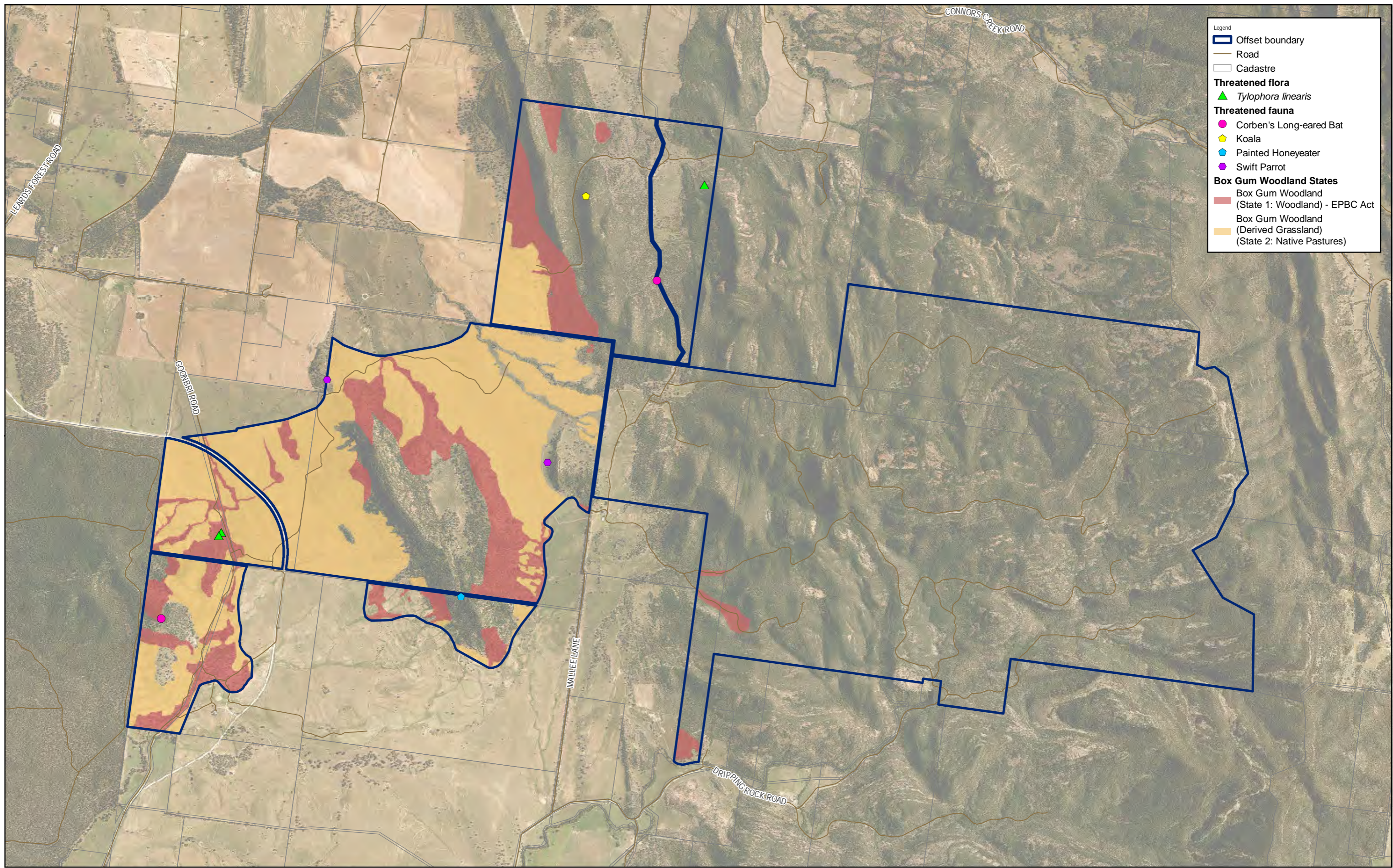
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Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

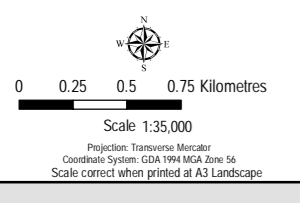
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DATE:	28/11/2019



- Legend**
- Offset boundary
 - Road
 - Cadastre
 - Threatened flora**
 - ▲ *Tylophora linearis*
 - Threatened fauna**
 - Corben's Long-eared Bat
 - ◆ Koala
 - ◆ Painted Honeyeater
 - Swift Parrot
 - Box Gum Woodland States**
 - Box Gum Woodland (State 1: Woodland) - EPBC Act
 - Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)



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DATE:	28/11/2019

3.2.4 NAMOI OFFSETS

The Namoi Offset is comprised of the Namoi and Jerralong BOAs. These BOAs are located approximately 1.9 km from the EIS mine disturbance limit on the Namoi River floodplain. The offset links the Namoi River floodplain with Leard State Forest. A summary of the Namoi Offset locality is provided below in Table 3.9.

Table 3.9 Summary of the Namoi Offset

CRITERIA	LOCATION
Council	Narrabri Shire Council
Bioregion	Brigalow Belt South
Catchment Management Area (CMA)	Namoi CMA Liverpool Plains sub-catchment
Botanical Subdivision	Bordering the North Western Slopes (NWS) and North Western Plains (NWP) subdivisions
Mitchell landscapes	Liverpool Alluvial Plains Mooki - Namoi Channels and Floodplains Upper Namoi Swamps and Lagoons Bugaldie Uplands Cubbo Uplands
Noxious weed control area	Narrabri

It is noted that the Namoi Offset contains land purchased as a joint venture between Boggabri Coal and the Maules Creek Coal Mine. Boggabri Coal owns 50% of land purchased under the joint venture agreement. The Namoi BOA, as discussed in this OMP, totalling 3,214.9 ha, encompasses properties wholly owned by Boggabri Coal.

3.2.4.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Namoi Offset contains three threatened ecological communities that occur as MNES (Figure 3.11), including:

- 326.4 ha of the EPBC Act listed Critically Endangered Ecological Community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is classified as State 1 Woodland. A further 590.1 ha is derived native grassland (State 2: Native pasture) Box Gum Woodland.
- 20.3 ha of the EPBC Act listed Critically Endangered Ecological Community Natural Grassland on Basalt and Fine-textured Alluvial Plains of Northern New South Wales and Southern Queensland (Plains Grassland).
- 30.2 ha of the EPBC Act listed Endangered Ecological Community Weeping Myall Woodlands. A further 2.3 ha of this ecological community occurs as derived native grassland.

Corben's Long-eared Bat and the Painted Honeyeater have been recorded annually in the Namoi Offset in areas of suitable habitat (Figure 3.11). The Grey-headed Flying-fox has also been recorded therein. The Namoi Offset also provides suitable habitat for the Regent Honeyeater, Swift Parrot/Superb Parrot, Large-eared Pied Bat, White-throated Needletail and Koala.

While large areas of the Namoi Offsets occur on floodplain topography, which has been largely cleared for agricultural purposes, their strategic location in reference to linkages between Leard State Forest and westward woodland remnants towards the Pilliga is key to building a corridor of vegetation from the Pilliga, through the Namoi floodplain to Leard State Forest, the Central offsets, Nandewar Range, Eastern Offsets and beyond.

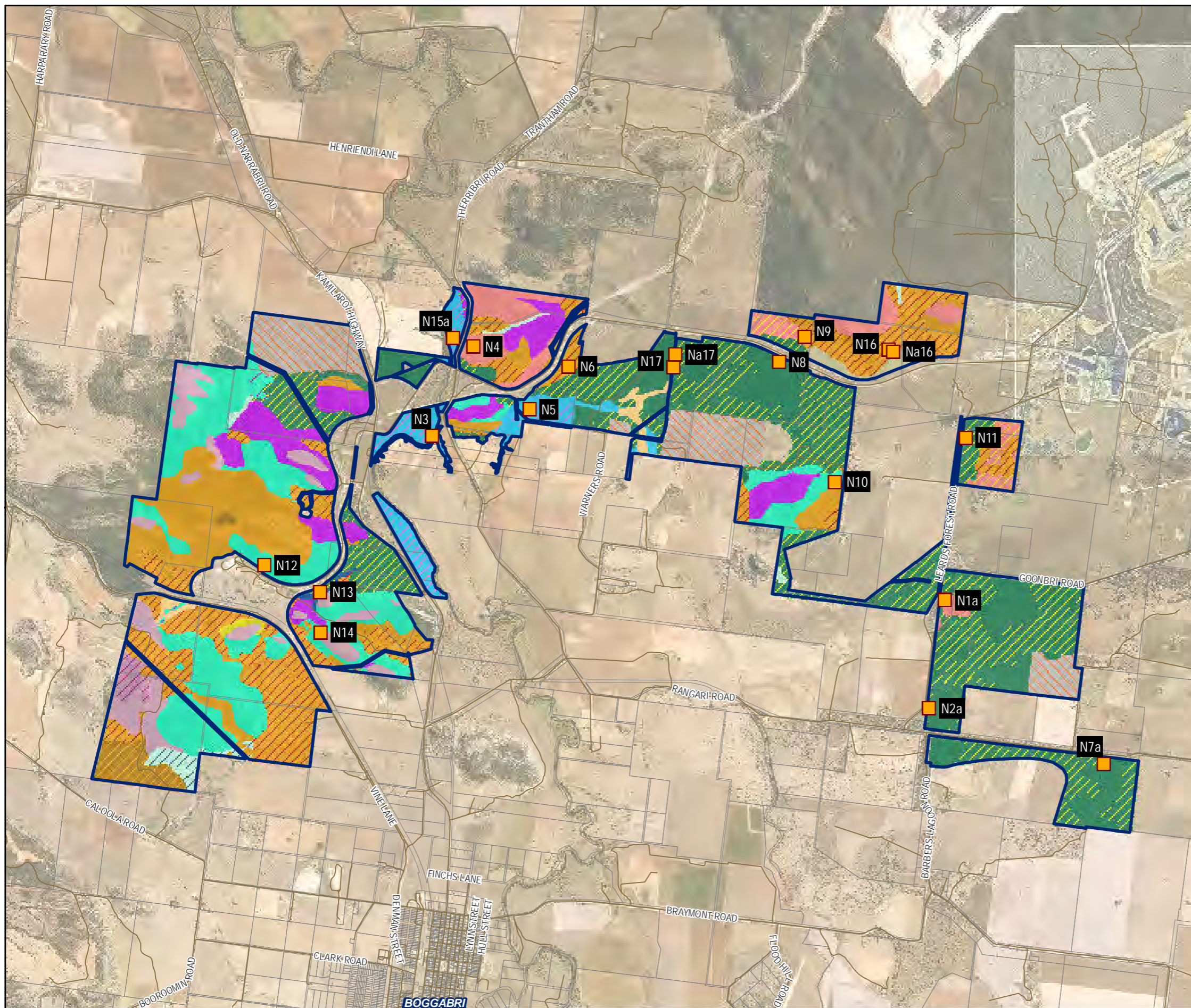
The woodland landscapes associated with the Namoi Offsets are spread across the Namoi River floodplain to the south and west of Leard State Forest. Much of the floodplain country has been subject to agricultural land-uses for a long period and so the country is generally open with small woodland patches or isolated paddock trees. Stands of White Box on more widespread uplifted habitats (such as that occurring within the Victoria Park, Daisymeade and Rocklea properties) attract nomadic and resident nectarivorous birds, and represent suitable habitat for Regent Honeyeaters and Swift Parrots.

The landscape is punctuated with persistent rocky up lifts, which continue to support generally healthy woodland habitats and it is these habitats that support a diversity of microchiropteran bats, including Corben's Long-eared Bat.

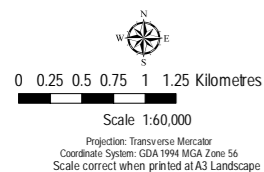
3.2.4.2 THREATS AND DISTURBANCES

Existing threats and disturbances within the Namoi Offset include:

- Clearing and fragmentation — a large proportion of the Namoi Offset has been historically cleared and now occurs as low condition woodland, derived native grassland or exotic dominated pasture.
- Livestock grazing – a proportion of the Namoi Offset (namely the Jerralong BOA) is currently grazed by cattle and sheep. The existing grazing regime is likely to be reducing the potential for native species regeneration and increasing nutrient loads across the BOA, thereby promoting weed growth.
- Weedy exotic plants and pest animals — The Namoi Offset contains areas of high weed density, particularly within the riparian zone of the Namoi River which is dominated by herbaceous weeds. Without management intervention, weed densities within these areas are likely to increase and potentially spread into areas supporting low and moderate weed densities throughout the BOA.
- Pest animals of concern within the Namoi Offset include Rabbits, Goats and Pigs. These feral pests are known to damage soil, prohibit native species regeneration and compete for food resources with native species.
- Alteration of abiotic factors (hydrology, nutrients and soil) — The Namoi Offset contains several large ephemeral drainage lines and the Namoi River, where significant areas of erosion have been identified. In the absence of management intervention, erosion within these areas is likely to intensify through natural processes such as flooding or inappropriate land use activities.
- Pesticides and herbicides — areas of remnant vegetation within BOA boundaries may be subjected to spray drift or chemical run-off from adjoining agricultural land.



- Legend**
- Monitoring location
 - Offset boundary
 - Road
 - Cadastre
- Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region**
- Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region [PCT55/NA102]
 - Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region - Derived Native Grassland [PCT55/NA102]
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range**
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]
 - Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range - Derived Native Grassland
- Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion**
- Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion**
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]
 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165]
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion**
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion [PCT88/NA179]
 - Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion - Derived Native Grassland [PCT88/NA179]
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions**
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191]
- River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion**
- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived**
- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion**
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion**
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion [PCT27/NA219]
 - Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT27/NA219]
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion**
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]
 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion**
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228]
 - White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion - Derived Native Grassland
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion**
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
 - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion - Derived Native Grassland
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion**
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237]
 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion - Derived Native Grassland [PCT1329/237]
- Miscellaneous**
- Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Not applicable (crop land)



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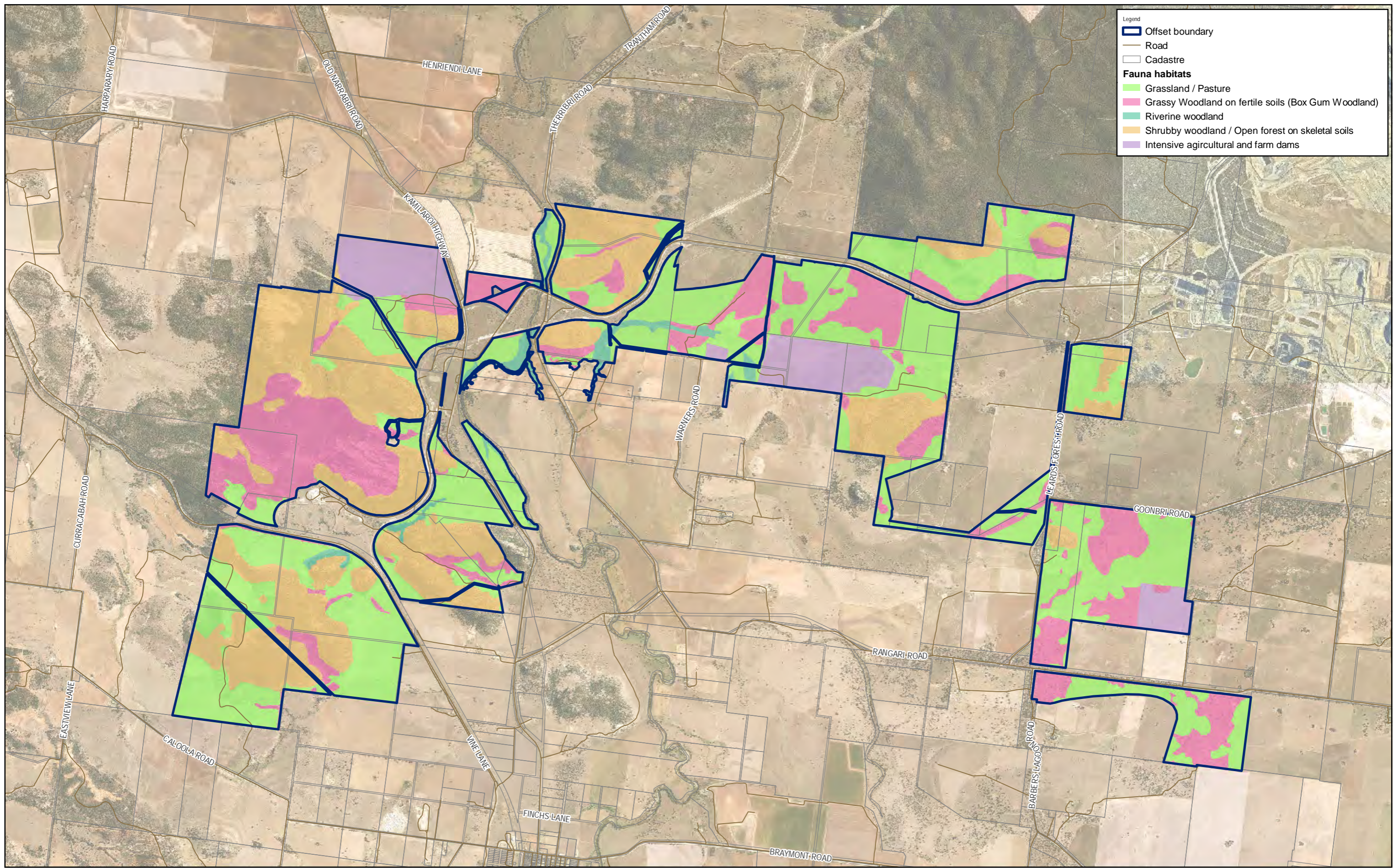
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APPENDIX

3.9

TITLE: VEGETATION COMMUNITIES WITHIN
THE NAMOI OFFSETS



Legend

- Offset boundary
- Road
- Cadastre

Fauna habitats

- Grassland / Pasture
- Grassy Woodland on fertile soils (Box Gum Woodland)
- Riverine woodland
- Shrubby woodland / Open forest on skeletal soils
- Intensive agricultural and farm dams

0 0.25 0.5 0.75 1 1.25 Kilometres

Scale 1:50,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

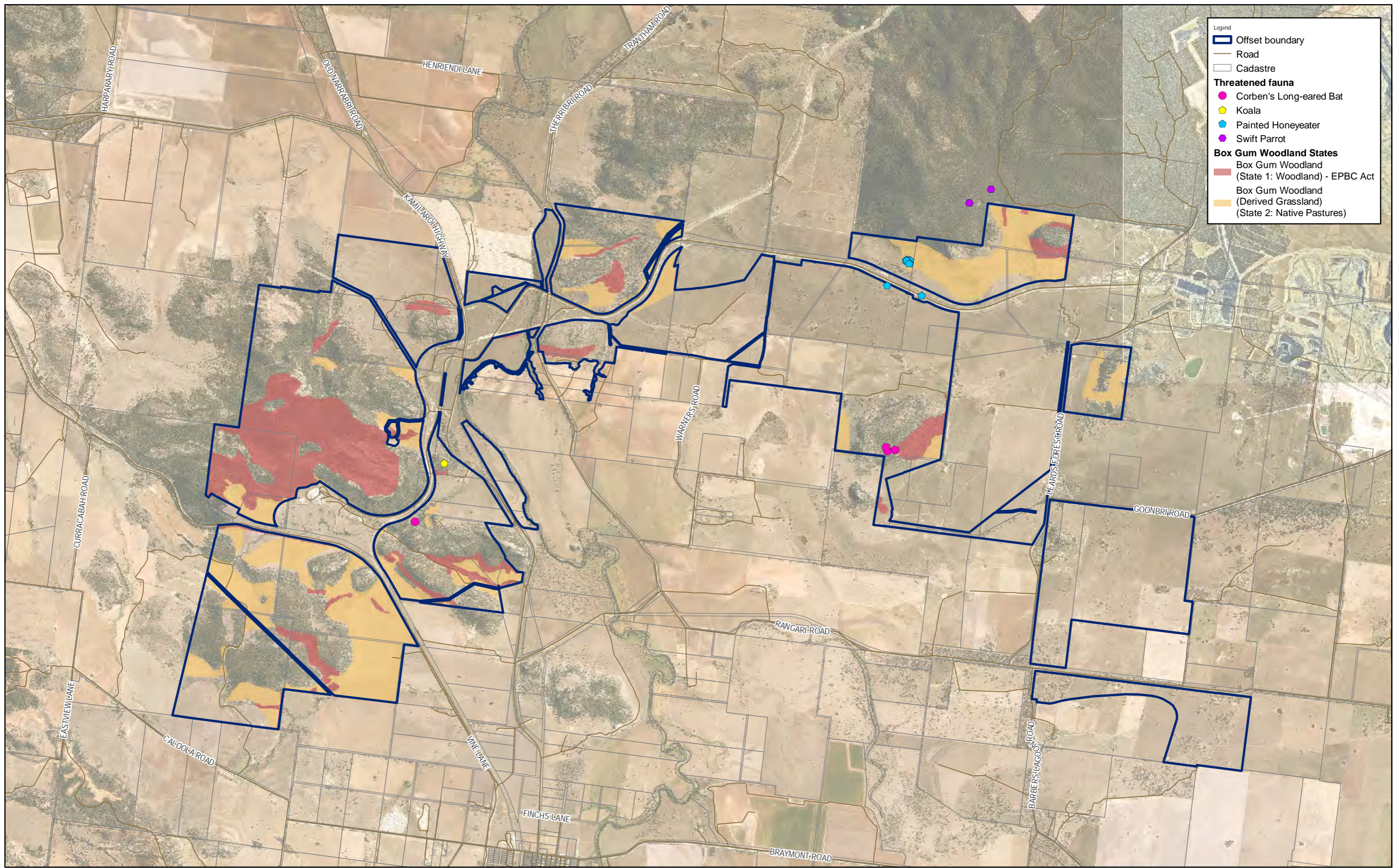
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APPENDIX **3.10**

TITLE: **FAUNA HABITATS WITHIN THE NAMOI OFFSETS**



Legend

- Offset boundary
- Road
- Cadastre

Threatened fauna

- Corben's Long-eared Bat
- Koala
- Painted Honeyeater
- Swift Parrot

Box Gum Woodland States

- Box Gum Woodland (State 1: Woodland) - EPBC Act
- Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)

0 0.25 0.5 0.75 1 1.25 Kilometres


Scale 1:50,000

Imagery: BCPL (2015) and

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
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APPENDIX **3.11**

TITLE: **MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE WITHIN THE NAMOI OFFSETS**

3.2.5 WESTERN OFFSETS

The Western Offset is comprised solely of the Merriendi BOA. The Merriendi BOA forms the north-west corner of the Regional East-West Wildlife Corridor. The north-east boundary of the BOA adjoins approximately 1.7 km of the Leard State Conservation Area, which was gazetted in 2005 under the BNCCA Act. A summary of the Western Offset locality is provided below in Table 3.10.

Table 3.10 Summary of the Western Offset

CRITERIA	LOCATION
Council	Narrabri Shire Council
Bioregion	Brigalow Belt South
Catchment Management Area (CMA)	Namoi CMA Liverpool Plains sub-catchment
Botanical Subdivision	Bordering the North Western Slopes (NWS) and North Western Plains (NWP) subdivisions
Mitchell landscapes	Bugaldie Uplands Liverpool Alluvial Plains
Noxious weed control area	Narrabri

3.2.5.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Merriendi BOA contains approximately 176.1 ha of the EPBC Act listed Critically Endangered Ecological Community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, which is classified as State 1 Woodland. A further 150.5 ha is derived native grassland Box Gum Woodland (State 2: native pasture). This ecological community is situated throughout the Merriendi BOA on lower slopes and flatter land (Figure 3.14).

The Western Offset also provides suitable habitat for the Regent Honeyeater, Swift Parrot, Superb Parrot, Grey-headed Flying-fox, Corben's Long-eared Bat, Large-eared Pied Bat, White-throated Needle-tail, Painted Honeyeater and Koala.

A key justification for acquiring the Western Offset for fauna conservation purposes, was its excellent areas of existing habitats for threatened fauna and its direct linkage to the Leard State Forest Conservation Area, which secures existing Box dominated woodland as part of a buffer for loss of habitats within Leard State Forest and offers the opportunity to extend those habitats through the rehabilitation of agricultural lands.

The dominant topography of the Western Offset is a rocky ridgeline, of similar character to the topography occurring in the ridgeline of western Leard State Forest and Leard State Forest Conservation Area. The Western Offsets uplifted areas contain a mixture of Dwyer's Red Gum (*Eucalyptus dwyeri*) dominant woodlands, White Cypress Pine stands and open grassy areas with White Box. The lowlands around its periphery are largely cleared with occasional White Box persisting as paddock trees. The habitat supports a diversity of State threatened woodland birds and blossom events attract a diversity of nectarivorous birds including nomadic species such as Noisy Friarbird and Little Friarbird.

Painted Honeyeater has been recorded in Leard State Forest using mistletoe (*Amyema miquelii*) in Pilliga Box (*Eucalyptus pilligaensis*) (WSP ecologist pers. obs.), but locally the species is more reliably observed using an acacia-preferring mistletoe, *Amyema quandang*. *A. quandang* is often observed parasitising stands of Weeping Myall in the region. The eucalypt mistletoe *Amyema miquelii* occurs widely throughout box woodland habitats across the Western Offset and provides large areas of suitable habitat for the Painted Honeyeater.

Superb Parrot records in the Leard State forest locality are scant, although there are relatively recent records from the wider region, at Breeza to the south east on the Liverpool Plains, to the west of Mt Kaputar around Narrabri and more distantly, to the south of the Pilliga around the Warrumbungles. The Western Offset occurs in closest proximity to

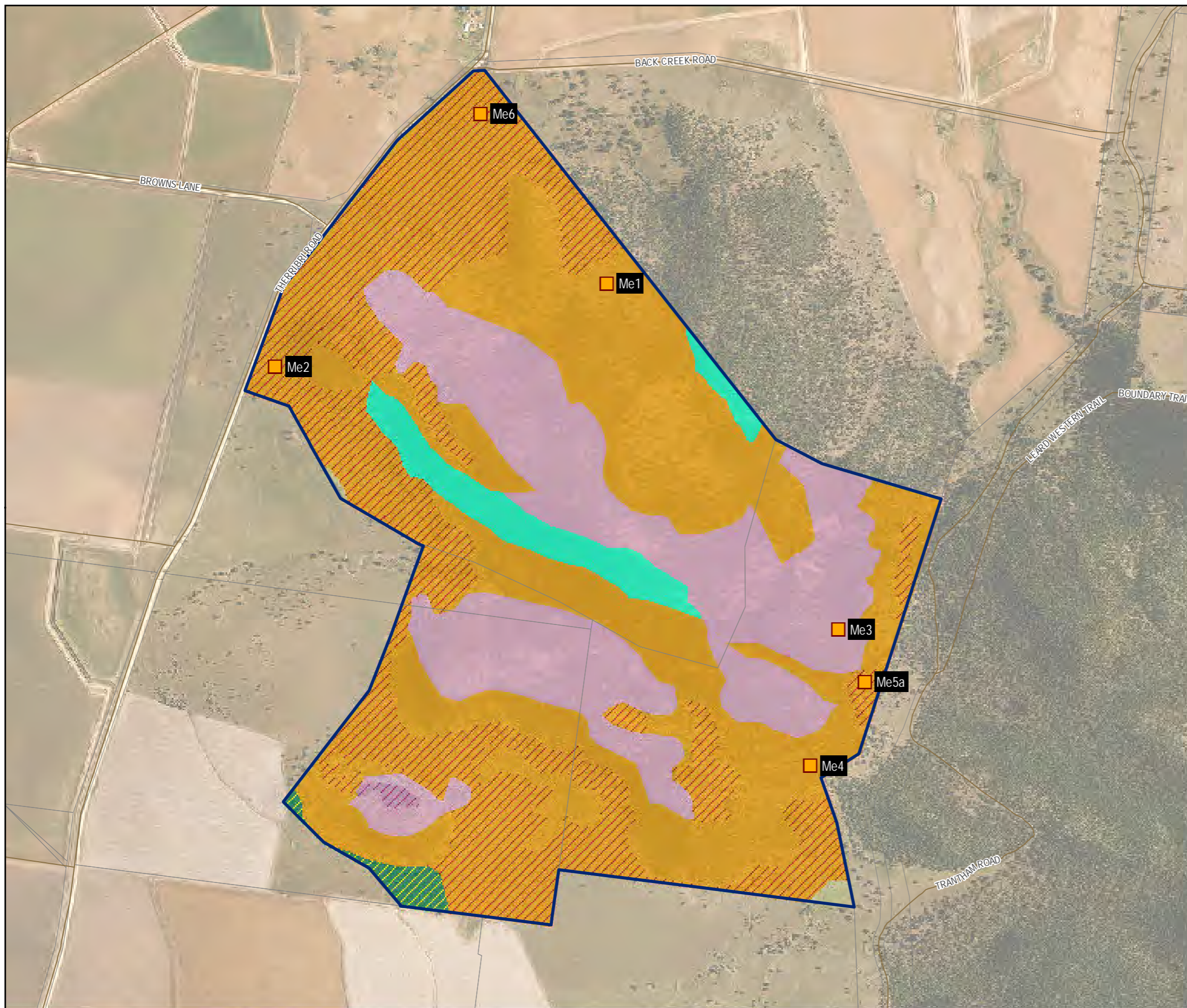
Narrabri Superb Parrot occurrences and is relatively proximate to the riparian habitats of Maules Creek, where Superb Parrots may occur when present locally. The existing box woodlands provide foraging opportunities for Superb Parrot, which include White Box blossom in its diet.

The large areas of woodland habitats that occur throughout the Western Offset provide a diversity of woodland habitats for invertebrate populations, which are the favoured prey group of microchiropteran bats. Rocky habitats in the southeast of the BOA provide potential roosting locations for the Large-eared Pied Bat and the woodland habitats provide a moderate density of hollows for Corben's Long-eared Bat.

3.2.5.2 THREATS AND DISTURBANCES

Existing threats and disturbances within the Western Offset include:

- Clearing and fragmentation – a large proportion of the Western Offset supports remnant woodland; however areas which have been historically cleared and now occurs as low condition woodland, derived native grassland, exotic dominated pasture or agricultural crops.
- Livestock grazing – The Western Offset was previously subject to livestock grazing, which is likely to have reduced the potential for native species regeneration.
- Weedy exotic plants and pest animals – The habitat management zone, which constitutes a large proportion of the Western Offset, contains a low abundance of weeds and pests. The density of weeds and pests increases to moderate and high in areas adjoining pasture and croplands along the south and west BOA boundary.
- Alteration of abiotic factors (hydrology, nutrients and soil) – The Western Offset contains several large ephemeral drainage lines. In the absence of management intervention, erosion within these areas is likely to intensify through natural processes such as flooding or inappropriate land use activities.
- Pesticides and herbicides – land adjoining the south and west BOA boundaries may be subjected to spray drift or chemical run-off from adjoining agricultural land.



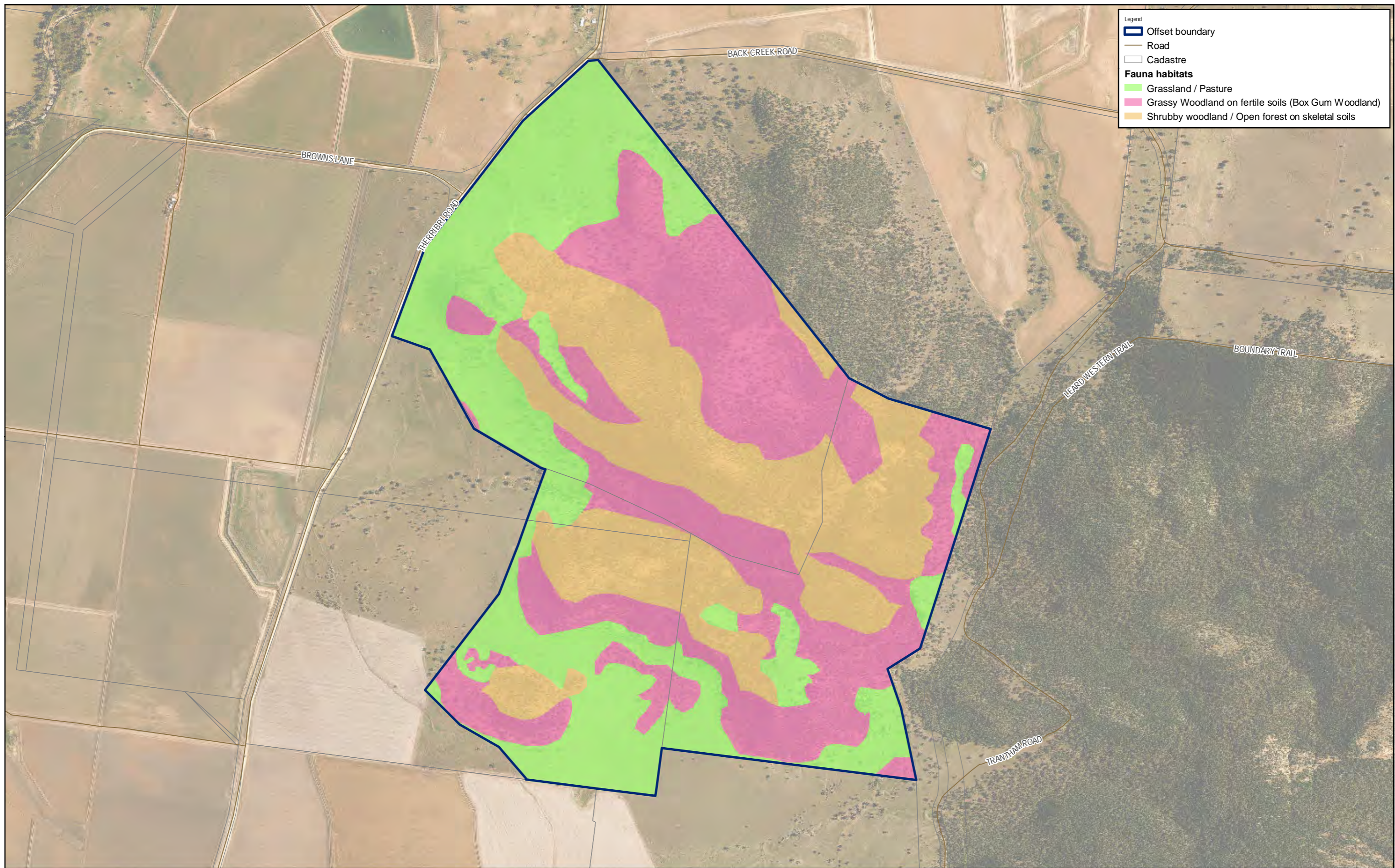
- Legend**
- Monitoring location
 - Offset boundary
 - Road
 - Cadastre
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range**
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]
 - Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range - Derived Native Grassland
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion**
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion**
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion - Derived Native Grassland [PCT88/NA179]
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion**
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion [PCT27/NA219]
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion**
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]
 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]

0 0.25 Kilometres
Scale 1:15,000
Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
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Legend

- Offset boundary
- Road
- Cadastre

Fauna habitats

- Grassland / Pasture
- Grassy Woodland on fertile soils (Box Gum Woodland)
- Shrubby woodland / Open forest on skeletal soils

0 0.25 Kilometres

Scale 1:15,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
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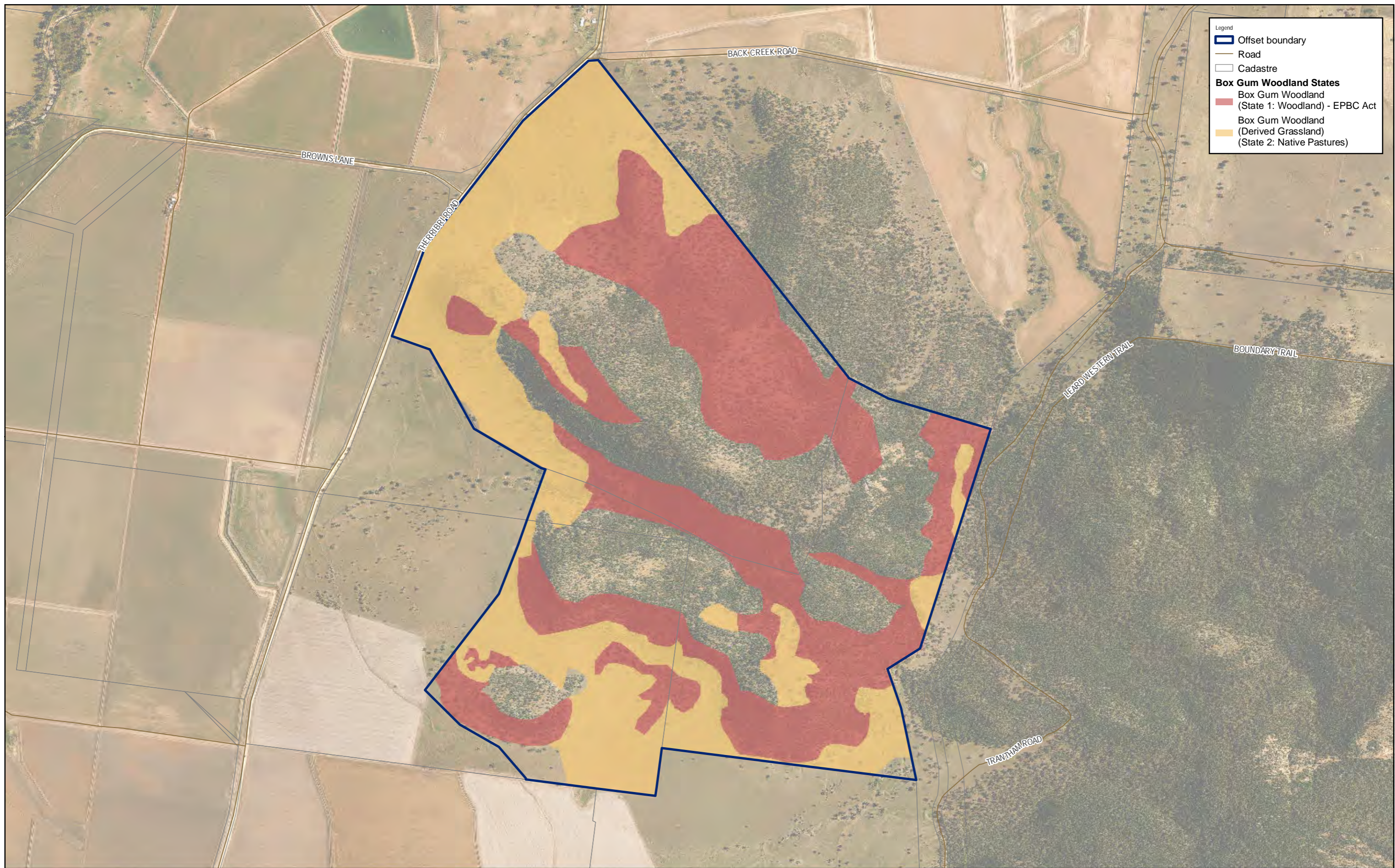
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APPENDIX 3.13

**FAUNA HABITATS WITHIN THE
WESTERN OFFSETS**



Legend

- Offset boundary
- Road
- Cadastre

Box Gum Woodland States

- Box Gum Woodland (State 1: Woodland) - EPBC Act
- Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)

0 0.25 Kilometres

Scale 1:15,000

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APPENDIX **3.14**

TITLE: **MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE WITHIN THE WESTERN OFFSETS**

4 POTENTIAL AND KNOWN IMPACTS

The Boggabri Coal Project was approved under Project Approval EPBC 2009/5256 under sections 130(1) and 133 of the EPBC Act 1999. Known and potential impacts associated with the Boggabri Coal Project were comprehensively assessed and documented in the *Continuation of Boggabri Coal Mine Environmental Assessment* (Project EA) (Hansen Bailey, 2010). BCOPL subsequently applied for modifications of the Project's State Approval, to modify the Project's approval boundary for additional activities and ancillary infrastructure. Environmental Assessments and associated approvals in accordance with the NSW EP&A Act have been completed for Modifications 3, 4 and 5. In addition to the Project's modifications, BCOPL has made commitments to provide additional offsets for impacts associated with the Goonbri Road Upgrade assessed under Part 5 of the NSW EP&A Act and non-approved clearing of understory vegetation outside of the approved Project Boundary.

The most significant impact of the Project comprises the disturbance of native vegetation and associated habitats. Approximately 1,458.5 ha of native vegetation will be disturbed, including 637.8 ha of threatened ecological communities (refer Table 4.1).

The BOS has been carefully designed to provide a robust offsets package that will conserve regionally significant biodiversity and in the medium to long-term improve ecological outcomes.

Table 4.1 Extent of impact to Matters of National Environmental Significance and biodiversity offsets

VEGETATION COMMUNITY	PLANT COMMUNITY TYPE (PCT)	THREATENED ECOLOGICAL COMMUNITY	TOTAL PROJECT DISTURBANCE (HA) ⁴	AVAILABLE OFFSETS WITHIN REVISED BOS5		
				'LIKE FOR LIKE' (HA) ³	DERIVED NATIVE GRASSLAND (HA) ³	TOTAL VEGETATION OFFSET (HA) ⁵
Threatened ecological communities						
Box Gum Woodland ¹	White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT 1383] and Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329] and Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion – (grassy variant) [PCT1118]	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland ^{1,2}	634.1	1,527.9	1,959.7	3,487.6
Plains Grassland CEEC ¹	Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion [PCT102]	Plains Grassland ^{1,2}	0.5	20.3	0	20.3
Weeping Myall Woodland EEC ²	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion [PCT27]	Weeping Myall Woodland ³	0.4	31.8	2.3	34.1
Subtotal threatened ecological communities			635.0	1,580.0	1,962.0	3,542.0
Non-threatened vegetation communities						
Natural Drainage System of the Lowland Catchment of the Darling River	River Red Gum riparian tall woodland/ open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT 78 / BVT NA 193]	-	2.8	68.6	94.0	162.6
Dwyer's Red Gum woodland	Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610]	-	0.3	390.6	29.2	419.8

Narrow-leaved Ironbark – pine – Brown Bloodwood shrub/grass open forest	Narrow-leaved Ironbark - pine - Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion [PCT1380]	-	14.8	0	0	0
Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland	Pilliga Box – White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion [PCT88]	-	85	417.3	836.8	1,254.1
White Box – Melaleuca riverine forest	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84]	-	0.6	36.3	0	36.3
Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313]	-	532.3	2,219.1	47.3	2,266.4
White Box – Narrow-leaved Ironbark – White Cypress Pine shrubby open forest White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (shiny bush) Regrowth – White Cypress Pine	Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion (PCT 1381)	-	184	1,140.2	110.5	1,250.7
Silver-leaved Ironbark heathy woodland	White Cypress Pine - Silver-leaved Ironbark – shrubby open forest of the Nandewar Bioregion [PCT1307]	-	3.7	231.2	7.9	239.1
Tumbledown Red Gum grassy woodland Myrtle Shrubland (+- White Pine/Tumbledown Red Gum); Dripping Rock	Cypress pine – Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427]	-	0	169.3	0	169.3
White Box – White Cypress Pine shrubby open forest (including White Cypress Pine regrowth and Shiny Bush)	White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1308]	-	0	896.7	0	896.7
Rough Barked Apple Riparian Forbs/Grassy Forest	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118]	-	0	187.8	0	187.8

New England Blackbutt Rough-barked Apple shrubby open forest	Nandewar Box – Western New England Blackbutt – Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion [PCT542]	-	0	1.3	0	1.3
Belah alluvial woodlands	Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region [PCT55]	-	0	2.7	65.3	68.0
Intensive agriculture Exotic grassland	Miscellaneous Ecosystem – highly disturbed areas with no or limited native vegetation	-	0	0	0	147.4
Farm dams	Miscellaneous Ecosystems – water bodies, rivers, lakes, streams (not wetlands)	-	0	0	0	1.0
Subtotal other remnant vegetation			823.5	5,761.1	1,191.0	7,100.5
Total			1,458.5	7,341.1	3,153.0	10,642.5
Grassy Woodland on fertile soils			676.6	1,676.1		
Shrubby Woodlands/Open Forest on skeletal soils			735.1	5,048.4		
Riverine Woodland			3.4	596.3		
Grassland			43.4	2,945.6		
Intensive agriculture and farm dams (not including other land for agriculture)			0	376.1		
Total fauna habitats			1,458.5	10,642.5		

- (1) Critically Endangered Ecological Community, listed under EPBC Act.
- (2) Endangered Ecological Community, under the EPBC Act.
- (3) The Namoi BOA contains land purchased as a joint venture between Boggabri Coal and the Maules Creek Coal Mine. The Namoi BOA as discussed in this OMP, totalling 3,214.9 ha, encompasses properties wholly owned by Boggabri Coal and Boggabri Coal's 50 % liability (i.e. 50 % of credits generated) of land purchased under the joint venture agreement.
- (4) Areas include Continuation of Boggabri Coal EA, Modification 3, Modification 4, Modification 5, inadvertent clearing outside the project boundary and Goonbri Road Upgrade.
- (5) The total vegetation offsets include surplus areas of vegetation to current offset requirements.

Vegetation communities to be disturbed during the Project provide known and potential habitat for many threatened species of fauna and flora. Significance assessments completed for the Project EA (Hansen Bailey, 2010) concluded that the Project will have a significant and long-lasting impact on the habitat of the Regent Honeyeater and Corben's Long-eared Bat and White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland) ecological community listed under the EPBC Act (Table 4.2).

Table 4.2 Summary of significance assessments completed for MNES

BIODIVERSITY VALUES	RECORDED IN PROJECT BOUNDARY	EPBC ACT¹	LIKELY SIGNIFICANT IMPACT
Endangered Ecological Communities			
Box Gum Grassy Woodland	Yes	CE	Yes
Weeping Myall Woodland	Yes	E	No
Plains grassland	Yes	CE	No
Threatened plants			
<i>Digitaria porrecta</i> ²	No	E	No
<i>Diuris tricolor</i> ³	No	V	No
<i>Pultenaea setulosa</i>	Yes	V	No
<i>Tylophora linearis</i>	Yes	E	No
Threatened animals			
Sloane's Froglet ⁴	No	E	No
Painted Honeyeater ⁵	Yes	V	Yes
Swift Parrot	No	CE	No
Superb Parrot	No	V	No
Regent Honeyeater	No	CE	Yes
Corben's Long-eared Bat	Yes	V	Yes
Large-eared Pied Bat	No	V	No
Spotted-tailed Quoll	No	E	No
Koala ⁶	Yes	V	No
Border Thick-tailed Gecko	No	V	No

(1) *Environment Protection and Biodiversity Conservation Act 1999*, CE = Critically Endangered, E = Endangered, V = Vulnerable.

(2) *Digitaria porrecta* delisted from the EPBC Act, effective 14 December 2013.

(3) *Diuris tricolor* delisted from the EPBC Act, effective 19 August 2011.

(4) Sloane's Froglet listed as Endangered under the EPBC Act, effective 4 July 2019.

(5) Painted Honeyeater listed as Vulnerable under the EPBC Act, effective 8 July 2015.

(6) Koala listed as Vulnerable under the EPBC Act, effective 2 May 2012.

Section 6 of this OMP provide actions to mitigate and manage the operational impacts of the Project on BOAs.

5 MANAGEMENT SAFEGUARDS

5.1 CONTINGENCY PLANNING

Potential risks to the successful implementation of the OMP such as fire or flood within the BOAs and contingency measures that would be implemented to mitigate against these risks are set out in this Section. Potential issues, responsibilities and management actions are provided in Table 5.1. Potential risks and mitigation measures associated with revegetation activities are detailed in Appendix D. Furthermore, a Trigger Action Response Plan is provided in Section 7.3, which will be used to determine whether additional actions are required to rectify any problems.

Table 5.1 Contingency plan

ISSUE	RESPONSIBILITY	MANAGEMENT ACTION
New information regarding biodiversity values (e.g. new threatened species)	Environment Superintendent	Contact DPI&E (formerly OEH) and/or DoEE in the event that a threatened species previously not recorded is identified Review of OMP and monitoring program, as appropriate
Chemical impacts on flora/ fauna	Environment Superintendent	Follow reporting and communication procedures in accordance with the Incident Management Protocol (refer Section 8.2.1) Revise procedures to mitigate future risks
Unplanned clearing activity	Environment Superintendent	Report location and extent of clearing. Collect photo evidence and provide information to relevant authorities (Police and DPI&E (formerly OEH)) Undertake follow up compliance checks
Fire	Environment Superintendent	Follow reporting and communication procedures in accordance with the Incident Management Protocol Replace and maintain damaged fences and signs Exclude stock from burnt areas to allow natural regeneration. Monitor areas to identify weed control requirements
Flood	Environment Superintendent	Follow reporting and communication procedures in accordance with the Incident Management Protocol Replace and maintain damaged fences and signs Monitor inundated areas to identify weed control requirements

ISSUE	RESPONSIBILITY	MANAGEMENT ACTION
Drought	Environment Superintendent	<p>Follow reporting and communication procedures in accordance with the Incident Management Protocol</p> <p>Reduce livestock grazing during times of drought</p> <p>Monitor the survival and growth of regenerated areas which have been direct seeded or planted with tube stock, where drought stress is identified provide a mechanism to alleviate stress such as additional watering events</p> <p>Prevent, control and monitor feral animals</p>

5.2 CONSERVATION AND BIODIVERSITY BOND

In accordance with Condition 4 of the Project EPBC Approval (EPBC 2009/5256), BCOPL are required to submit a Conservation and Biodiversity Bond under Condition 52 of the Project EP&A Act (State) Approval (09_0182). BCOPL will submit a Conservation and Biodiversity Bond that may be combined with the rehabilitation security deposit as administered by DRG (formerly NSW Trade and Investment – Division of Resources and Energy) under the NSW *Mining Act 1992*.

BCOPL will submit details of the bond and the rehabilitation security deposit to the Minister.

Alternative funding arrangements for long-term management of the BOS, such as a conservation agreement or transfer of BOAs to conservation reserve estate may also be used by BCOPL to reduce any bond amount.

5.3 CONSERVATION COVENANTS

The long-term objective of the Boggabri Coal BOS is to provide conservation of the BOAs in-perpetuity. There are a number of options available to secure land under permanent conservation agreements. Boggabri Coal is committed to exploring and identifying the most suitable conservation arrangement for land in consultation with the relevant stakeholders. Potential options may include:

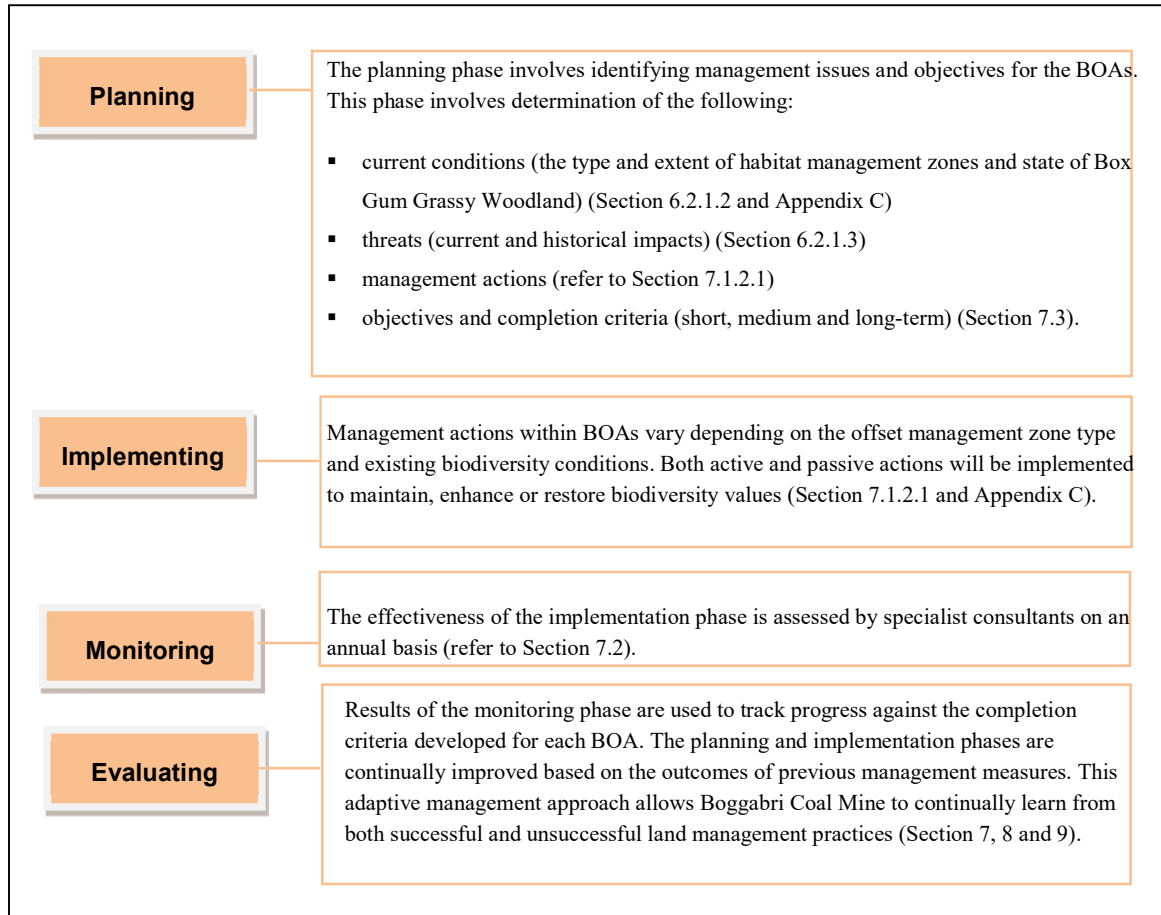
- Voluntary Conservation Agreement
- Dedication to National Parks reserve estate
- Biodiversity Stewardship Agreement.

It should be recognised that a number of different conservation strategies to provide for the ongoing protection of offsets may be required and one strategy may not be suitable for all land tenures. Boggabri Coal is committed to establishing suitable conservation agreements for offsets to meet the objectives of the Boggabri Coal BOS and provide a regional approach to biodiversity conservation.

Boggabri Coal currently manage approximately 10,642.5 ha of land associated with the BOAs (not including areas dedicated as other land for agriculture). In accordance with the Project's EPBC Approval, BCOPL will register one or more legally binding conservation covenants over the BOAs. This will include no less than 3,065.2 ha of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community.

6 BIODIVERSITY MANAGEMENT IN THE OFFSET AREAS

The process for managing BOAs has been developed from the Commonwealth Government’s *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a). This process involves four key phases (Inset 2) and is successive from the commencement of the management program, with each phase implemented continually until achievement of the relevant completion criteria (Section 7.2).



Inset 2 Overview of the offset management process

The Planning and implementing phases of the BOS are detailed in Sections 6.1 and 6.2. The Biodiversity monitoring program is provided in Section 7.1, whilst measures associated with the evaluating phase are outlined in Section 7.2, 7.3 and 7.4.

6.1 PLANNING

The planning phase involves the development of site specific objectives/ completion criteria and gathering of information to guide the implementation of appropriate management measures. The objectives of the planning phase was to:

- Identify the baseline condition of each BOA
- Establish a set of measurable performance indicators and completion criteria to determine trends and effectiveness of management measures
- Identify appropriate methods of adaptive management to improve outcomes of management over time.

To determine the baseline condition of each BOA, preliminary field survey and assessments were conducted by WSP ecologists, as described in Section 3.2. These surveys were used specifically to identify current condition and management actions for inclusion in the OMP (including identification of management zones described in Section 6.1.1). The quantity, quality and ecological characteristics of the offset areas have been validated by the independently approved ecological expert (Niche Environment and Heritage, 2014). A summary of the existing environments determined by these surveys is provided in Section 3.2.

During this time (i.e. 2012 to 2015) a monitoring program was developed across the BOAs to determine baseline condition of each BOAs. Although BOA monitoring in 2012, 2014 and 2015 was completed prior to the implementation of any management, data collected during the 2015 monitoring session is considered the baseline condition as it is the first year in which all 10 BOAs were surveyed collectively. Prior to 2015, monitoring surveys were limited to BOAs associated with the Western, Namoi and Central Offsets, as the Eastern Offsets had not yet been acquired. The BOA monitoring methodology and baseline condition is described in Section 7.1.

Completion criteria have been developed for the BOAs (Section 7.2). The criteria are directly linked to BBAM 2014 benchmarks and analogue sites from Leard State Forest. To demonstrate achievement of the completion criteria, specific environmental indicators (e.g. foliage cover) have been set out in Section 7.2.

A Trigger Action Response Plan (Section 7.3) has been developed to enable adaptive management. The plan includes a set of trigger thresholds associated with attributed collected as part of the BOA monitoring and annual inspection which will be used to determine when measures being implemented are not effective and require adaption.

When developing implementation measures for biodiversity management, identifying the condition of the subject site and the existing disturbances affecting or threatening environmental health is important. The following sections detail the process of identifying existing conditions and summarise the disturbances known to be impacting on the BOAs.

6.1.1 EXISTING MANAGEMENT CONDITION OF BOAS

Four distinct management zones are recognised within the BOAs. These zones are classified according to environmental condition (as determined through preliminary survey investigations described in Section 3.2) and the distinct suite of management measures required maintaining, enhancing or restoring biodiversity values within these areas. A brief description of each management zone is provided in the following sections and a breakdown of the extent of each zone within the BOAs is provided in Table 6.1 and illustrated in Figure 6.1 to Figure 6.4.

HABITAT MANAGEMENT ZONE

The habitat management zone is associated with remnant native woodland vegetation in good condition, with limited disturbances and exotic species present. This zone requires some active pest and weed management activities, fencing of areas adjoining lands not managed for biodiversity conservation and the exclusion of livestock grazing. These areas are generally considered to not require any assisted revegetation and provide existing high quality fauna habitats.

HABITAT RESTORATION ZONE

The habitat restoration zone incorporates those areas of good condition native grassland communities with only moderate exotic species present and an existing soil seed bank with the potential for natural revegetation. Management activities within this zone involve fencing, targeted pest and weed management and supplementary canopy planting to facilitate enhanced revegetation of the canopy layer. This zone will also incorporate the provision of supplementary habitat features to further encourage use by local fauna species.

CORRIDOR ENHANCEMENT ZONE

The corridor enhancement zone incorporates those areas of non-native grasslands that have been significantly disturbed by past land use practices, including clearing, cropping, pasture improvement and heavy grazing. This zone incorporates supplementary canopy planting and some targeted weed and pest management activities to increase woody canopy cover and build on adjoining existing wildlife corridors. This zone is likely to further encourage the use of the proposed wildlife corridors by semi mobile fauna species in the medium to long-term.

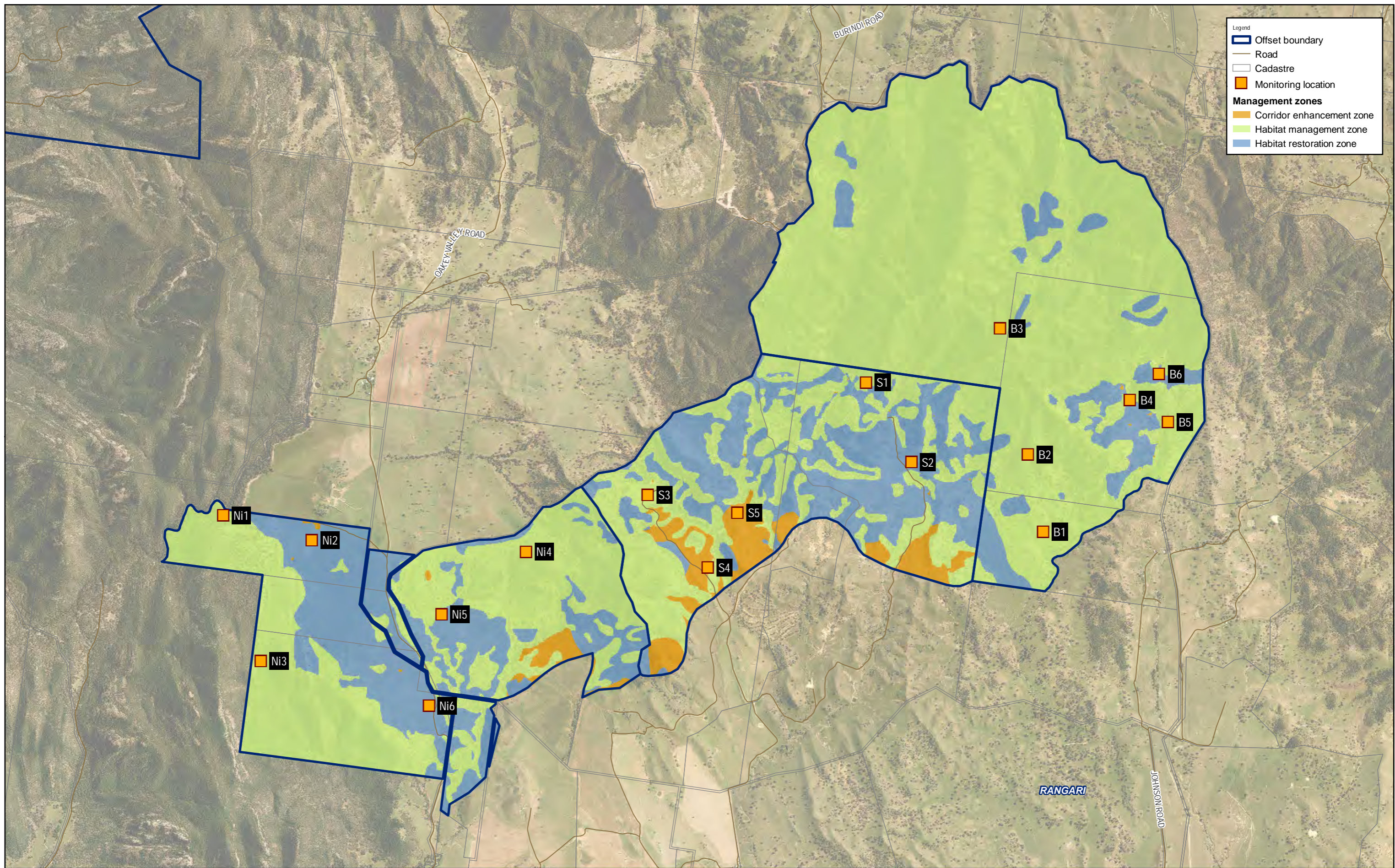
OTHER LANDS FOR AGRICULTURE ZONE

The other lands for agriculture zone incorporates highly productive agricultural land previously identified as containing pasture improvement, cropping or other intensive agricultural activities. These areas are considered to provide only limited potential for revegetation and are not considered critical to the establishment of the proposed wildlife corridors or habitat areas within the BOAs.

Table 6.1 Extent of offset management zones within each BOA

BOA	MANAGEMENT ZONES (HA)				TOTAL
	Habitat Management	Habitat Restoration	Corridor Enhancement	Other Lands for Agricultural	
Eastern Offsets					
Braefield	1,283.2	117.1	0.4	0	1,400.7
Sunshine	353.2	300.1	84.7	0	738.0
Nioka North	523.1	316.6	17.9	0	857.6
Total	2,159.5	733.8	103.0	0	2,996.3
Central Offsets					
Mallee	2,025.9	40.3	0	0	2,066.2
Myall Plains	367.4	62.0	43.9	0	473.3
Wirrilah	326.8	371.8	185.6	0	884.2
Goonbri	127.6	88.3	15.1	0	231.0
Total	2,847.7	562.4	244.6	0	3,654.7
Namoi Offsets					
Namoi ¹	1,563.4	1,391.4	30.3	229.8	3,214.9
Jerralong	222.4	300.8	0	46.9	570.1
Total	1,785.8	1,692.2	30.3	276.7	3,785.0
Western Offset					
Merriendi	327.0	156.2	0	0	483.2
Combined Offsets Total	7,120.0	3,144.6	377.9	276.7	10,919.2

- (1) The Namoi BOA contains land purchased as a joint venture between Boggabri Coal and the Maules Creek Coal Mine). The Namoi BOA as discussed in this OMP, totalling 3,214.9 ha, encompasses properties wholly owned by Boggabri Coal and Boggabri Coal's 50 % liability (i.e. 50 % of credits generated) of land purchased under the joint venture agreement.



Legend

- Offset boundary
- Road
- Cadastre
- Monitoring location

Management zones

- Corridor enhancement zone
- Habitat management zone
- Habitat restoration zone

0 0.25 0.5 0.75 Kilometres

Scale 1:35,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

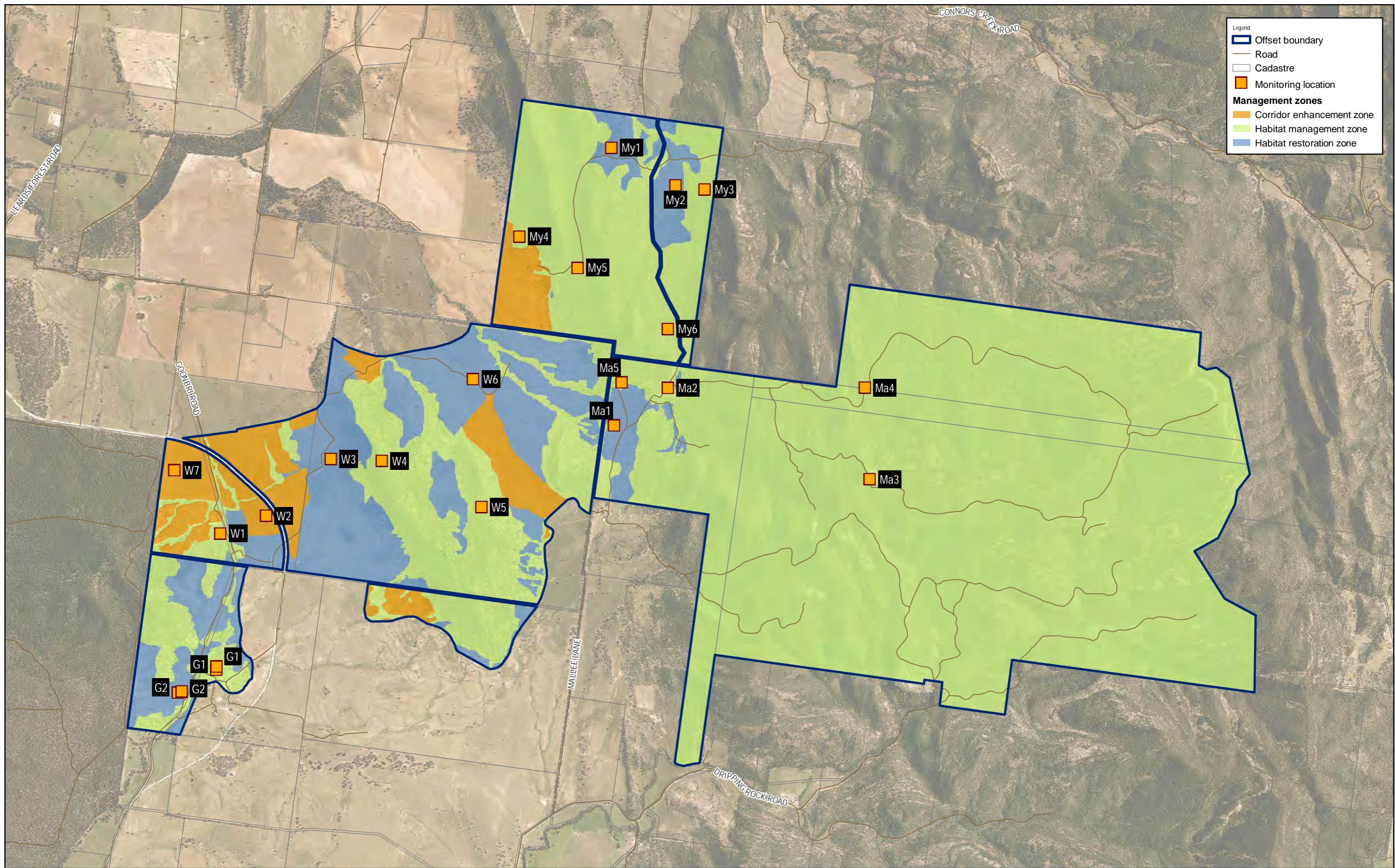
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APPENDIX **6.1**

TITLE: **MANAGEMENT ZONES WITHIN EASTERN OFFSETS**



Legend

- Offset boundary
- Road
- Cadastre
- Monitoring location

Management zones

- Corridor enhancement zone
- Habitat management zone
- Habitat restoration zone


0 0.25 0.5 0.75 Kilometres

Scale 1:35,000

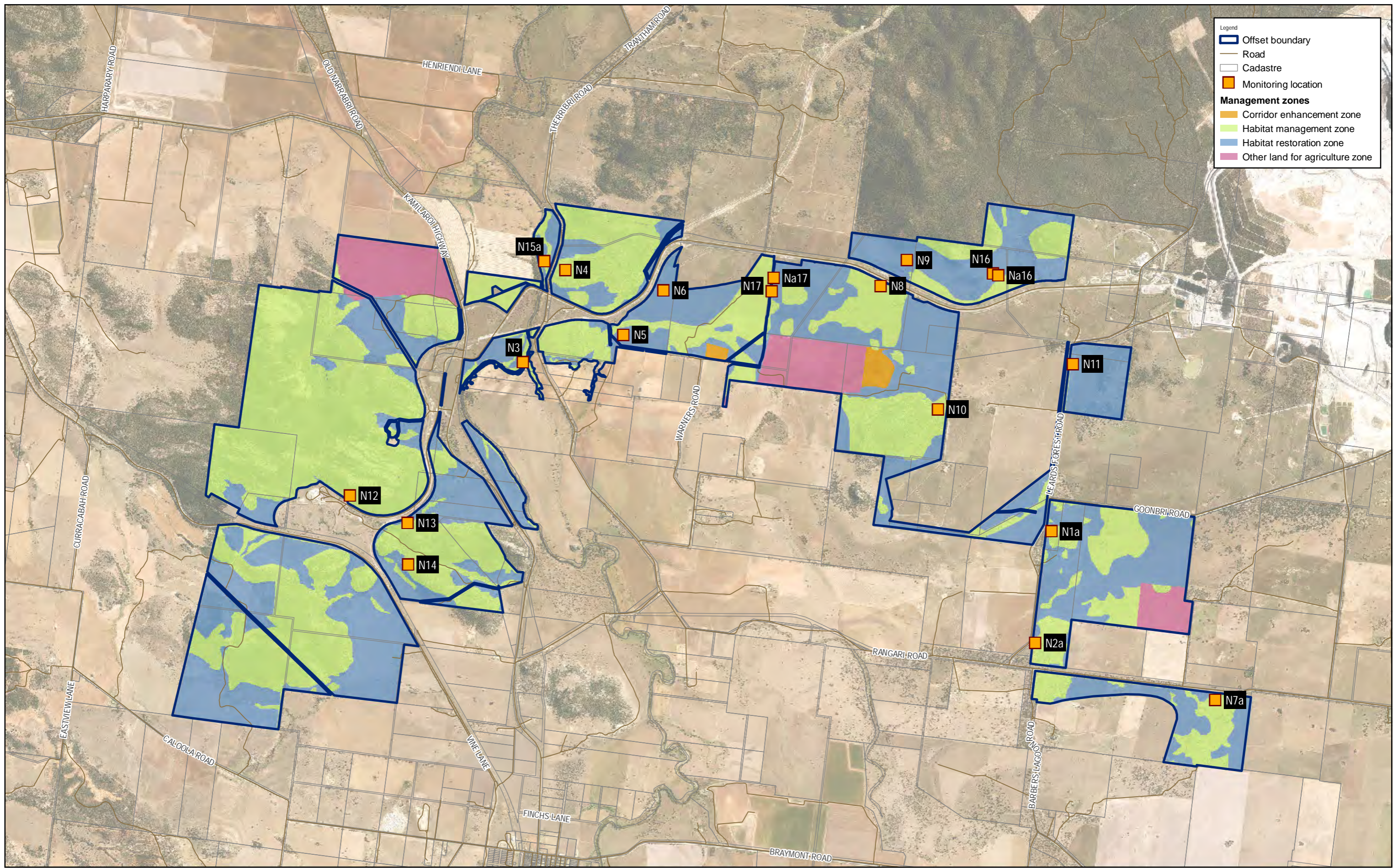
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 Coordinate System: GDA 1984 MGA Zone 56
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Legend

- Offset boundary
- Road
- Cadastre
- Monitoring location

Management zones


- Corridor enhancement zone
- Habitat management zone
- Habitat restoration zone
- Other land for agriculture zone

0 0.25 0.5 0.75 1 1.25 Kilometres

Scale 1:50,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery: BCPL (2015) and



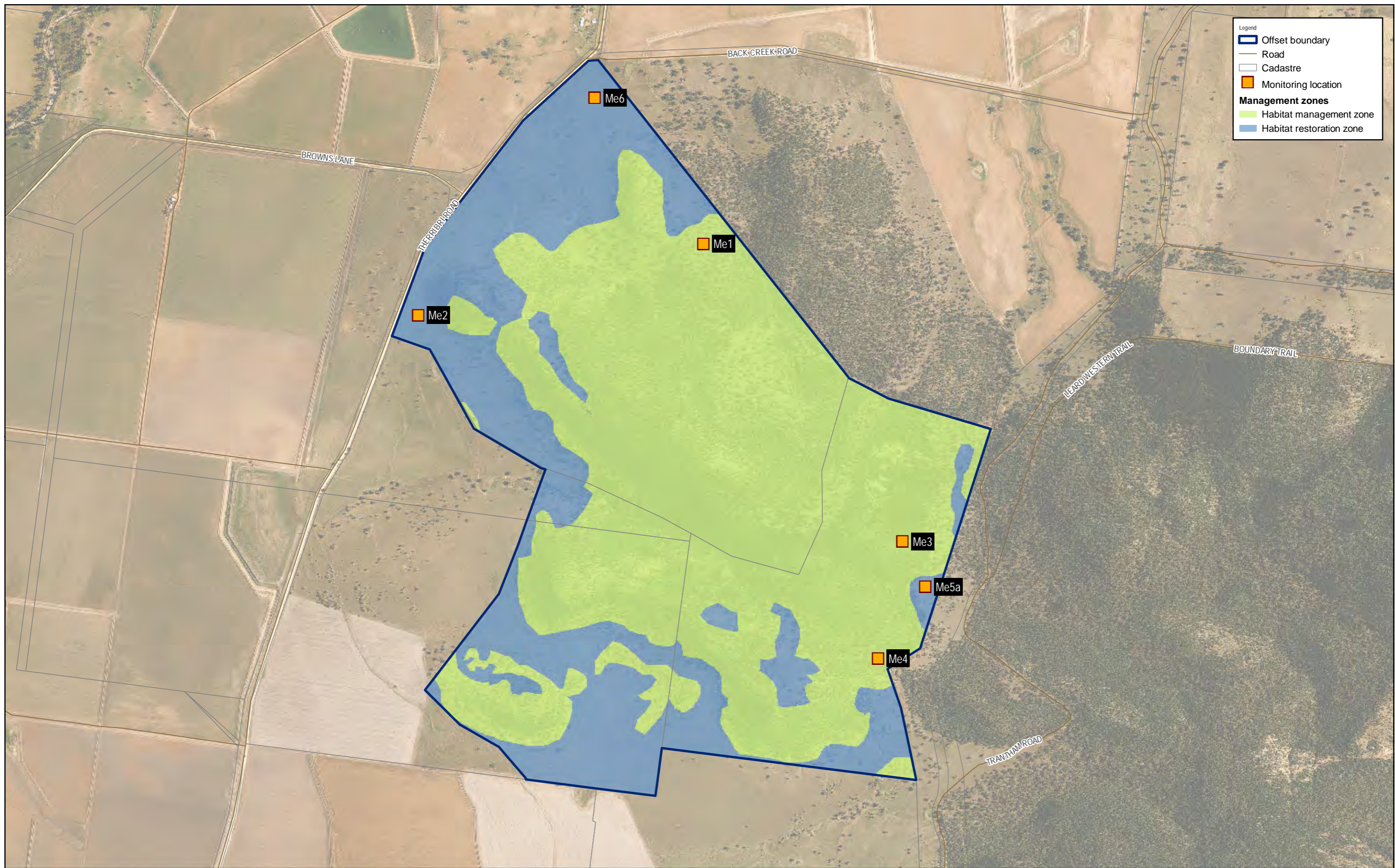
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APPENDIX **6.3**

MANAGEMENT ZONES WITHIN NAMOI

TITLE: OFFSETS



Legend

- Offset boundary
- Road
- Cadastre
- Monitoring location

Management zones

- Habitat management zone
- Habitat restoration zone

0 0.25 Kilometres

Scale 1:15,000

Projection: Transverse Mercator
Coordinate System: GDA 1984 MGA Zone 56
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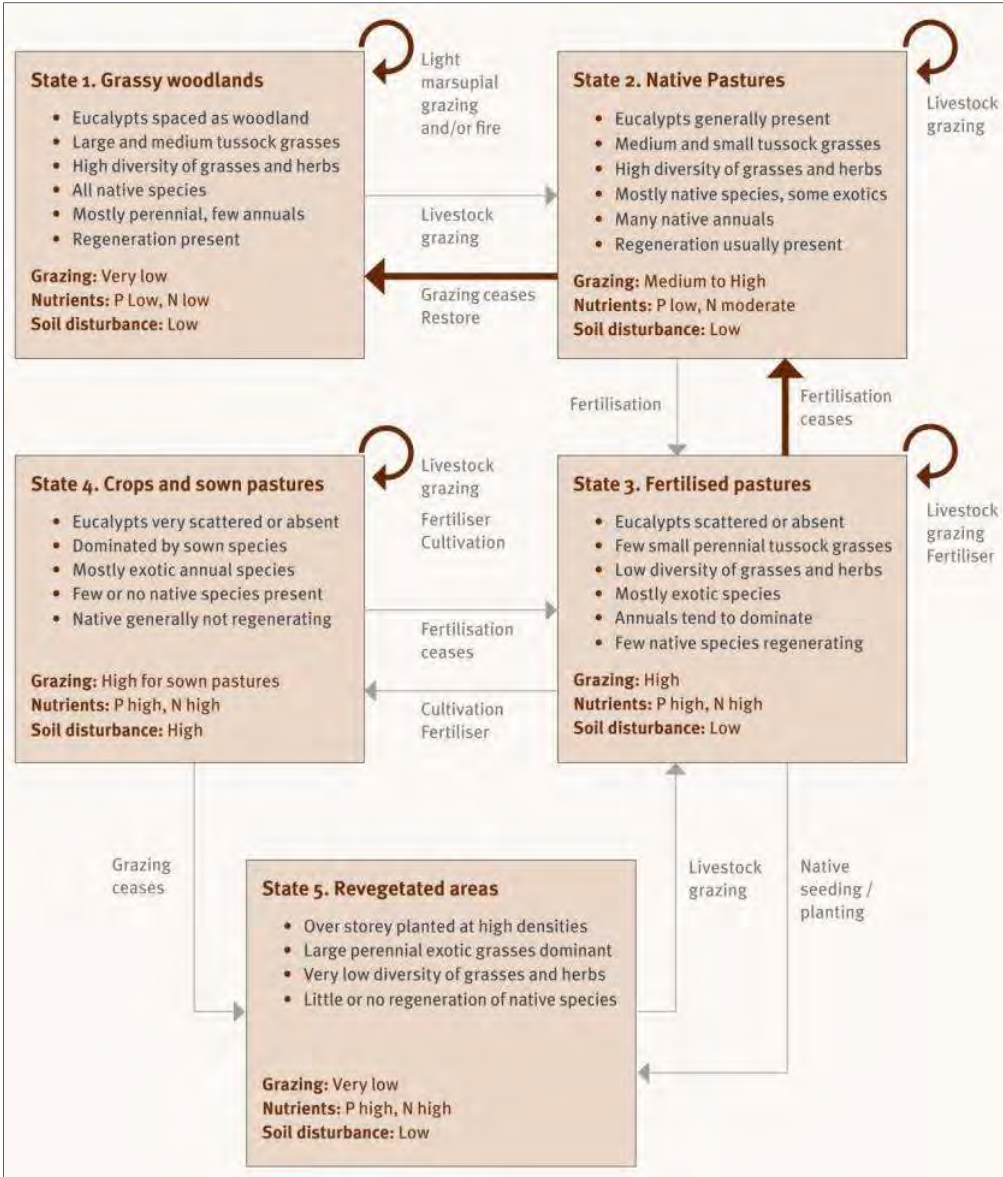
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APPENDIX 6.4

**MANAGEMENT ZONES WITHIN
WESTERN OFFSETS**

6.1.2 BOX GUM GRASSY WOODLAND

Areas of the Box Gum Grassy Woodland community within each offset management zone have been further classified in accordance with the State and Transition Model provided in the Commonwealth Government’s *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a) (Inset 3).



— **Inset 3 Box Gum Grassy Woodland State and Transition Model (Rawlings et al. 2010)**

The State and Transition Model identifies the drivers for change between the five recognised states of Box Gum Grassy Woodland. The BOAs contain Box Gum Grassy Woodland ranging in condition between States 1 and 5. While the transition of all areas to State 1 is not a realistic objective in the short to medium term, the management measures are focused on progressing each patch to the succeeding level of environmental health i.e. Stage 3 - fertilised pasture to Stage 2 - native pasture.

The BOAs contain approximately 3,487.6 ha of Box Gum Woodland which is listed under the EPBC Act as White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grasslands. A summary of the Box Gum Woodland across the BOAs is provided below in Table 6.2 and illustrated in Figure 6.5.

Table 6.2 Summary of Box Gum Woodland EEC within the BOAs

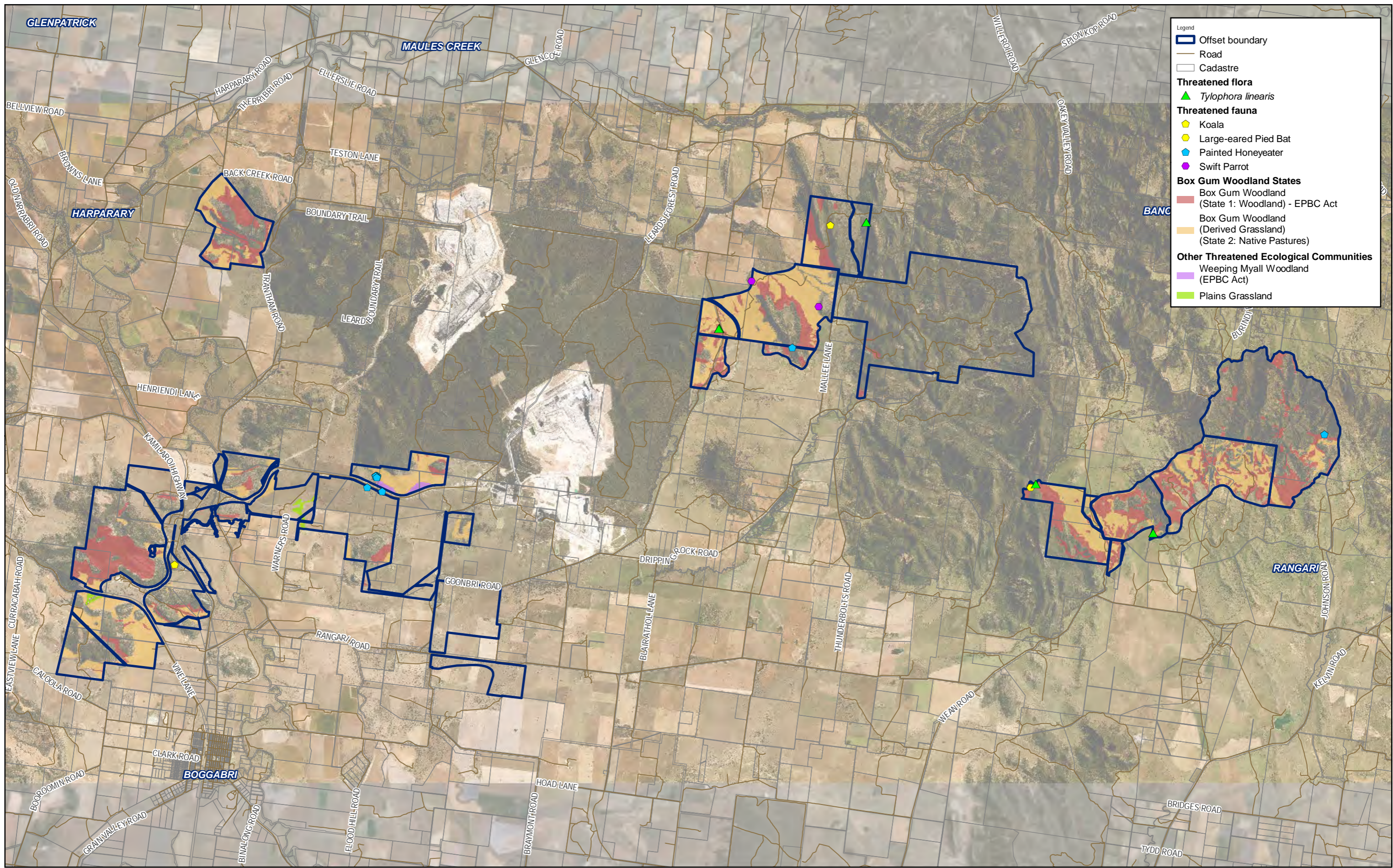
BIODIVERSITY OFFSET AREA	STATE OF BOX GUM WOODLAND	
	State 1 – Woodland (ha)	State 2 – Native pastures (ha)
Merriendi	176.1	150.5
Namoi	326.4	590.1
Jerralong	0	0
Goonbri	72.3	88.3
Wirrilah	146.1	517.5
Myall Plains	66.5	43.9
Mallee	14.2	0
Nioka North	291.5	265.2
Sunshine	240.5	248.8
Braefield	194.3	55.4
Total	1,527.9	1,959.7

The general relationship between the condition class of Box Gum Grassy Woodland and each offset management zone is defined in Table 6.3. In accordance with Condition 7 of the Project EPBC Approval (EPBC 2009/5256), areas of ‘native pastures’ will be restored back to ‘woodland’.

Table 6.3 Offset management zones corresponding with Box Gum Grassy Woodland condition classes

OFFSET MANAGEMENT ZONE	BOX GUM GRASSY WOODLAND CONDITION CLASS ¹
Habitat management zone	State 1 woodland
Habitat restoration zone	State 2 native pastures
Corridor enhancement zone	States 3 and 5
Other lands and agriculture zone	State 4

Note: Sourced from ‘A Guide to Managing Box Gum Grassy Woodlands’ (Rawlings et al., 2010a).



Legend

- Offset boundary
- Road
- Cadastre

Threatened flora

- ▲ *Tylophora linearis*

Threatened fauna

- ◆ Koala
- Large-eared Pied Bat
- ◆ Painted Honeyeater
- Swift Parrot

Box Gum Woodland States

- Box Gum Woodland (State 1: Woodland) - EPBC Act
- Box Gum Woodland (Derived Grassland) (State 2: Native Pastures)

Other Threatened Ecological Communities

- Weeping Myall Woodland (EPBC Act)
- Plains Grassland


0 1 2 Kilometres

Scale 1:115,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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6.1.3 IMPACTS AND THREATS

Appropriate management measures have been identified for each BOA (Section 6.3). These actions have been developed with reference to the historical drivers of transition and current processes impacting upon or threatening biodiversity values within each site. Disturbances known to be threatening the BOAs include:

- clearing and fragmentation
- livestock grazing
- nutrient enrichment
- weedy exotic plants and pest animals
- inappropriate fire regimes
- alteration of abiotic factors (hydrology, nutrients and soil)
- pesticides and herbicides
- firewood collection.

The type and extent of disturbances vary between the four offset management zones within each BOA. For example, land within the habitat management zone is likely to be subjected to fewer disturbances than land within the habitat restoration zone.

6.2 IMPLEMENTING BIODIVERSITY MANAGEMENT WITHIN THE BOAS

The management of BOAs requires a combination of both passive (e.g. retaining fallen timber) and active (e.g. revegetation) measures. The type and extent of management measures required differ between the offset management zones as described in Table 6.4.

Table 6.4 Management measures associated with each offset management zone

MANAGEMENT MEASURE	OFFSET MANAGEMENT ZONE		
	Habitat Management Zone (Maintenance)	Habitat Restoration Zone (Enhancement)	Corridor Enhancement Zone (Restoration)
Fencing ¹	●	●	●
Grazing management for conservation		●	●
Weed and pest control	●	●	●
Fire management for conservation ²	●	●	●
Management of human access and disturbance	●	●	●
Retention or addition of habitat features	●	●	●
Nutrient control		●	●
Erosion control		●	●

Thinning (Pine and Native Shrub)	•	•	•
Natural regeneration	•	•	•
Active revegetation		•	•

- (1) The existing and proposed fences may include areas that do not line up exactly with zones but each of the zones will be protected.
- (2) The use of fire is subject to approval from the relevant state authorities (e.g. NSW Rural Fire Service) (refer Section 6.2.1).

Management measures associated with the maintenance, enhancement and restoration of BOAs are described in the following sections. These measures have been adapted from a range of guidelines and literature, particularly the Commonwealth Government’s *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a). Specific management measures for each BOA are provided in separate management plans in Section 6.3.

6.2.1 MAINTENANCE AND ENHANCEMENT

6.2.1.1 ACCESS CONTROL FOR THE PROTECTION OF EXISTING HABITATS

Permanent fencing will be used within BOAs to exclude livestock from areas managed for biodiversity conservation, including habitat management zones and habitat restoration zones.

The siting and design of livestock exclusion fencing will consider potential risks to native wildlife, particularly temporary electric fences, which have the greatest potential to injure and kill native species.

Overarching management controls employed across all BOAs include:

- where BOAs share common boundaries, fencing designs must not restrict native fauna movement or connectivity between habitats
- fences along BOAs common boundaries being managed in the same way must be investigated to determine whether unnecessary fences could be removed/avoided
- any fencing along waterways will be installed a minimum of 10 m from the top edge of the bank
- where required, fences will include a gate to manage access
- the bottom strand of any electric fences will not be electrified and barbed-wire will be avoided
- consideration will be given to avoiding or minimising clearing of native vegetation when installing new fences where none currently exist
- fencing will be implemented in a staged approach to control livestock.

6.2.1.2 GRAZING MANAGEMENT FOR CONSERVATION

Poorly managed livestock grazing can cause significant damage to patches of remnant vegetation and restoration areas; however, if managed appropriately grazing can be used as an effective tool to control weeds, manage bushfire risks, reduce biomass and positively manipulate species composition and vegetative structure. As such boundary fencing of all BOAs will be upgraded as to exclude unauthorised stock grazing.

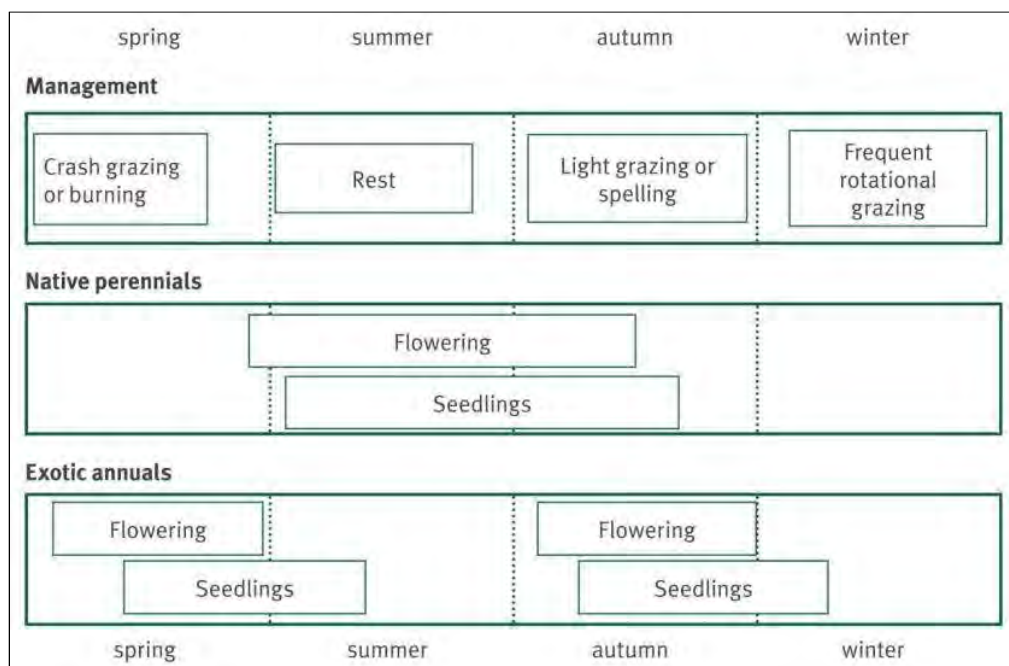
Livestock grazing will be permanently excluded from habitat management zones. Livestock will initially be excluded from habitat restoration zones and corridor enhancement zones. Following the establishment of plantings within these areas, an investigation into sustainable livestock carrying capacities will be undertaken to assess the feasibility of introducing a strategic livestock regime.

The exclusion of livestock or alteration of grazing regimes can lead to positive or negative outcomes. Unintended and negative outcomes will be identified during annual inspections undertaken within the BOAs and as part of the Biodiversity Monitoring Program (Section 7.1).

In the event that a grazing regime is deemed feasible within the habitat restoration zones and corridor enhancement zones, the following overarching management controls will be employed:

- crash and seasonal grazing may be used in habitat restoration zones and corridor enhancement zones to control weed species and encourage native species diversity
- crash grazing using cattle is usually undertaken between late autumn and mid spring before weeds go to seed and while palatability and nutrient content is still high. Crash grazing would be restricted to small, temporarily fenced areas by allowing large numbers of livestock to graze for very short periods; generally until plants are grazed to a height between 5 -10 cm
- the timing of grazing would be appropriate to targeted weeds and native species (Inset 4). Only limited grazing will be undertaken during summer, allowing native grasses to seed and regain dominance
- the timing of grazing regime would also be critical for use in reduction of fuel loads in BOAs. The use of grazing for reduction in fuel loads would only be used when it has been assessed that the fuel load is extreme within the BOAs.

Inset 4 provides an example of a seasonal grazing strategy aimed at controlling annual weeds.



— **Inset 4** Seasonal grazing strategy (Rawlings et al. 2010)

6.2.1.3 WEED AND PEST CONTROL

Weed and pest control measures within the BOAs will be undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and the control schedules developed for each BOA. Weed density mapping provided in this OMP. Overarching management controls employed across all BOAs include:

- weed management and pest control trends to be communicated to other coal mines (BMT Complex) in the locality and include:

- review of Weed and Pest Management Strategy (Appendix B) and BMP for current information and updates on weeds and pests
- discussion and prioritisation of weed and pest prevention, control measures and targets species across the BMT Complex for the following year
- liaise with local land managers and stakeholders regarding control measures and schedules.
- BMT complex to be alerted of any new or emerging weed and/or pest species recorded on any of the BOAs, where identified
- an integrated weed management and pest control approach may be implemented across the BOAs to allow for a consistent reporting and analysis
- weed management may comprise of a combination of nutrient management, physical removal and herbicide application. Crash grazing may also be used in habitat restoration zones and corridor enhancement zones. Weeds along creeks and drainage lines will be controlled in a staged approach.
- weed control methods may be targeted to specific species and the condition of the subject site. Methods may include physical and mechanical controls such as hand-pulling, chipping, slashing and where necessary, use of machinery. Methods of herbicide application will include spray-topping, the cut and paint method, stem injection and spot spraying.
- significant weed infestations or establishment of new weed species within BOAs to be reviewed and control measures implemented within 1 year of identification
- pest control strategies may include the destruction of burrows, shooting, trapping and baiting in accordance with NSW Codes of Practice and Standard Operating Procedures as outlined in Appendix B
- public communication on pest animal records may be reported through Feral Scan as outlined in Appendix B
- Significant pest occurrences or newly identified pest species within BOAs to be reviewed and control measures implemented within 1 year of identification.

6.2.1.4 MANAGEMENT OF FUEL LOADS AND IMPLEMENTATION OF APPROPRIATE FIRE REGIME FOR CONSERVATION

Fire management is an important tool for biomass control, nutrient management and positive species manipulation, through stimulation of seed germination. Developing an appropriate fire regime is difficult, as a lack of fire (or a disturbance that mimics fire) can lead to denser canopies and less diversity in the groundcover and mid-storey layers, while excessive burning can adversely affect soil surface conditions resulting in compaction, crusting, poor infiltration, decreased biological activity which results in a decreased biodiversity of native species (Rawlings et al., 2010b).

The implementation of a fire regime within the BOAs is subject to approval from relevant authorities. As an alternative to using fire, biomass control, nutrient management and positive species manipulation may be managed through a seasonal grazing strategy within habitat restoration zones and corridor enhancement zones.

The following overarching management controls relate to the implementation of fire regimes within all BOAs:

- fuel load assessment will be undertaken as part of annual BOA inspections to determine whether a fuel reduction burn is required based on a risk basis or as recommended by the NSW Rural Fire Service.
- in the event a fuel load assessment indicates extreme fuel loads which pose significant fire risks within the BOAs, BCOPL will consider trialling strategic crash grazing, introduction of fire breaks and/or hazard reduction burns. Should a hazard reduction burn be necessary, a management plan would be developed in consultation with the NSW Rural Fire Service to undertake ecological burns to reduce fuel loads.

- control burns must aim to reduce impacts on biodiversity by undertaking burns (as far as practicable) in autumn and avoid burning trees which contain hollow resources to encourage native species recruitment and minimise impacts on roosting and nesting availability
- control burns must consider recommendations outlined in Section 9 of Guide to Managing Box Gum Grassy Woodlands (Rawlings et al., 2010b)
- maintenance of existing access tracks and fire breaks within the BOAs in accordance with the LLS Act, BC Act or *Rural Fires Act 1997* would be continued to control any inappropriate fire regimes
- relevant permits and approvals will be sourced from the NSW Rural Fire Service before BCOPL proceeds with a hazard reduction burn
- where practical mosaic burning will be implemented to reduce the extent of any negative outcomes, provide refuge for wildlife and promote structural and species diversity
- the fire regime may use ‘hot fires’ to stimulate regeneration from the soil seed bank or ‘cool fires’ to control established weeds
- the timing of burning will be site specific; however, it will generally be undertaken in autumn to encourage native species recruitment. Controlled burning may also be undertaken in spring to reduce the seed set of exotic annuals.
- the frequency of fire events (average) will range between four and eight years, however the interval between fires may be less than four years, depending on the site-specific objectives.

6.2.1.5 MANAGEMENT OF HUMAN ACCESS AND DISTURBANCE

Unauthorised access to the BOAs has the potential to inhibit the success of management activities, particularly through the introduction and spread of weed and pest species. Weed and pest infestations may also be promoted by surrounding land use activities, which can increase edge effects.

Specific measures to control access and limit disturbance associated with adjoining land uses have been developed for each BOA (Section 6.3). Overarching management controls employed across all BOAs include:

- access gates will be locked and key distribution controlled by the Environment Superintendent (or an alternate nominated BCOPL representative)
- existing access tracks within each BOA will be maintained to allow access for monitoring events and potential fire control.

6.2.1.6 SALVAGE OF HABITAT RESOURCES AND PROVISION OF ARTIFICIAL/ SUPPLEMENTARY HABITAT

Habitat features, such as fallen timber provide significant habitat for a range of native fauna species and reduce the risk of soil erosion. The Commonwealth Government’s *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a) indicates that healthy Box Gum Grassy Woodland communities generally contain at least four to ten cubic metres of fallen timber per hectare.

Habitat features will be retained within all offset management zones and BOAs. The addition of habitat features in BOAs will be undertaken in accordance with the Clearing and Fauna Management Procedure (Appendix B). Habitat resources relocated to BOAs will include fallen timber and natural hollows. BCOPL will trial the relocation of hollow-bearing trees (stags) into rehabilitation areas to assess the feasibility of this practice (Appendix B).

In accordance with the Leard Forest Regional Biodiversity Strategy 2 – Strategy Report (Umwelt (Australia) Pty Limited, 2017), a nest box procedure will be prepared for each offset area (Eastern, Central, Namoi and Western) five years following commencement of active revegetation. The total number of hollows will be at least the same as the number of hollows with signs of use (nesting material, feathers, fur, scratches, etcetera) and of suitable dimensions for species

occupancy removed from the Project impact site. The procedure will be integrated into each BOA Management Plan and identify the target quantities, types and provide a protocol for installation, maintenance and monitoring.

Specific measures regarding the retention and addition of habitat features have been developed for each BOA (Section 7.2). Overarching management controls employed across all BOAs include:

- habitat features will only be sourced from areas cleared for mine development or where approved thinning has occurred. Habitat features for consideration when salvaging will include one or more of the following where available and of suitable structural integrity:
 - fallen timber
 - arboreal hollows
 - hollow logs
 - bush rock.
- the addition of habitat features will only occur in habitats identified as having low habitat resources (i.e. land classified as a habitat restoration zone or corridor enhancement zone)
- habitat features will be placed perpendicular to the flow of water, sediments and nutrients to capture on site resources. Additionally, habitat features may be placed to provide refuge islands within large areas of open space.
- A nest box procedure will be prepared for each offset area (Eastern, Central, Namoi and Western) five years following commencement of active revegetation.
- The total number of hollows (existing hollows and nest boxes combined) at each offset area (Eastern, Central, Namoi and Western offsets) will be at least the same as the number of hollows with signs of use (nesting material, feathers, fur, scratches, etcetera) and of suitable dimensions for species occupancy removed from the Project impact site.
- nest boxes installed must be of high quality and made with durable materials and designed to target hollow-dependent threatened species known to occur in the Project locality (i.e. woodland birds, arboreal mammals and microchiropteran bats)
- nest box installation is to be staged over time to reflect the regeneration of the woodland.

6.2.1.7 NUTRIENT CONTROL

The addition of soil nutrients, such as phosphorus and nitrogen promotes weed growth and inhibits the development of native plants, which have adapted to cope in relatively low nutrient environments.

Nutrient management may be undertaken by physically removing nutrients from a site (crash grazing, hay cutting, topsoil removal (scalping)) or by employing methods (burning, seeding, carbohydrate addition) to lock nutrients in preferred vegetation, such as Kangaroo Grass (*Themeda australis*). Considerations will also be made to reducing or eliminating fertiliser use in adjacent or upslope paddocks and creation of buffers to capture nutrients before they enter areas of native vegetation or water bodies, wherever practicable.

Nutrient control within BOAs will be managed through weed control (physical and chemical), revegetation and in some instances grazing management (i.e. restricted and controlled stock crash grazing where applicable) and controlled burning.

6.2.1.8 EROSION CONTROL

Soil erosion will be managed within BOAs by restricting livestock access and through the implementation of revegetation activities, pest control, appropriate placement of habitat features and development of specific erosion control measures in high risk or severely affected areas. Erosion control measures employed within the BOAs may include:

- interceptor banks

- sediment fences
- gabions
- drain and bank stabilisation using geofabrics
- mulching.

Specific measures regarding erosion control have been developed for each BOA (Section 7.2).

6.2.1.9 PINE THINNING

Areas within the BOAs have been identified as containing dense patches of regrowth native White Cypress Pine (*Callitris glaucophylla*). These patches are characterised by a bare understorey, with the recruitment of other native species inhibited by shading and the layering of pine needles. In addition to inhibiting the recruitment of native species, pine monocultures limit food and habitat resources for native fauna and increase surface water run-off and erosion.

The Commonwealth Government's *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a) indicates that healthy Box Gum Grassy Woodland communities generally contain approximately 30 mature trees per hectare.

Specific measures regarding pine and native shrub thinning have been developed for each BOA (Section 6.3) generally in accordance with the 'Actively Managing for Better Ecological Outcomes for the Brigalow and Nandewar State Conservation Area' (Natural Resources Commission, 2014a). Overarching management controls employed across all BOAs may include:

- investigation into most appropriate management method prior to undertaking works including:
 - prescribed burns (early cypress regrowth)
 - ecological thinning (more advanced regrowth)
 - targeted grazing in certain circumstances (refer Section 8.4 of the Actively Managing for Better Ecological Outcomes for the Brigalow and Nandewar State Conservation Areas (Natural Resources Commission, 2014b),
- thinning will retain mosaic patches of approximately 400 stems per hectare (approximately 5x5 m spacing) of small trees (<10 cm diameter at breast height (DBH))
- cleared material will be spread around the subject site to minimise weed establishment or used elsewhere
- areas subject to thinning will be regularly inspected to identify the establishment of any weed species and the requirements for active revegetation
- using machinery to thin some patches of regrowth White Cypress Pine in the BOAs.

6.2.1.10 NATIVE WOODY WEED THINNING

Areas within the BOAs have been identified as containing dense patches of regrowth native woody weeds, also referred to as "shiny bushes" (*Olearia elliptica*, *Dodonaea viscosa* and *Beyeria viscosa*), which are encroaching on areas of grassy Box Gum Woodland. These native woody weeds are colonising species which encroach on Box Gum Woodland which has been exposed to past disturbances and which lacks appropriate fire management. As a result of the encroachment, the structural characteristics and floristic composition of the vegetation community are altered from grassy to shrubby Box Gum Woodland hence altering the fauna habitat it provides.

These patches of the native woody weeds are typically characterised by an understorey with lower species diversity and can lack a midstorey and/or canopy species. The high density of stems per hectare prevents the recruitment of some native groundcover, midstorey and canopy species.

The Commonwealth Government's *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a) and Commonwealth's listing advice for 'White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands' (Threatened Species Scientific Committee, 2006) indicate that healthy Box Gum Grassy Woodland

communities generally contain a ‘few’, ‘occasional’, ‘sparse’ or a ‘patchy’ shrub layer (i.e. shrub layer with a cover <30%). Therefore, in order to maintain a sparse shrub layer shiny bush encroachment must be managed to retain the grassy nature of the Box Gum Woodland in accordance with projects COAs to ensure long-term protection of these grassy habitats.

Specific measures regarding shiny bush thinning have been developed for each BOA (Section 6.3). Overarching management controls employed across all BOAs may include:

- thinning will be restricted to those areas identified as containing high densities of shiny bush requiring management. Shiny bush within these areas will be thinned to obtain and maintain <30% cover.
- conservational grazing will be used, where appropriate. This method has been proven to successfully control *Dodonaea viscosa* in the Central West (Local Land Services, 2014). Conservational grazing followed by an appropriate fire regime (as outlined below) is the optimal management method which will reduce numbers and density of shiny bush and enable natural recruitment of other native species whilst not disturbing the ground
- implementation of appropriate fire regimes, where required, may occur to reduce large populations and/or as a secondary measure to control follow-up germination and regrowth of seedlings
- mechanical removal may be required in some areas of the BOAs, which has been observed to work in the Central West (Local Land Services, 2014).
- cleared material will be spread around the subject site to minimise weed establishment or used elsewhere
- areas subject to thinning will be regularly inspected to identify the establishment of any weed species and the requirements for active revegetation.

6.2.1.11 BIODIVERSITY MANAGEMENT CONSULTATION

Biodiversity issues relating to the Project boundary and BOAs will be communicated through appropriate forums to enable an integrated biodiversity management approach within the locality and BTM Complex. Consultation which will be considered includes:

- Environmental representatives from each mine (as well as relevant agencies) to meet and discuss biodiversity issues within BOAs
- Annual Review report detailing overall biodiversity performance and outcomes of the BOAs using information provided from annual Biodiversity Monitoring Reports
- Liaison with adjoining land owners and managers, as appropriate, to discuss concerns including BOA indirect impacts on adjoining land holdings, emerging weeds and pests and opportunities to improve biodiversity links across properties and the broader landscape
- Liaison with local stakeholders such as NPWS, Landcare, Forestry Corporation of NSW, Narrabri Shire Council and LLS as appropriate to discuss biodiversity management actions and issues.

6.2.2 RESTORATION MEASURES

All Habitat Restoration Zones and Corridor Enhancement Zones within each of these BOAs require large scale revegetation works. Figure 6.6 provides an overview of an indicative revegetation schedule proposed across all offsets. The scope and scale of revegetation works will be reviewed on an annual basis to identify specific areas to be targeted and methods to be employed. Where natural regeneration is observed, large-scale revegetation works will be avoided, natural regeneration will be assisted and/or natural regeneration will be monitored to allow for adaptive management should it fail.

6.2.2.1 NATURAL REGENERATION

Prior to active restoration, habitat restoration zones will be allowed to naturally regenerate. This will be promoted through the management of the following threatening processes as detailed in more detail above:

- Management of weeds and pests in accordance with the Weeds and Pest Management Strategy (Appendix B)
- Pine thinning and native woody weed management
- Control burns
- Nutrient and erosion management
- Exclusion of livestock grazing (where appropriate, in conjunction with conservational grazing).

Incorporating management options as detailed above will encourage native canopy species and native grasses and forbs to regenerate naturally.

Where natural regeneration of canopy species is not observed following 10 years of management measures being implemented active revegetation will be implemented.

6.2.2.2 COLLECT AND PROPAGATE SEED

To ensure the genetic diversity in species found in the Brigalow Belt South is maintained through seed collection and propagation. Overarching management control regarding the collection and propagation of seed within the BOAs include:

- collect native seed for the establishment of native vegetation, in accordance with the RMP and Florabank Guidelines (FloraBank, 2018)
- if sufficient seed resources are available, undertake seed collection in the local area
- collect seed from the three broad native vegetation classes (native grasslands, grassy woodland on fertile soils and shrubby woodlands/ open forest on skeletal soils) including the threatened Box Gum Grassy Woodland community as detailed in Table 6.5.
- collect seed from a wide variety of species present in each vegetation class
- ensure that plants are propagated and raised in a nursery.

6.2.2.3 ACTIVE REVEGETATION

Revegetation directly promotes species diversity and structure, reduces the risk of erosion and salinity, improves soil condition and provides habitat and refuge for locally occurring and nomadic species of fauna.

Revegetation works within the BOAs will be completed generally in accordance with the Commonwealth Government's *Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al., 2010a).

Most revegetation areas will target areas where natural regeneration is unlikely to occur and where natural regeneration require supplementary planting to meet appropriate performance and completion criteria as detailed in Section 7.2. Most of these areas occur adjacent to remnant vegetation providing connectivity and maximising the likelihood of success of native species reestablishment. While it is impractical to restore the Box Gum Grassy Woodland communities and other vegetation types within the BOAs to their pre-European settlement states, realistic restoration targets such as enhancing native species diversity, controlling exotic species, while increasing the area, connectivity and diversity of these sites can be achieved.

The planted species and revegetation methods will vary within each BOA. Revegetation methods will include mechanical direct seeding, hand spot planting and hand broadcasting/ niche seeding. Deep ripping will be undertaken at least three months before planting in areas extensively grazed by livestock and where terrain and tree densities permit.

Overarching management controls regarding the revegetation of BOAs include:

- revegetation will generally not be undertaken in habitat management zones, where remnant native woodland vegetation exists in good condition with limited disturbances and exotic species present
- revegetation within habitat restoration zones and corridor enhancement zones will be undertaken using a staged approach to improve vegetative structure and allow for the integration of responsive measures identified through monitoring and evaluation
- species selected for planting will be from the Brigalow Belt South Bioregion
- where practicable, seedlings will be protected from native and exotic grazers by tree guards and/or fencing
- survival rates and growth of revegetated areas will be monitored, and additional deep watering events will occur where survival rates are low i.e. <80% survival rates
- planting methods will where practicable be consistent with surrounding vegetation communities. Vegetation will be planted/ seeded along natural contours and will not be planted in grid layouts.
- depending on the vegetation community to be established the approximate seed quantities may comprise:
 - tree species — 200g/ha
 - shrub species — 300g/ha
 - grass species — 5,000g/ha.
- species selected for hand spot planting will be based on the target vegetation community, and may include a selection of species as detailed in Table 6.5. Seed mix attributes will be based on a mixture and abundance of the target species
- Box Gum Woodland revegetation to include a mix of grass, shrubs and tree species characteristic of the White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community as per the NSW Scientific Final Determination (Office for Environment & Heritage, 2011) and Commonwealth EPBC Act Policy Statement 3.5 species list (Department of the Environment and Heritage, 2006).

The extent, timing and methodologies of revegetation to be employed across the BOAs will be determined on an annual basis. An indicative revegetation schedule is provided in Figure 6.6. Prior to commencing revegetation works a site inspection would be undertaken by a suitably qualified person to identify areas which must be targeted to identify specific methods required i.e. soil preparation, weed management, thinning and seed/tube stock densities and composition.

The methods used in soil preparation and revegetation are described below.

DEEP RIPPING

Selected areas within habitat restoration zones and corridor enhancement zones will be deep ripped to prepare soil beforehand broadcasting and hand spot planting. Deep ripping assists root development by increasing soil aeration and water infiltration. Soil to be planted with trees and shrubs will be deep ripped. Preparation for planting groundcover species will be prepared using equipment, baseline monitoring data and completion criteria to determine the success of the management measures.

Table 6.5 Species list

SCIENTIFIC NAME	COMMON NAME	GROWTH FORM	TARGET VEGETATION COMMUNITY ¹			
			Grassy Box Gum Woodland ²	River Red Gum	Poplar Box woodland	Ironbark Shrubby Forest
<i>Angophora floribunda</i>	Rough-barked Apple	Tree	-	2	-	-
<i>Eucalyptus albens</i>	White Box	Tree	3	-	1	1
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Tree	1	1	1	-
<i>Eucalyptus camaldulensis</i>	River Red Gum	Tree	1	3	-	-
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Tree	1	-	-	3
<i>Eucalyptus melliodora</i>	Yellow Box	Tree	1	1	-	-
<i>Eucalyptus piligensis</i>	Piliga Box	Tree	-	-	3	
<i>Eucalyptus populnea</i>	Poplar Box	Tree	1	-	3	-
<i>Callitris endlicheri</i>	Black Cypress Pine	Tree	1	-	-	1
<i>Callitris glaucophylla</i>	White Cypress Pine	Tree	2	-	2	2
<i>Casuarina cunninghamii</i>	River Oak	Tree	-	2	-	-
<i>Melaleuca bracteata</i>	Bracteata Honey Myrtle	Shrub	-	2	-	-
<i>Acacia decora</i>	Western Golden Wattle	Shrub	1	-	2	2
<i>Acacia cheelii</i>	Motherumbah	Shrub	-	-	1	1
<i>Beyeria viscosa</i>		Shrub	-	-	2	2
<i>Breynia oblongifolia</i>	Coffee Bush	Shrub	-	-	1	1
<i>Bursaria spinosa</i>	Native Blackthorn	Shrub	-	-	1	1
<i>Cassinia</i> sp.		Shrub	1	-	1	1
<i>Dodonaea tenuifolia</i>		Shrub	-	-	1	1

<i>Dodonaea viscosa</i>		Shrub	1	-	2	2
<i>Geijera parviflora</i>	Wilga	Shrub	1	1	1	1
<i>Hibbertia obtusifolia</i>		Shrub	1	-	1	1
<i>Indigofera australis</i>		Shrub	1	-	1	1
<i>Notelaea microcarpa</i>	Native Olive	Shrub	2	1	2	2
<i>Olearia elliptica</i>	Sticky Daisy Bush	Shrub	-	-	2	2
<i>Pimelea curviflora</i>		Shrub	-	-	1	1
<i>Pimelea microcephala</i>		Shrub	-	-	1	1
<i>Aristida ramosa</i>	Threeawn Speargrass	Grass	1	1	3	3
<i>Aristida vagans</i>		Grass	1	-	1	1
<i>Austrodanthonia bipartita</i>	Wallaby Grass	Grass	1	1	1	2
<i>Austrodanthonia ramosa</i>	Wallaby Grass	Grass	1	1	1	1
<i>Austrodanthonia setacea</i>		Grass	2	1	1	1
<i>Austrostipa scabra</i>	Speargrass	Grass	2	1	2	2
<i>Bothriochloa decipiens</i>	Red Grass	Grass	1	1	1	2
<i>Bothriochloa macra</i>	Red Grass	Grass	1	1	1	1
<i>Chloris truncata</i>	Windmill Grass	Grass	1	1	1	1
<i>Chloris ventricosa</i>	Tall Chloris	Grass	1	-	1	1
<i>Cymbopogon refractus</i>	Barbed Wire Grass	Grass	2	-	2	2
<i>Cynodon dactylon</i>	Couch	Grass	-	1	-	-
<i>Dichanthium sericeum</i>	Queensland Bluegrass	Grass	2	-	1	1
<i>Eragrostis lacunaria</i>	Purple Lovegrass	Grass	1	-	1	1

<i>Eragrostis laniflora</i>	Wollybutt	Grass	1	-	1	1
<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Grass	-	1	1	1
<i>Panicum effusum</i>	Hairy Panic	Grass	2	1	2	2
<i>Themeda australis</i>	Kangaroo Grass	Grass	2	1	1	1
<i>Lomandra multiflora</i>		Graminoid	1	2	-	-
<i>Lomandra longifolia</i>		Graminoid	-	2	-	-
<i>Arthropodium milleflorum</i>	Vanilla Lily	Herb	-	-	1	1
<i>Asperula conferta</i>	Common Woodruff	Herb	1	1	2	2
<i>Brunoniella australis</i>	Blue Trumpet	Herb	1	1	2	2
<i>Caesia parviflora</i>	Pale Grass Lily	Herb	1	-	1	1
<i>Calotis sp.</i>	Burr Daisy	Herb	1	1	2	2
<i>Desmodium brachypodium</i>	Large Tick-trefoil	Herb	2	-	2	2
<i>Dianella spp.</i>		Herb	1	-	1	1
<i>Dichondra repens</i>	Kidney Weed	Herb	1	2	1	1
<i>Swainsona sp.</i>		Herb	1	1	1	1
<i>Swainsona swainsonioides</i>		Herb	1	1	1	1
<i>Vittadinia cuneata</i>	Fuzzweed	Herb	2	1	2	2
<i>Glycine clandestina</i>		Climber	1	1	1	1
<i>Glycine tabacina</i>		Climber	1	2	2	2
<i>Cheilanthes distans</i>		Fern	1	1	1	1
<i>Cheilanthes sieberi</i>	Mulga Fern	Fern	1	1	1	1

(1) Relative abundance of species to be restored in each vegetation type. - = very low density, 1 = low density, 2 = moderate density, 3 = high density.

(2) Grassy Box Gum Woodland refers to White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC revegetation.

6.3 SPECIFIC MANAGEMENT PLANS FOR EACH BOA

The ten BOAs have been separated into four management areas based broadly on their location in the landscape and management measures they require. Separating the BOAs into these four management areas allows for greater ease in managing and implementing the management measures successfully. The four management areas are:

- Eastern Offsets –Braefield, Sunshine and Nioka North BOAs (Figure 6.1)
- Central Offsets – Mallee, Myall Plains, Wirrilah and Goonbri BOAs (Figure 6.2)
- Namoi Offsets – Jerralong and Namoi BOAs (Figure 6.3)
- Western Offsets – Merriendi BOA (Figure 6.4).

This section provides further details regarding the following management actions in each of the four management areas:

- maintenance, enhancement and restoration measures
- target implementation schedule
- monitoring and evaluation.

6.3.1 EASTERN OFFSETS

6.3.1.1 MAINTENANCE, ENHANCEMENT AND RESTORATION MEASURES

Figure 6.7, Figure 6.8 and Figure 6.9 illustrate baseline weed densities, monitoring locations, revegetation zones and the proposed layout of permanent fencing and restricted access signage. Target implementation measures for the Eastern Offsets are provided in Table 6.6. It is noted that these implementation measures will be adapted based on results of annual reviews and monitoring results.

FENCING

The layout of permanent fencing proposed for the Eastern Offsets is illustrated in Figure 6.7, Figure 6.8 and Figure 6.9. These layouts aim to exclude livestock from areas within the property and delineate areas based on environmental conditions and conflicting management measures. Existing boundary fencing will be replaced or upgraded to comply with the overarching management controls and minimum fencing design standards detailed in Section 6.2.1.1.

The current fence condition within the Eastern Offsets is variable. Fencing within the Braefield BOA is in good condition whilst fencing in Nioka North and Sunshine is in generally moderate to good condition. Initial fencing will focus on areas where it is required to exclude livestock for example the north and south east boundaries of Nioka North.

Fence line maintenance will be undertaken as required following the initial fencing program, based on issues identified during routine inspections. Redundant interior fencing will be removed over time to reduce the risk of injury to native fauna. At present, no feral animal exclusion fencing is proposed for the Eastern Offsets.

All fencing will be installed and maintained in accordance with the overarching management controls detailed in Section 6.2.1.1. A schedule for fencing activities within the Eastern Offsets is provided in Table 6.6.



Photo 6.1 Existing fencing to be upgraded on Nioka North BOA



Photo 6.2 Existing fencing to be upgraded on Sunshine BOA

GRAZING MANAGEMENT FOR CONSERVATION

Exclusion of livestock grazing of the Eastern Offset BOAs will occur gradually to remove impacts and risks associated with the existing grazing regime (Photo 6.3, Photo 6.4). Timing for livestock exclusion at each Eastern Offset BOA will be as follows:

- Nioka North and Sunshine – from late 2017, livestock grazing was gradually excluded from all areas classified as a Habitat Management Zone and Habitat Restoration Zone (Figure 6.7 and Figure 6.8); grazing to be excluded by 2020.
- Braefield – livestock grazing gradually managed out of the southern portion of Braefield from 2016 and excluded by early 2020 from all areas classified as a Habitat Management Zone and Habitat Restoration Zone (Figure 6.9).



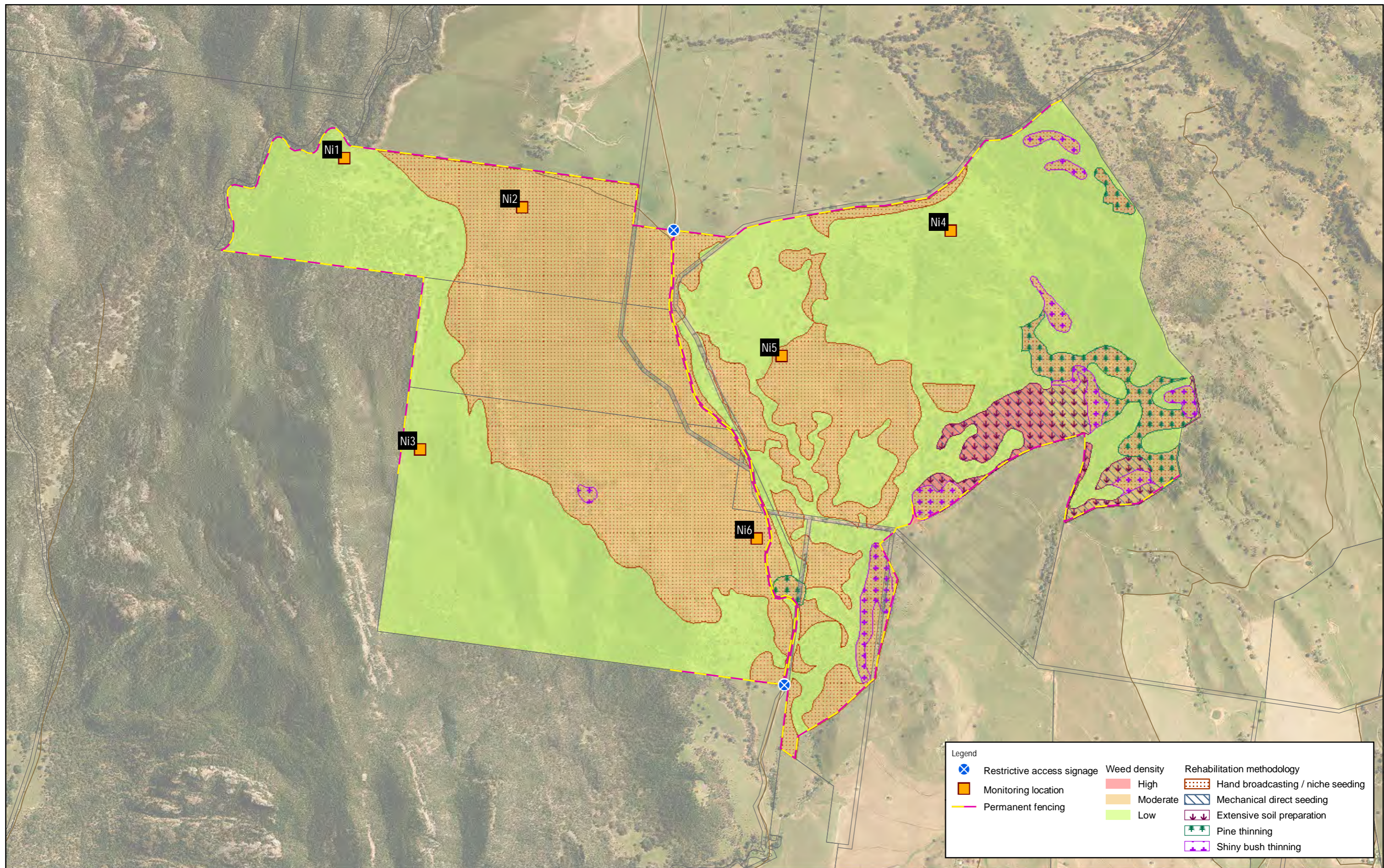
Photo 6.3 Pasture and weed invasion from livestock grazing



Photo 6.4 Livestock grazing damage on steep slopes on Sunshine BOA

Following active revegetation (currently scheduled for 2020/2021 (Sunshine) and 2021/2022 (Braefield and Nioka North) (Figure 6.6), an investigation will be undertaken to determine the sustainable livestock carrying capacity. Annual inspections and monitoring following this initial investigation will determine whether a seasonal grazing strategy is required for conservation (i.e. to control weed invasion) and if deemed necessary a site specific seasonal grazing strategy would be employed in suitable areas.

If required, the use of livestock for weed control within the Eastern Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.2.



Legend	
	Restrictive access signage
	Monitoring location
	Permanent fencing
	High Weed density
	Moderate Weed density
	Low Weed density
	Hand broadcasting / niche seeding
	Mechanical direct seeding
	Extensive soil preparation
	Pine thinning
	Shiny bush thinning

0 250 metres

 Scale 1:17,500

 Projection: Transverse Mercator

 Coordinate System: GDA 1994 MGA Zone 56

 Scale correct when printed at A3 Landscape

Imagery: BCPL (2015) and

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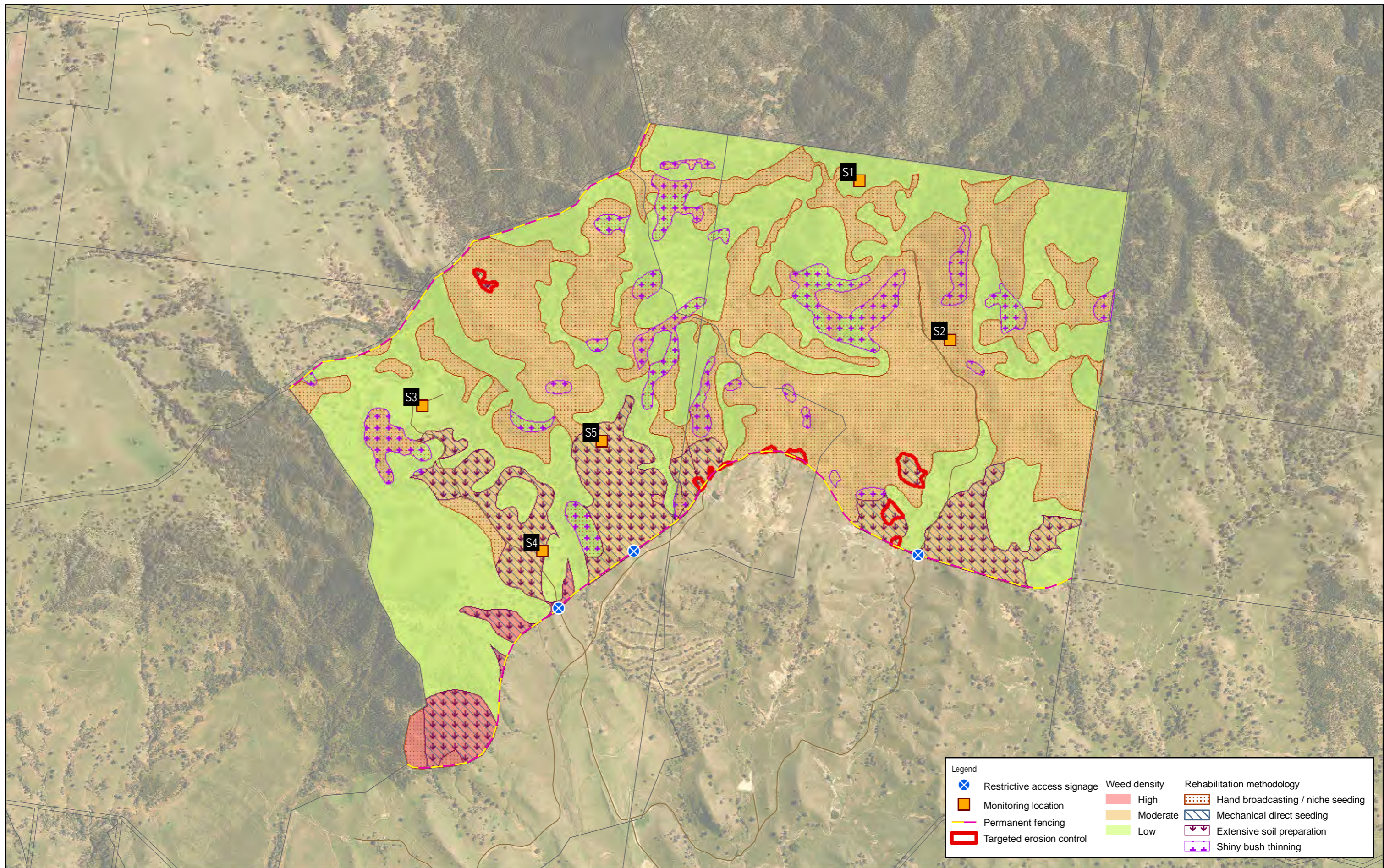
 AUTHOR: SuansriR

 CHECKED BY: N.Cooper

 DATE: 28/11/2019

FIGURE **6.7**

 TITLE: IMPLEMENTATION MEASURES FOR THE NIOKA NORTH BOA



Legend		Weed density		Rehabilitation methodology	
	Restrictive access signage		High		Hand broadcasting / niche seeding
	Monitoring location		Moderate		Mechanical direct seeding
	Permanent fencing		Low		Extensive soil preparation
	Targeted erosion control				Shiny bush thinning

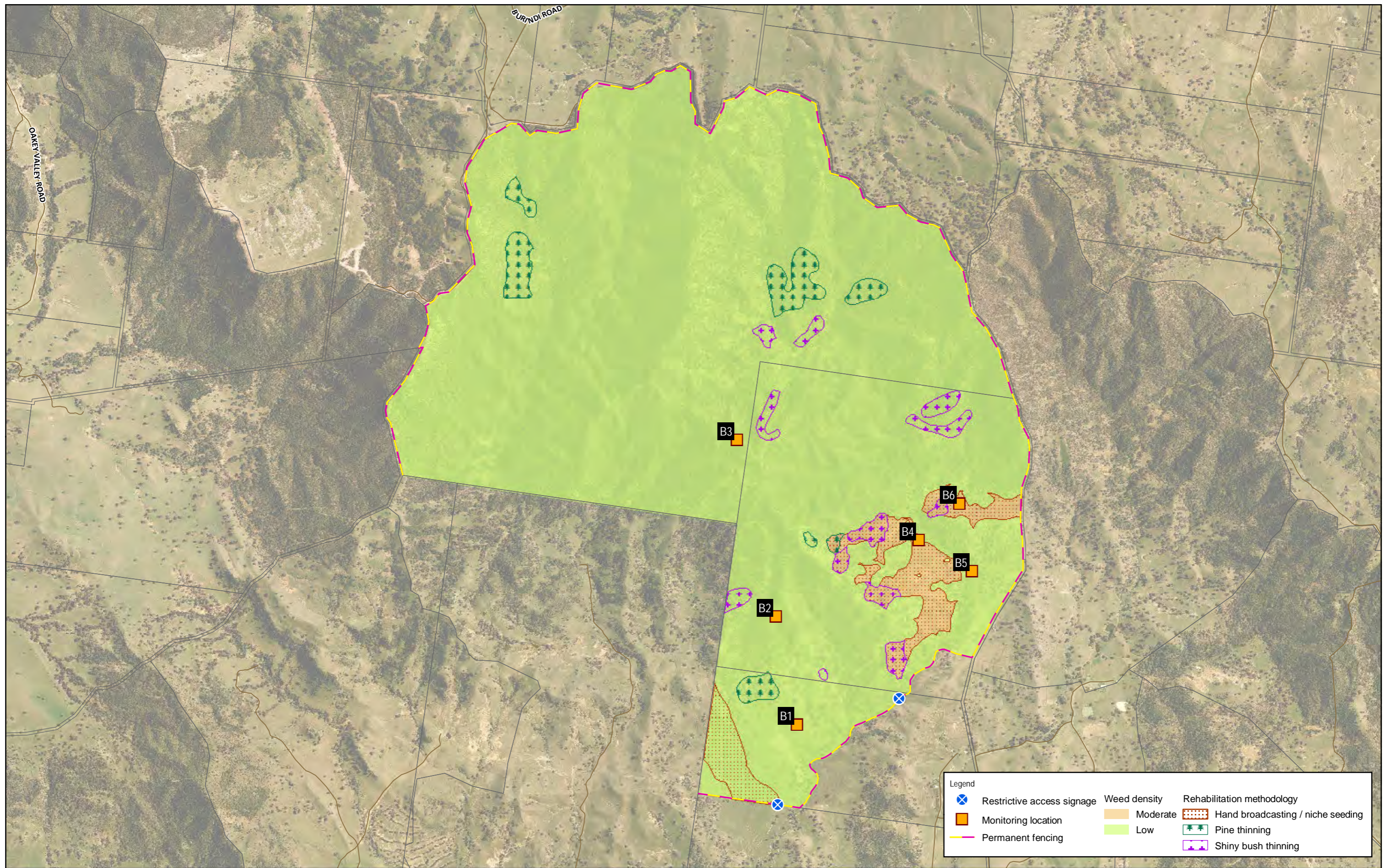
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FIGURE 6.8
 TITLE: IMPLEMENTATION MEASURES FOR THE SUNSHINE BOA



Legend		
	Restrictive access signage	Weed density
	Monitoring location	Moderate
	Permanent fencing	Low
		Rehabilitation methodology
		Hand broadcasting / niche seeding
		Pine thinning
		Shiny bush thinning

Scale 1:25,000

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FIGURE **6.9**
 TITLE: IMPLEMENTATION MEASURES FOR THE BRAEFIELD BOA

Table 6.6 Eastern Offset target implementation schedule

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Fencing			
Construction of permanent fencing	From 2018/2019	Annual	Section 6.2.1.1
Maintenance of fence lines, including removal of interior fences	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of fence lines to occur within one year of required works being identified.	Annual	Section 6.3.1
Grazing management			
Livestock exclusion	Livestock grazing exclusion to commence gradually once existing leases have expired i.e. Braefield (from late 2016) and Nioka North and Sunshine (from late 2017). Grazing will be phased out over a 5-year period. Grazing will be excluded following active revegetation.	Annual	Section 6.2.1.2 Section 6.3.1
Investigation into sustainable livestock carrying capacities and implementation of a seasonal grazing strategy	Following active revegetation (currently scheduled for 2020/2021 (Sunshine) and 2021/2022 (Braefield and Nioka North). Annual inspections and monitoring will determine whether a seasonal grazing strategy is required and employed as deemed necessary in suitable locations. If deemed feasible must be undertaken in accordance with Section 6.2.1.2.	Annual	
Weed and pest control			
Broad-scale and targeted weed control in consultation with key stakeholders	Initial broad-scale event in first spring/summer following livestock exclusion. Thereafter, every three years following initial treatment or as required to fulfil performance criteria (i.e. based on results of annual monitoring and inspections). Targeted weed control event to occur prior to active revegetation works.	Annual	Section 6.2.1.3 Section 6.3.1 Appendix B
Targeted pest control - destruction of burrows, shooting, trapping and baiting	Commencement in 2019/2020. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	
Fire management for conservation			

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Engage the Rural Fire Service and communicate the conservation objectives for the Eastern Offsets. Identify fire risks, access points and watering point locations	Commencement of BOA management and as required based on annual inspections and discussions with Rural Fire Service.	Annual	Section 6.2.1.4 Section 6.3.1
Inspection of fuel loads and assessment of fire requirements	To be undertaken on an annual basis as part of annual inspection following commencement of BOA management.	Annual	
Management of human access and disturbance			
Installation of restricted access signs at the designated location	Installation in winter/spring 2019/2020.	Bi-annual	Section 6.2.1.5 Section 6.3.1
Maintenance of restricted access signs	As required, maintenance requirements to be determined on an annual basis during annual inspections or as identified opportunistically whilst undertaking other management actions/monitoring. Maintenance of restricted access signs to occur within 6 months of required works being identified.	Bi-annual	
Maintenance of designated access tracks	As required, maintenance of designated access tracks to be determined on an annual basis during annual inspections or as identified opportunistically whilst undertaking other management action/monitoring. Maintenance of designated access tracks to occur within 1 year of required works being identified.	Bi-annual	
Retention or addition of habitat features			
Preparation of a nest box procedure	In accordance with criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared five years following commencement of active revegetation.	Annual	Section 6.2.1.6 Section 6.3.1
Addition of habitat features	To be determined on an annual basis, following yearly tree clearing operations. Additions dependent upon annual habitat feature availability and habitat feature requirements of other BOAs.	Annual	
Erosion management			

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Identification and assessment of high risk areas	To be completed on an annual basis following commencement of BOA management. Assessment to be undertaken as part of routine inspections.	Annual	Section 6.2.1.8 Section 6.3.1
Ongoing monitoring and implementation of suitable erosion controls	Implementation of erosion controls in Sunshine as identified in Figure 6.8 to be initiated at the commencement of BOA management. Ongoing monitoring to occur annually. Follow up work to occur as required based on results of annual inspections.	Annual	
Thinning			
Monitor thinning requirements, particularly areas of regenerating White Cypress Pine and Shiny Bush	Monitoring to be undertaken annually as part of annual inspections and monitoring.	Bi-annual	Section 6.2.1.9 Section 6.2.1.10 Section 6.3.1
Implementation of thinning activities	Initial thinning activities to coincide with initial broad-scale weed program. Thereafter, as required based on routine inspections and determined on an annual basis.	Bi-annual	
Revegetation			
Site inspection by a suitably qualified person prior to undertaking revegetation works to determine specific revegetation required such as weed management, seed and tube stock and soil preparation. Update of BMP as required.	After existing leases have expired (i.e. grazing excluded). Prior to commencing revegetation works to ensure that the most appropriate measures are being implemented. To be determined an annual basis.	Annual	Section 6.2.2 Section 6.3.1
Hand broadcasting/ niche seeding and Mechanical direct seeding and tube stock planting	To be undertaken in 2020-2022 dependent on annual updates to revegetation schedule across all BOAs. Refer to Figure 6.6 for preliminary revegetation plan.	Annual	
Follow-up planting, weed control and deep watering	Monitoring and follow up measures to be implemented bi-annually following initial planting / seeding as required based on monitoring inspections.	Bi-annual	

WEED AND PEST CONTROL

Targeted weed and pest control measures will be undertaken as required throughout the Eastern Offsets. Routine inspections will continually monitor the introduction of new weed and pest species and changes to baseline densities which are illustrated in Figure 6.7, Figure 6.8 and Figure 6.9.

Planned weed control activities include a broad-scale control event scheduled for the first spring and/or summer following grazing exclusion and every three years after initial treatment or as required against performance criteria and annual monitoring. Targeted weed control is to be completed in revegetation areas before each planting/seeding event. Broad-scale control events will be undertaken with reference to the weed density mapping, which will be updated annually as part of the OMP review process.

As part of past agricultural practices, the Sunshine BOA has been subject to large scale aerial seeding of *Medicago* sp. (Clover) (approx. 5 years ago). In addition, all Eastern Offsets properties have experience extensive thistle infestations predominately by Mexican Poppy (*Argemone ochroleuca* subsp. *ochroleuca**), Saffron Thistle (*Carthamus lanatus**), Variegated Thistle (*Silybum marianum**) and Maltese Thistle (*Centaurea melitensis**). These weeds appear during spring in response to rain and cover a large portion of the grassland areas as previously observed in 2016 (Photo 6.5). It is recommended that these weeds be targeted during broad-scale and targeted weed control events prior to active revegetation. Weed incursions within the Eastern Offsets are generally concentrated within cleared areas subject to livestock grazing and along riparian areas.



Photo 6.5 Thistle infestation within the Eastern Offsets (Sunshine BOA, 2016)



Photo 6.6 Damage from feral goats, Braefield BOA

A number of feral pest animals have been recorded throughout the Eastern Offsets including goats, pigs, foxes and rabbits. Goats and pigs are the most abundant and most damaging pests (Photo 6.6). The previous owner of Braefield has undertaken targeted 1080 baiting for foxes in conjunction with adjoining property owners in attempts to reduce the abundance of these species. It is recommended that pest control strategies be developed to help control the numbers of these feral animals.

All weed and pest control measures within the Eastern Offsets will be undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and the overarching management controls detailed in Section 6.2.1.

FIRE MANAGEMENT FOR CONSERVATION

No prescribed burning activities are planned within the Eastern Offsets at present. Fire management within the BOAs will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.4.

MANAGEMENT OF HUMAN ACCESS AND DISTURBANCE

To prevent unauthorised access (e.g. illegal shooting, trail bikes, rubbish dumping) and reduce the risk of introducing or spreading weed and pest species, access gates into the Eastern Offsets will be maintained. In 2019/2020, signage will be erected at each of the three BOAs to advise unauthorised personnel not to enter. The locations at each BOA are as follows:

- Nioka North – two signs, one at each entry locations, at the north and south of the property boundary, no gates will be installed or locked at this BOA as the main access track through the centre is an easement and right of way to adjoining properties in the north
- Sunshine – three signs, one at each of the entry locations along the southern boundary of the property, gates occur at these three locations and will be locked at a future date if unauthorised access becomes an issue
- Braefield – two signs, one at each entry location on the southern and eastern boundary of the property, gates occur at these two locations and will be locked at a future date if unauthorised access becomes an issue.

Management of human access and disturbance within the Eastern Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.1.

RETENTION OR ADDITION OF HABITAT FEATURES

No habitat features, such as fallen timber will be removed from any areas within the Eastern Offsets. Following clearing for mine development or approved thinning activities, habitat features will be transported and strategically placed within the Eastern Offsets. Priority areas to receive habitat features include land within the Eastern Offset's Habitat Restoration Zones.

Pine trees (*Callitris glaucophylla*) removed from the Nioka North and Braefield BOAs as part of thinning activities will remain in the Eastern Offsets. The removed pine will be placed in the Habitat Restoration Zones for fallen timber to provide habitat for reptiles and other ground dwelling fauna.

Rehabilitation activities will be complemented with nest boxes where required to supplement hollows until the rehabilitated areas begin generating. In accordance with the criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared for the Eastern Offsets five years following commencement of active revegetation.

The retention and addition of habitat features within the Eastern Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.

EROSION CONTROL

No targeted erosion control measures are proposed within the Nioka North and Braefield BOAs. Such measures will be undertaken as the need is identified during routine environmental inspections. Appropriate erosion control measures may be employed, depending on the nature and extent of future erosion where and when identified.

Targeted erosion control measures are recommended within the Sunshine BOA. There is soil erosion occurring within numerous locations predominately along ephemeral drainage lines (Photo 6.7) and require mitigation measures to prevent further damage. These areas are mapped on Figure 6.8, with a schedule for erosion outlined in Table 6.6. One area on the Braefield BOA has been subject to contour banks development to control historic erosion concerns (near monitoring location B6). These contour banks are currently aiding in reducing impacts associated with erosion (Photo 6.8), however will be monitored annually as part of routine inspections.

Specific erosion and sediment control measures should be implemented for these sites such as terracing or other appropriate sediment and erosion control methods. The majority of the erosion is rill erosion and the rehabilitation of these areas should be undertaken in accordance with the relevant soils and erosion guidelines. The following erosion control measures may be employed, depending on the nature and extent of erosion:

- interceptor banks
- sediment fences
- gabions
- drain and bank stabilisation using geofabrics
- mulching.

Ongoing surveillance for erosion management will target high risk areas, as identified in Photo 6.7 and Photo 6.8. All erosion control measures will be undertaken in accordance with the overarching management controls.



Photo 6.7 Rill erosion in an ephemeral drainage line in the north of the Sunshine BOA



Photo 6.8 Contour banks employed to control erosion in the south-west of the Sunshine BOA

THINNING

PINE THINNING

There are several locations across both the Braefield and Nioka North BOAs where White Cypress Pine (*Callitris glaucophylla*) thinning will be required. Locations where White Cypress Pine dominates extensively are illustrated in Figure 6.7 and Figure 6.9. White Cypress Pine have regenerated in dense thickets (Photo 6.9) at these locations between scattered White Box trees and are preventing the natural regeneration of native groundcover, midstorey and canopy species. The scattered White Box trees and soil seed bank are likely to respond well to thinning of the White Cypress Pines. No areas requiring pine thinning have yet been identified within the Sunshine BOA.

Within the Braefield BOA there are several areas of White Cypress Pine thickets that are located in remote bushland where access to undertake management actions would be difficult given the surrounding terrain. The practicalities of thinning these areas will need to be investigated further, particularly in the north-west of the BOA. The remaining areas are all accessible and are recommended for thinning.

In addition to manual and mechanical thinning, Boggabri Coal will investigate and potentially complete trials to assess the potential for controlling White Cypress Pine thickets using low-intensity burns. It is not recommended that low intensity burns be employed in the remote bushland areas of the Braefield BOA to control the pine thickets as the bushland is dense and control of any fire within this area may be difficult.

Thinning activities within the Eastern Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.9. Densities of White Cypress Pine throughout the Eastern Offsets will be monitored, with thinning completed as the need is identified during routine environmental inspections.



Photo 6.9 Existing White Cypress Pine requiring thinning in the Braefield BOA

NATIVE SHRUB MANAGEMENT (SHINY BUSH)

Targeted control of dense native shrub thickets (consisting of *Dodonea viscosa*, *Oleria elliptica* and *Beyeria viscosa*) will be undertaken throughout the Eastern Offsets (Photo 6.10, Photo 6.11). These areas have been collectively referred to as “Shiny Bush” and have been mapped on Figure 6.7, Figure 6.8 and Figure 6.9. Routine inspections will continually monitor the introduction of changes to baseline densities.

It is anticipated that the timing of control measures for Shiny Bush would coincide with initial broad-scale weed and pest control measures. This would involve broad-scale targeted spraying, use of machinery or cut and paste method to thin the densities of the shrubs. These control methods are to be conducted in accordance with the Weed and Pest Management Strategy (Appendix B) and the overarching management controls. Broad-scale control events will be undertaken with reference to the native shrub density mapping, which will be updated as part of the OMP review process.



Photo 6.10 Native shrub invasion on the lower slopes of the Braefield BOA



Photo 6.11 Native shrub invasion within the Nioka North BOA

REVEGETATION

Revegetation within the Eastern Offsets will focus on the restoration of Box Gum Grassy Woodland within Habitat Restoration Zones which contain Box Gum Woodland derived native grassland. Revegetation will be undertaken progressively to increase structural diversity and allow for adaptive management.

The extent, timing and methodologies of revegetation to be employed in the Eastern Offsets will be determined on an annual basis. Prior to commencing revegetation works a site inspection would be undertaken by a suitably qualified person to identify:

- areas which should be targeted during revegetation session
- specific methods required i.e. soil preparation, weed management, thinning and seed/tube stock densities and composition.

Revegetation works within the Eastern Offsets will commence once the existing leases have expired, refer to Figure 6.6 and Table 6.6 for indicative timeframe.

Revegetation methods to be employed in the Eastern Offsets will largely include mechanical direct seeding and tube stock planting and hand broadcasting/ niche seeding. Deep ripping and other soil amelioration will be undertaken in targeted areas where required (Figure 6.7, Figure 6.8 and Figure 6.9) to prepare the soil prior to seeding.

Seed procurement will be determined after the site inspection and prior to revegetation works based on seed mix attributes provided in Table 6.5, availability of seed and in accordance with the current condition and regeneration occurring within the Eastern Offsets (Table 6.6).

Fertilising of tube stock will be undertaken at the time of planting by adding 100 g of DAP (di-ammonium phosphate) under the soil surface within 250 mm of the tube stock. Planted tubestock will be watered (approximately 5L/plant) at the time of planting and at least three times within the first year of growth (Table 6.6).

Most the Braefield BOA (both intact woodland and derived native grasslands) is in good condition and requires less revegetation works than the other two properties. Vegetation condition observed in previous surveys suggests that the soil seed bank is likely to be in good condition. It is recommended that natural revegetation generally be applied to the cleared areas within this BOA which have been subject to livestock grazing. If no natural revegetation is observed within 5 years, then active revegetation would be completed.

6.3.1.2 MONITORING AND EVALUATION

Progress against the completion criteria (Section 7.2) developed for the Eastern Offsets will be monitored as part of the Biodiversity Monitoring Program. Seventeen permanent monitoring sites (nine in habitat management zones, six in habitat restoration zones and two in corridor enhancement zone) will be monitored within the Eastern Offsets, with specific indicators used to compare each site with a corresponding analogue site (Figure 6.7, Figure 6.8, Figure 6.9 and Table 6.7).

In addition to these monitoring sites it is proposed that permanent remote cameras are installed in the northern portion of the Eastern Offset properties where access is difficult. These cameras will have the batteries replaced every 6 months and the data downloaded and viewed to capture fauna species which are difficult to record using other methods (i.e. Spotted-tailed Quoll and pest fauna species).

Table 6.7 Summary of replicate monitoring sites in the Eastern Offsets

PLANT COMMUNITY TYPE	MANAGEMENT ZONE	NO. MONITORING SITES		
		Nioka North	Sunshine	Braefield
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84]	Habitat management zones	-	-	1
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1119]		-	1	-
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1382]		1	-	-

White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1309]		-	-	2
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383]		1	1	1
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329]		1	-	-
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383] (low condition)	Habitat restoration zones	3	1	2
Miscellaneous Ecosystem – highly disturbed areas with no or limited native vegetation	Corridor enhancement zone	-	2	-

The success of active revegetation activities within Habitat Management Zones and Corridor Enhancement Zones will be monitored and evaluated on an annual basis as part of routine inspections following the initial planting event. This will be achieved by identifying plant stress and monitoring mortality rates. Permanent monitoring locations will be established in these areas to aid in this process. Once established these monitoring sites will be added to the BOA Monitoring Program described in Section 7. Areas where high mortality rates are recorded will be revegetated and continually monitored.

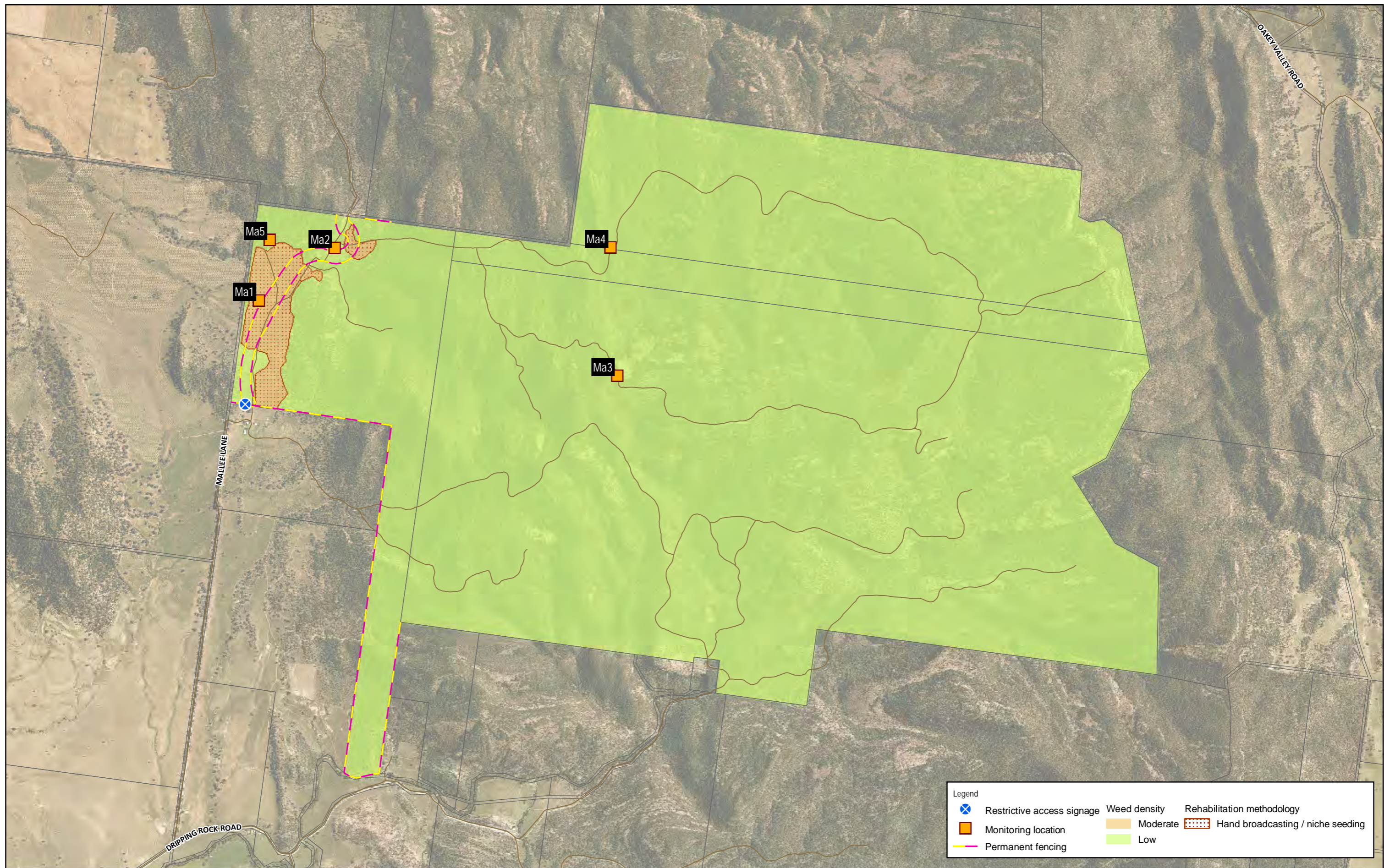
6.3.2 CENTRAL OFFSETS

6.3.2.1 MAINTENANCE, ENHANCEMENT AND RESTORATION MEASURES

Figure 6.10, Figure 6.11 and Figure 6.12 illustrate baseline weed densities, monitoring locations, revegetation zones and the proposed layout of permanent fencing and restricted access signage within the Central Offsets. Target implementation measures for the Central Offsets are provided in Table 6.8 . It is noted that these measures will be amended as required and reviewed at least every twelve months. Specific implementation measures are detailed in the following sections.

FENCING

The layout of permanent fencing proposed for the Central Offsets is illustrated in Figure 6.10, Figure 6.11 and Figure 6.12. This layout has been developed to exclude livestock from all accessible areas within the Central Offsets. Existing boundary fencing (Photo 6.12) identified in the figures will be replaced or upgraded as required to comply with the overarching management controls for stock exclusion as provided in Section 6.2.1.



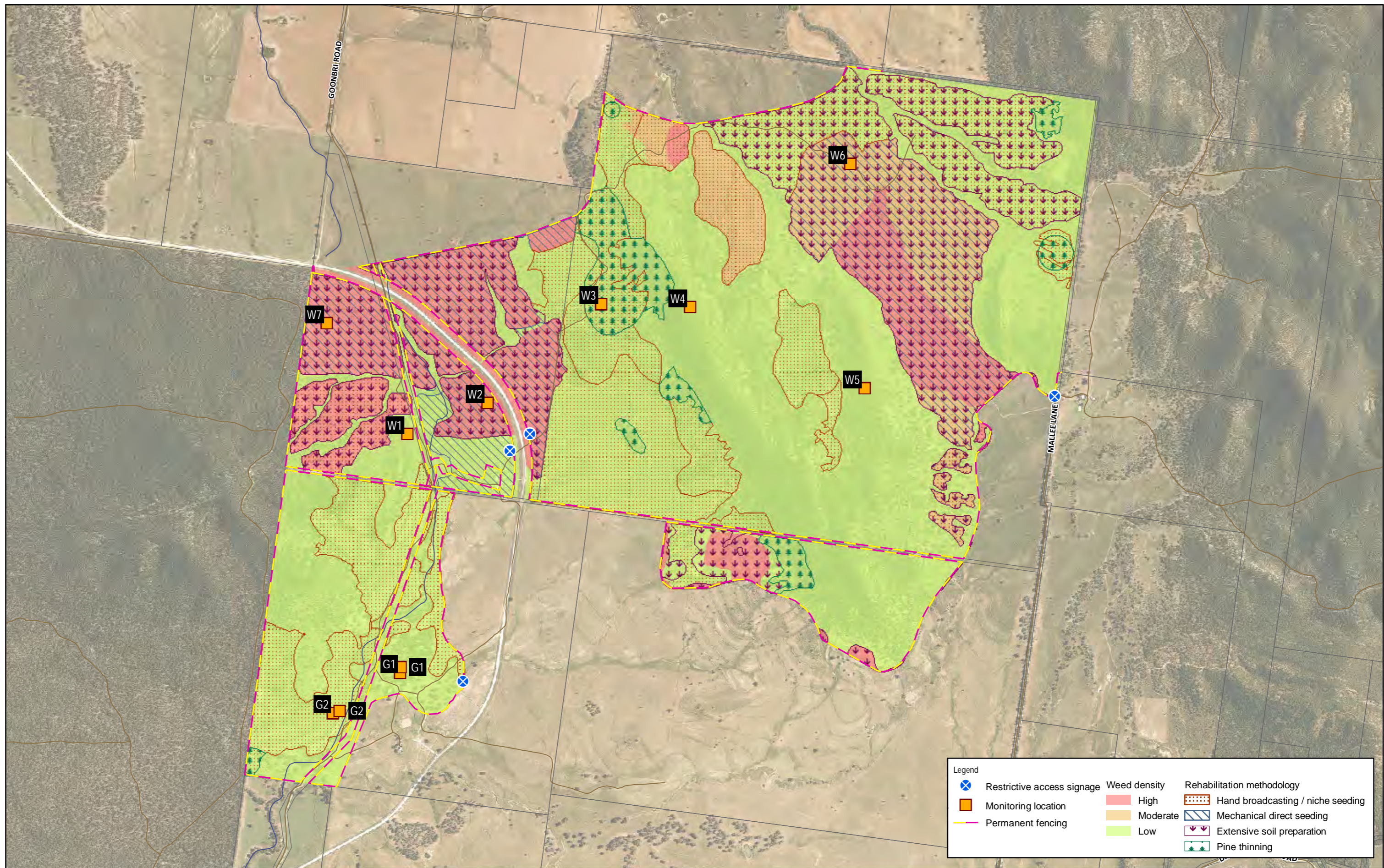
Legend		Weed density	Rehabilitation methodology
	Restrictive access signage		
	Monitoring location		Hand broadcasting / niche seeding
	Permanent fencing	Low	

Scale 1:25,000

Imagery: BCPL (2015) and
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MINE NAME: BC2019_OMP_001_A1
 AUTHOR: SuansriR
 CHECKED BY: N.Cooper
 DATE: 28/11/2019

FIGURE 6.10
 IMPLEMENTATION MEASURES FOR THE MALLEE BOA



Legend		
	Restrictive access signage	Weed density
	Monitoring location	
	Permanent fencing	
		Rehabilitation methodology

Scale 1:20,000

 Projection: Transverse Mercator

 Coordinate System: GDA 1984 MGA Zone 56

 Scale correct when printed at A3 Landscape

Imagery: BCPL (2015) and

MINE NAME:	BC2019_OMP_001_A1
AUTHOR:	SuansriR
CHECKED BY:	N.Cooper
DATE:	28/11/2019

FIGURE **6.12**

IMPLEMENTATION MEASURES

 TITLE: FOR THE WIRRILAH BOA

Table 6.8 Central Offsets Target Implementation schedule

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Fencing			
Construction of permanent fencing	From 2017 to 2020	Annual	Section 6.2.1.1
Maintenance of fence lines, including removal of interior fences	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of fence lines to occur within one year of required works being identified.	Annual	Section 6.3.2
Grazing management			
Livestock exclusion	On commencement of management, livestock exclusion to be continued at Mallee BOA. Livestock grazing exclusion commenced in early 2017 at Myall Plains and Wirrilah BOAs and phased out over a 5-year period.	Annual	Section 6.2.1.2 Section 6.3.2
Investigation into sustainable livestock carrying capacities and implementation of a seasonal grazing strategy	As required, based on results of annual inspections (i.e. to be determined on an annual basis). If deemed feasible must be undertaken in accordance with Section 6.2.1.2.	Annual	
Weed and pest control			
Broad-scale and targeted weed control in consultation with key stakeholders	Commencement in spring/summer 2017. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	Section 6.2.1.3 Section 6.3.2 Appendix B
Targeted pest control - destruction of burrows, shooting, trapping and baiting	Commencement in 2017/2020. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	
Fire management for conservation			
Engage the Rural Fire Service and communicate the conservation objectives for the Central Offsets. Identify fire risks, access points and watering point locations	Commencement of BOA management and as required based on annual inspections and discussions with Rural Fire Service.	Annual	Section 6.2.1.4 Section 6.3.2

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Inspection of fuel loads and assessment of fire requirements	To be undertaken on an annual basis following commencement of BOA management.	Annual	
Management of human access and disturbance			
Installation of restricted access signs at the designated location	Installation in winter/spring 2017.	Bi-annual	Section 6.2.1.5 Section 6.3.2
Maintenance of restricted access signs	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of restricted access signs to occur within 6 months of required works being identified.	Bi-annual	
Maintenance of designated access tracks	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of designated access tracks to occur within 1 year of required works being identified.	Bi-annual	
Retention or addition of habitat features			
Preparation of a nest box procedure	In accordance with criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared five years following commencement of active revegetation.	Annual	Section 6.2.1.6 Section 6.3.2
Addition of habitat features	Following yearly tree clearing operations. Addition dependent upon annual habitat feature availability and habitat feature requirements of other BOAs. To be determined on an annual basis.	Annual	
Erosion management			
Identification and assessment of high risk areas	To be undertaken on an annual basis following commencement of BOA management.	Annual and after large storm events	Section 6.2.1.8 Section 6.3.2
Ongoing monitoring and implementation of suitable erosion controls	To be undertaken on an annual basis following commencement of BOA management. If required, erosion management will commence within one year of identification.	Annual	

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Thinning			
Monitor thinning requirements, particularly areas of regenerating White Cypress Pine	Monitoring to be undertaken annually. Thinning activities if required would commence within one year of required works being identified.	Bi-annual	Section 6.2.1.9 Section 6.3.2
Implementation of thinning activities	Implementation of thinning as identified in Figure 6.10, Figure 6.11 and Figure 6.12 at commencement of BOA management. As required, based on annual inspections (i.e. to be determined on an annual basis).	Bi-annual	
Revegetation			
Site inspection by a suitably qualified person prior to undertaking revegetation works to determine revegetation required such as weed management, seed and tube stock and soil preparation. Update of BMP as required.	Prior to commencing revegetation works to ensure that the most appropriate measures are being implemented. To be determined an annual basis.	Annual	Section 6.2.2 Section 6.3.2
Hand broadcasting/ niche seeding and Mechanical direct seeding and tube stock planting	Revegetation to occur as follows: Wirrilah BOA –2017 all areas requiring revegetation works Myall Plains, Mallee and Goonbri BOAs - TBD refer to Figure 6.6 for preliminary revegetation plan. Timing of and areas to be revegetated will be dependent on annual updates to revegetation schedule across all BOAs.		
Follow-up planting, weed control and deep watering	Monitoring and follow up measures to be implemented bi-annually following initial planting / seeding as required based on monitoring inspections.	Bi-annual	



Photo 6.12 An example of existing fencing to be upgraded

Fence line maintenance will be undertaken as required, with issues identified during routine inspections. Redundant interior fencing will be removed over time to reduce the risk of injury to native fauna. At present, no feral animal exclusion fencing is proposed within the Central Offsets. All fencing will be installed and maintained in accordance with the overarching management controls detailed in Section 6.2.1.1. A schedule for fencing activities within the Central Offsets is provided in Table 6.8.

GRAZING MANAGEMENT FOR CONSERVATION

Livestock grazing will be excluded within the Central Offsets to remove impacts and risks currently associated with the existing grazing regime. Livestock exclusion within the Central Offsets will involve:

- Mallee BOA – continued livestock exclusion from the Mallee property.
- Myall Plains, Wirrilah and Goonbri BOAs - exclusion of livestock grazing from all areas classified as Habitat Management Zone, Habitat Restoration Zone and Corridor Enhancement Zone from late 2016.

Following the establishment of planted vegetation (approximately five years from planting) within the Central Offsets (Figure 6.10, Figure 6.11 and Figure 6.12), an investigation will be undertaken to identify sustainable livestock carrying capacities. Based on the results of the investigation, a seasonal grazing strategy may be employed in suitable areas.

The use of livestock for weed control within the Central Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.2.



Photo 6.13 Cattle pugging observed in the Wirrilah BOA

WEED AND PEST CONTROL

Targeted weed and pest control measures will be undertaken as required throughout the Central Offsets. Routine inspections will continually monitor the introduction of new weed and pest species and changes to baseline densities, as illustrated in Figure 6.10, Figure 6.11 and Figure 6.12.

Planned weed control activities include a broad-scale control event scheduled for spring or summer 2017 and targeted spraying or hand-pulling to be completed in revegetation areas before each planting event. Broad-scale control events will be undertaken with reference to the weed density mapping, which will be updated as part of the OMP review process.

Some locations within the Central Offsets are subject to extensive infestations of thistles, predominantly Saffron Thistle (*Carthamus lanatus**), Variegated Thistle (*Silybum marianum**) and Maltese Thistle (*Centaurea melitensis**). These thistles appear during spring in response to rain and cover a large portion of the grassland areas and along access tracks. It is recommended that these weeds be targeted as part of the weed control measures to ensure correct management of the site for increased biodiversity. Weed incursions within the Central Offsets are generally concentrated within cleared areas subject to livestock grazing and along riparian areas.

In spring/ summer 2016, the Environment Superintendent will undertake an investigation to identify the extent of feral goats within the Central Offsets and their impact on biodiversity values. Depending on the outcomes of this investigation, a targeted control plan may be developed and implemented, following the upgrade/ construction of permanent boundary fencing.

All weed and pest control measures within the Central Offsets will be undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and the overarching management controls detailed in Section 6.2.1.3.

FIRE MANAGEMENT FOR CONSERVATION

No prescribed burning activities are planned within the Central Offsets. Fire management within the Central Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.4.

MANAGEMENT OF HUMAN ACCESS AND DISTURBANCE

To prevent unauthorised access (e.g. trail bikes, rubbish dumping) and reduce the risk of introducing or spreading weed and pest species, access gates into the Central Offsets will be locked.

During winter or spring 2016, a restricted access sign will be erected at each of the Central Offset BOAs to advise unauthorised personnel not to enter. The location of restricted access signs will be as follows:

- Mallee BOA – single sign at the entrance of the property in the south-western boundary of the BOA (Figure 6.10) and access restrictions into the property will additionally be communicated through signage erected as part of management of the Wirrilah and Myall plains properties.
- Myall Plains BOA – two signs, one along the northern boundary of the BOA and one on the western boundary (Figure 6.11) and access restrictions into the property will additionally be communicated by signage erected as part of management of the Wirrilah and Mallee BOAs.
- Wirrilah BOA – three signs, one sign at the entrance of the property on the eastern boundary, and two at the entrances off Goonbri Road towards the centre of the property (Figure 6.12). Access restrictions into the BOA will additionally be communicated through signage erected as part of management of the Myall Plains and Mallee BOAs.
- Goonbri – two signs, one along the south-western boundary of the BOA and one at the entrance off Goonbri Road (Figure 6.12).

Management of human access and disturbance within the Central Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.5.

RETENTION OR ADDITION OF HABITAT FEATURES

No habitat features, such as fallen timber will be removed from any areas within the Central Offsets. Following clearing for mine development or approved thinning, habitat features will be transported and strategically placed within the Central Offsets.

The addition of habitat features will be prioritised within the Habitat Restoration Zone, Corridor Enhancement Zone and Other Lands for Agriculture Zone within the Central Offsets Figure 6.10, Figure 6.11 and Figure 6.12. Rehabilitation activities will be complemented with nest boxes where required to supplement hollows until the rehabilitated areas begin generating. In accordance with the criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared for the Central Offsets five years following commencement of active revegetation.

The retention and addition of habitat features within the Central Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.

EROSION CONTROL

No targeted erosion control measures are proposed within the Central Offsets. Such measures will be undertaken as the need is identified during routine environmental inspections. The following erosion control measures may be employed, depending on the nature and extent of erosion:

- interceptor banks
- sediment fences
- gabions
- drain and bank stabilisation using geofabrics
- mulching.

Ongoing surveillance will aim to identify high risk areas and areas requiring management intervention, following extreme events, such as flood or fire. All erosion control measures will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.8.

THINNING

Thinning activities will be undertaken within the Wirrilah and Goonbri BOAs where White Cypress Pine has regenerated in dense thickets. Densities of White Cypress Pine throughout the BOAs will be monitored, with thinning completed as the need is identified during routine environmental inspections. In addition to manual and mechanical thinning, Boggabri

Coal will investigate and potentially complete trials to assess the potential for controlling White Cypress Pine thickets using low-intensity burns.

No thinning activities are planned within the Mallee or Myall Plains BOAs. Densities of White Cypress Pine will be monitored within these two BOAs, with thinning completed as the need is identified during routine environmental inspections.

Thinning activities within the Central Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.9 and Section 6.2.1.10.



Photo 6.14 White Cypress Pine thicket requiring management within the Wirrilah BOA

REVEGETATION

Revegetation within the Central Offsets will focus on the establishment of Box Gum Grassy Woodland and will be undertaken progressively to increase structural diversity and allow for adaptive management.

The extent, timing and methodologies of revegetation to be employed in the Central Offsets will be determined on an annual basis. Prior to commencing revegetation works a site inspection would be undertaken by a suitably qualified person to identify areas which should be targeted and the specific methods required (i.e. soil preparation, weed management, thinning and seed/tube stock densities and composition). Revegetation works within the Central Offsets will not commence until existing leases have expired (i.e. once grazing has been excluded) as illustrated in the preliminary revegetation plan in Figure 6.6.

Revegetation methods which will be employed within the Central Offsets include:

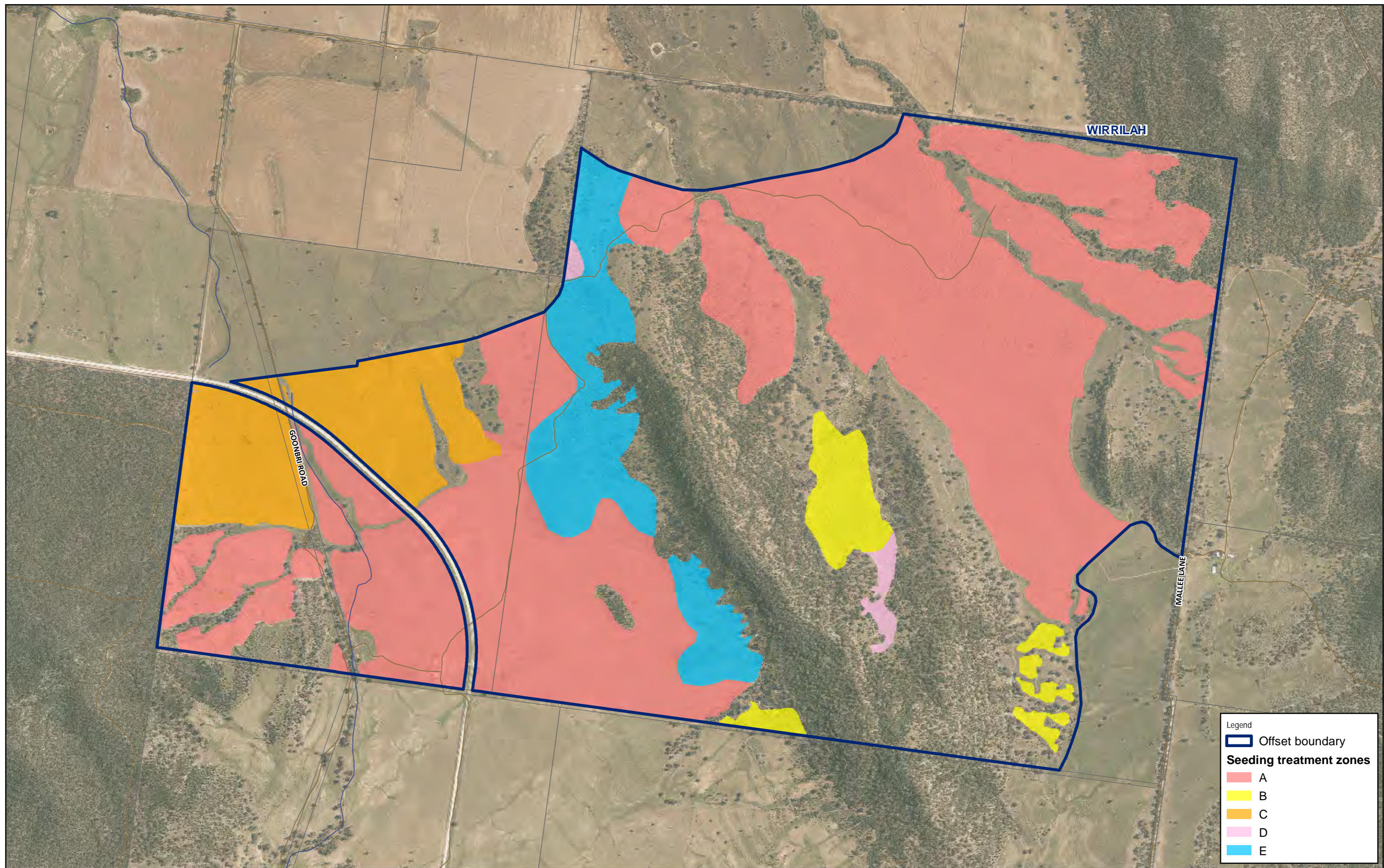
- Mallee BOA – hand broadcasting / niche seeding / planting method will be used to revegetate the north-western area of the BOA (Figure 6.10) using a seed mix developed to restore Box Gum Grassy Woodland.
- Myall Plains BOA– hand broadcasting / niche seeding / planting. Deep ripping will be undertaken in targeted areas (Figure 6.11) to prepare the soil before seeding.
- Wirrilah BOA – combination of mechanical direct seed and tube stock planting and hand broadcasting / niche seeding / planting. Deep ripping will be undertaken in targeted areas (Figure 6.12) to prepare the soil before seeding.
- Goonbri BOA - hand broadcasting / niche seeding / planting. Deep ripping will be undertaken in targeted areas (Figure 6.12) to prepare the soil before seeding.

Seed procurement will be determined after the site inspection and prior to revegetation works based on seed mix attributes, availability of seed and in accordance with the current condition and regeneration occurring within the Central Offsets (Table 6.6)

Fertilising of tube stock will be undertaken at the time of planting by adding 100 g of DAP (di-ammonium phosphate) under the soil surface within 250 mm of the tube stock. Planted tubestock will be watered (approximately 5L/plant) at the time of planting and at least three times within the first year of growth,

The Wirrilah BOA will be rehabilitated in 2017. A site inspection was undertaken in spring 2016 to determine the current condition and rehabilitation methods which will be required. A summary of the field validated treatment zones identified during the inspection are presented in Figure 6.13. Seeding and tube stock mixes are currently being procured for planting in 2017. The treatment zones include:

- A – Large areas where canopy, midstorey and groundcover species generally absent aside from disturb tolerant grasses and regrowth *Cassinia* and *Callitris*. Requires:
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
- B – Small areas which lack a native canopy and midstorey however the groundcover contains native grasses as well as some native herbs and shrubs.
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Monitoring of species diversity, regeneration and weeds, modify strategy as required.
- C – Highly disturbed consisting many of exotic species, native limited to the occasional tussock grass species. In very low densities.
 - Thistle control
 - Extensive soil preparation required including deep ripping and soil amelioration as required
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
- D – Minor canopy and groundcover regeneration present however no shrubs occur.
 - Thistle control
 - Monitoring of species diversity, regeneration and weeds, modify strategy as required.
- E – No canopy cover regeneration however sub-canopy and groundcover vegetation showing evidence of regeneration, *Callitris* clearing required.
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
 - *Callitris* thinning required.



Legend

- Offset boundary

Seeding treatment zones

- A
- B
- C
- D
- E


0 250 metres

Scale 1:15,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery: BCPL (2018);

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FIGURE **6.13**

TITLE: **IMPLEMENTATION MEASURES FOR THE WIRRILAH BOA**

6.3.2.2 MONITORING AND EVALUATION

Progress against the completion criteria developed for the Central Offsets will be monitored as part of the Biodiversity Monitoring Program. Twenty permanent monitoring sites (12 in Habitat Management Zones, six in Habitat Restoration Zone and two within Corridor Enhancement Zone) will be monitored within the Central Offsets, with specific indicators used to compare each site with a corresponding analogue site (Figure 6.10, Figure 6.11, Figure 6.12 and Table 6.9).

Table 6.9 Summary of replicate monitoring sites in the Central Offsets

PLANT COMMUNITY TYPE	MANAGEMENT ZONE	NO. MONITORING SITES			
		Mallee	Myall Plains	Wirrilah	Goonbri
Cypress Pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427]	Habitat management zone	1	-	-	-
White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion [PCT1307]		-	1	-	-
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1382]		2	1	-	-
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383]		-	1	1	-
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313]		1	1	2	-
Yellow Box – Blakely’s Red Gum grassy woodland of the Nandewar Bioregion (PCT1329)		-	-	-	1
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1382] (low condition)		Habitat restoration zone	1	1	-
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383] (low condition)	-		-	2	-
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313] (low condition)	-		1	-	-
Yellow Box – Blakely’s Red Gum grassy woodland of the Nandewar Bioregion (PCT1329)	-		-	-	1

White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383] (low condition)	Corridor enhancement zone	-	-	2	-
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The success of active revegetation activities within Habitat Management Zones and Corridor Enhancement Zones will be monitored and evaluated on an annual basis as part of routine inspections following the initial planting event. This will be achieved by identifying plant stress and monitoring mortality rates. Permanent monitoring locations will be established in these areas to aid in this process. Once established these monitoring sites will be added to the BOA Monitoring Program described in Section 7. Areas where high mortality rates are recorded will be revegetated and continually monitored.

6.3.3 NAMOI OFFSETS

6.3.3.1 MAINTENANCE, ENHANCEMENT AND RESTORATION MEASURES

Figure 6.14 illustrates baseline weed densities, monitoring locations, revegetation zones and the proposed layout of permanent fencing and restricted access signage. Target implementation measures for the Namoi Offsets are provided in Table 6.10. It is noted that these measures will be amended as required and reviewed at least every twelve months. Specific implementation measures are detailed in the following sections.

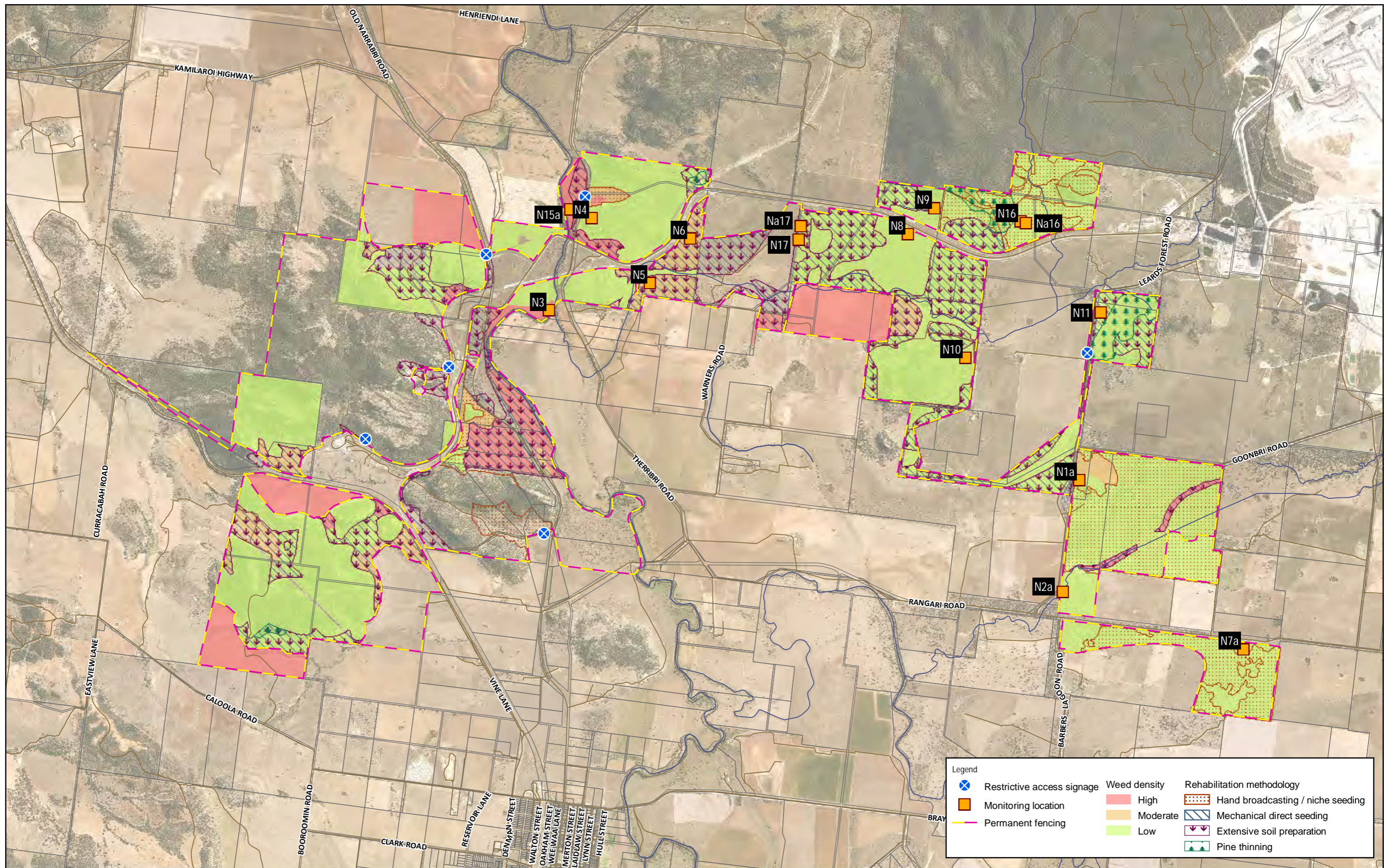
FENCING

The layout of permanent fencing proposed for the Namoi Offsets is illustrated in Figure 6.14. This layout has been developed to exclude livestock from areas within the property and delineate areas based on environmental conditions and conflicting management measures. Existing boundary fencing will be replaced or upgraded to comply with the overarching management controls and minimum fencing design standards (Photo 6.15).

Fence line maintenance will be undertaken as required, with issues identified during routine inspections. Redundant interior fencing will be removed over time to reduce the risk of injury to native fauna. At present, no feral animal exclusion fencing is proposed within the Namoi Offsets. All fencing will be installed and maintained in accordance with the overarching management controls detailed in Section 6.2.1.1. A schedule for fencing activities within the Namoi Offsets is provided in Table 6.10.



Photo 6.15 An example of existing fencing to be upgraded



Legend		Weed density		Rehabilitation methodology	
	Restrictive access signage		High		Hand broadcasting / niche seeding
	Monitoring location		Moderate		Mechanical direct seeding
	Permanent fencing		Low		Extensive soil preparation
					Pine thinning

0 250 500 750 1,000 1,250 metres
 Scale 1:50,000
 Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
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FIGURE 6.14

TITLE IMPLEMENTATION MEASURES FOR THE NAMOI BOA

Table 6.10 Namoi Offsets target implementation schedule

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Fencing			
Construction of permanent fencing	From late 2017	Annual	Section 6.2.1.1
Maintenance of fence lines, including removal of interior fences	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of fence lines to occur within one year of required works being identified.	Annual	Section 6.3.3
Grazing management			
Livestock exclusion	Livestock grazing exclusion to commence in late 2015 / early 2016 and phased out over a 5-year period. Livestock grazing exclusion in the Jerralong BOA to commence in late 2018 and phased out over a 5-year period.	Annual	Section 6.2.1.2 Section 6.3.3
Investigation into sustainable livestock carrying capacities and implementation of a seasonal grazing strategy	As required, based on results of annual inspections (i.e. to be determined on an annual basis). If deemed feasible must be undertaken in accordance with OMP	Annual	
Weed and pest control			
Broad-scale and targeted weed control in consultation with key stakeholders	Commencement in 2017/18. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	Section 6.2.1.3 Section 6.3.3
Targeted pest control - destruction of burrows, shooting, trapping and baiting	Commencement in 2017/18. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	Appendix B
Fire management for conservation			
Engage the Rural Fire Service and communicate the conservation objectives for the Namoi Offsets. Identify fire risks, access points and watering point locations	Commencement of BOA management and as required based on annual inspections and discussions with Rural Fire Service.	Annual	Section 6.2.1.4 Section 6.3.3

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Inspection of fuel loads and assessment of fire requirements	To be undertaken on an annual basis following commencement of BOA management.	Annual	
Management of human access and disturbance			
Installation of restricted access signs at the designated location	Installation in winter/spring 2016.	Bi-annual	Section 6.2.1.5
Maintenance of restricted access signs	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of restricted access signs to occur within 6 months of required works being identified.	Bi-annual	Section 6.3.3
Maintenance of designated access tracks	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of designated access tracks to occur within 1 year of required works being identified.	Bi-annual	
Retention or addition of habitat features			
Preparation of a nest box procedure	In accordance with criteria detailed in OMP (Section 6.2.1.6) and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared five years following commencement of active revegetation.	Annual	Section 6.2.1.6 Section 6.3.3
Addition of habitat features	To be determined on an annual basis, following yearly tree clearing operations. Addition dependent upon annual habitat feature availability and habitat feature requirements of other BOAs.	Annual	
Erosion management			
Identification and assessment of high risk areas	To be undertaken on an annual basis following commencement of BOA management.	Annual and after large storm events	Section 6.2.1.8

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Ongoing monitoring and implementation of suitable erosion controls	Implementation of erosion controls along Namoi River to be implemented in spring/summer 2018/2019. Ongoing monitoring to occur annually. Follow up work to occur as required based on results of annual inspections.	Annual	Section 6.3.3
Thinning			
Monitor thinning requirements, particularly areas of regenerating White Cypress Pine	Monitoring to be undertaken annually. Thinning activities if required would commence within one year of required works being identified.	Bi-annual	Section 6.2.1.9 Section 6.2.1.10 Section 6.3.3
Implementation of thinning activities	Implementation of thinning as identified in Figure 6.14 at commencement of BOA management. Thereafter as required, based on annual inspections (i.e. to be determined on an annual basis).	Bi-annual	
Revegetation			
Site inspection by a suitably qualified person prior to undertaking revegetation works to determine revegetation required such as weed management, seed and tube stock and soil preparation. Update of BMP as required.	Prior to commencing revegetation works to ensure that the most appropriate measures are being implemented. To be determined an annual basis.	Annual	Section 6.2.2 Section 6.3.3

GRAZING MANAGEMENT FOR CONSERVATION

From late 2017, livestock grazing will be excluded from all areas classified as Habitat Management Zone, Habitat Restoration Zone and Corridor Enhancement Zone. Following the establishment of planted vegetation (approximately five years from planting), an investigation will be undertaken to identify sustainable livestock carrying capacities. Based on the results of the investigation, a seasonal grazing strategy may be employed in suitable areas.

The use of livestock for weed control within the Namoi Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.2.

WEED AND PEST CONTROL

Targeted weed and pest control measures will be undertaken as required throughout the Namoi Offsets. Routine inspections will continually monitor the introduction of new weed and pest species and changes to baseline densities, as illustrated in Figure 6.14.

Planned weed control activities include a broad-scale control event scheduled for spring or summer 2017 and targeted spraying or hand-pulling to be completed in revegetation areas before each planting event (Table 6.10). Broad-scale control events will be undertaken with reference to the weed density mapping, which will be updated as part of the OMP review process.

In some locations within the Namoi Offsets are subject to extensive infestations of thistles, predominantly Saffron Thistle (*Carthamus lanatus**), Variegated Thistle (*Silybum marianum**) and Maltese Thistle (*Centaurea melitensis**). These thistles appear during spring in response to rain and cover a large portion of the grassland areas and along access tracks. It is recommended that these weeds be targeted as part of the weed control measures to ensure correct management of the site for increased biodiversity. Weed incursions within the Namoi Offsets are generally concentrated within cleared areas subject to livestock grazing and along riparian areas. Areas within the Namoi Offsets contain noxious woody weeds such as African Boxthorn (*Lycium ferocissimum**) which should also be targeted during control events.

In spring / summer 2016, the Environment Superintendent will undertake an investigation to identify the extent of feral animals (Photo 6.16) throughout the Namoi Offsets and their impact on biodiversity values. Following this investigation, a targeted control plan will be developed and implemented, following the upgrade/ construction of permanent boundary fencing.



Photo 6.16 Feral goats observed in the Namoi Offset

Weed and pest control measures within the Namoi Offsets will be undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and the overarching management controls detailed in Section 6.2.1.3.

FIRE MANAGEMENT FOR CONSERVATION

No prescribed burning activities are planned within the Namoi Offsets. Fire management within the BOAs will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.4.

MANAGEMENT OF HUMAN ACCESS AND DISTURBANCE

To prevent unauthorised access (e.g. trail bikes, rubbish dumping) and reduce the risk of introducing or spreading weed and pest species, access gates into the Namoi Offsets will be locked. During winter or spring 2016, signs will be erected at five locations to advise unauthorised personnel not to enter.

Management of human access and disturbance within the Namoi Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.5.

RETENTION OR ADDITION OF HABITAT FEATURES

No habitat features, such as fallen timber will be removed from any areas within the Namoi Offsets. Following clearing for mine development or approved thinning, habitat features will be transported and strategically placed within the Namoi Offsets. Priority areas to receive habitat features include land within Habitat Restoration Zones.

Rehabilitation activities will be complemented with nest boxes where required to supplement hollows until the rehabilitated areas begin generating. In accordance with the criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared for the Namoi Offsets five years following commencement of active revegetation.

The retention and addition of habitat features within the Namoi Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.6.

EROSION CONTROL

The Namoi Offsets contains areas of substantial erosion, particularly along the Namoi River, which was impacted by a major flood event in early 2012 (Photo 6.17).



Photo 6.17 An example of erosion along the banks of the Namoi River

In spring/summer 2017, the Environment Superintendent will consult with the Namoi CMA to identify appropriate measures to manage existing erosion and mitigate the impacts of future flooding events. Ongoing surveillance for erosion management will target high risk areas, as identified in Figure 6.14. All erosion control measures will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.8.

THINNING

Thinning will be undertaken at four locations in the Namoi Offsets where White Cypress Pine has regenerated in dense thickets (Photo 6.18). In addition to manual thinning, Boggabri Coal will investigate and potentially complete trials to assess the potential for controlling White Cypress Pine thickets using low-intensity burns. Thinning activities within the Namoi Offsets will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.9. Densities of White Cypress Pine throughout the BOA will be monitored with thinning completed as the need is identified during routine environmental inspections.



Photo 6.18 An example of White Cypress Pine thicket requiring thinning in the Namoi Offsets

REVEGETATION

Revegetation within the Namoi Offsets will focus on the establishment of the following four communities:

- Grassy Box Gum Woodland
- River Red Gum Woodland
- Poplar Box Woodland
- Ironbark Shrubby Forest.

Revegetation will be undertaken progressively to increase structural diversity and allow for adaptive management. The extent, timing and methodologies of revegetation to be employed in the Namoi Offsets will be determined on an annual basis. Prior to commencing revegetation works a site inspection would be undertaken by a suitably qualified person to identify areas that should be targeted and the specific methods required (i.e. soil preparation, weed management, thinning and seed/tube stock densities and composition), as per preliminary revegetation plan.

Revegetation methods to be employed in the Namoi Offsets will largely include mechanical direct seed and tube stock planting and hand broadcasting/ niche seeding. Deep ripping and other soil amelioration will be undertaken in targeted areas (Figure 6.14) to prepare the soil prior to seeding. Jerralong BOA will largely include mechanical direct seed and tube stock planting and hand broadcasting/ niche seeding. Seed procurement will be determined after the site inspection and prior to revegetation works based on seed mix attributes, availability of seed and in accordance with the current condition and regeneration occurring within the Namoi Offsets (Table 6.10).

A portion of the Namoi BOA will be rehabilitated in 2016/2017. A site inspection was undertaken in spring 2016 to determine the current condition and rehabilitation methods which will be required. A summary of the field validated treatment zones identified during the inspection are presented in Figure 6.15. Seeding and tube stock mixes are currently being procured for planting in 2016/2017. The treatment zones include:

- A – Large areas where canopy, midstorey and groundcover species generally absent aside from disturb tolerant grasses and regrowth *Cassinia* and *Callitris*. Requires:
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
- B – Small areas which lack a native canopy and midstorey however the groundcover contains native grasses as well as some native herbs and shrubs.
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Monitoring of species diversity, regeneration and weeds, modify strategy as required.
- C – Highly disturbed consisting many of exotic species, native limited to the occasional tussock grass species. In very low densities.
 - Thistle control
 - Extensive soil preparation required including deep ripping and soil amelioration as required
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
- D – Minor canopy and groundcover regeneration present however no shrubs occur.
 - Thistle control
 - Monitoring of species diversity, regeneration and weeds, modify strategy as required.
- E – No canopy cover regeneration however sub-canopy and groundcover vegetation showing evidence of regeneration, *Callitris* clearing required.
 - Thistle control
 - Deep ripping of soil prior to planting
 - Tube stock planting (7.5m grid)
 - Direct seeding between tube stock rows.
 - *Callitris* thinning required.
- F – Canopy species present however midstorey absent and groundcover species limited.
 - Thistle control
 - Niche seeding
 - *Callitris* thinning required.
- G – Regeneration appears to be evident in all stratum, *Callitris* thinning as required.
 - Monitor species diversity, regeneration and weeds, modify strategy as required.

Fertilising of tube stock will be undertaken at the time of planting by adding 100 g of DAP (di-ammonium phosphate) under the soil surface within 250 mm of the tube stock. Planted tubestock will be watered (approximately 5L/plant) at the time of planting and at least three times within the first year of growth (Table 6.10).

Routine inspections will be undertaken within revegetation sites to identify plant stress and monitor mortality rates. Areas where high mortality rates are recorded will be revegetated and continually monitored.

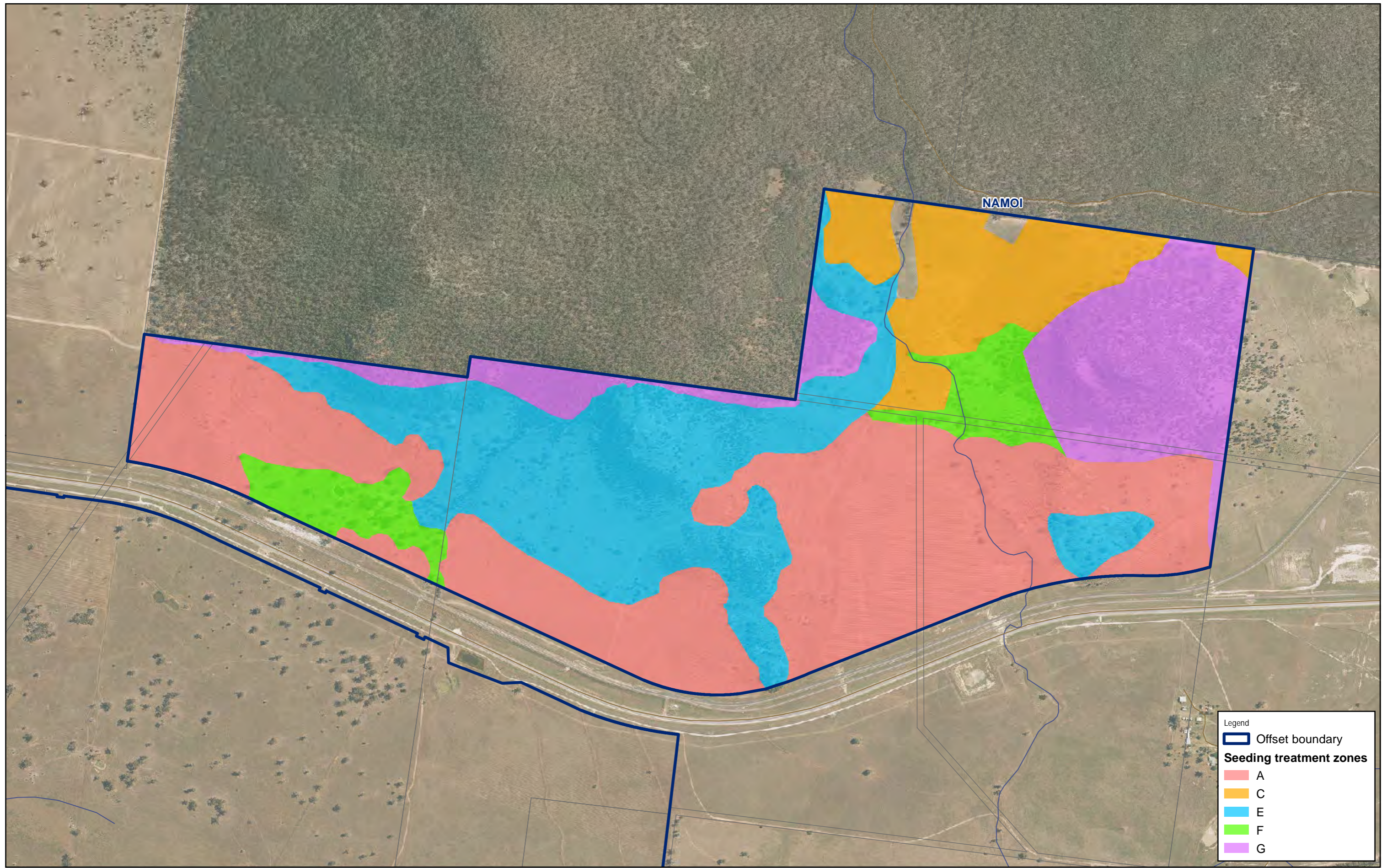
6.3.3.2 MONITORING AND EVALUATION

Progress against the completion criteria developed for the Namoi Offsets will be monitored as part of the biodiversity monitoring program (Section 7). Seventeen permanent monitoring sites (11 in habitat management zones and six in Habitat Restoration Zones) will be monitored within the Namoi Offsets, with specific indicators used to compare each site with a corresponding analogue site (Table 6.11).


Table 6.11 Summary of monitoring sites on the Namoi Offsets

VEGETATION COMMUNITY	MANAGEMENT ZONE	NO. MONITORING SITES	
		Namoi	Jerralong
Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]	Habitat management zone	1	
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228]		1	1
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (PCT 88 / BVT NA 179)		1	2
River Red Gum riparian tall woodland/ open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion (PCT 78 / BVT NA 193)		2	
Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (PCT 27 / BVT NA 219)		1	
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (PCT 84 / BVT NA 191)		1	
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion (PCT 1381 / BVT NA 165)		2	
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (PCT 88 / BVT NA 179) (Low condition)	Habitat restoration zone	2	
River Red Gum riparian tall woodland/ open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion (PCT 78 / BVT NA 193) (low condition)		1	
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (PCT 1383 / BVT NA 226) (low condition)		2	






The success of active revegetation activities within Habitat Restoration Zones and Corridor Enhancement Zones will be monitored and evaluated on an annual basis as part of routine inspections following the initial planting event. This will be achieved by identifying plant stress and monitoring mortality rates. Permanent monitoring locations will be established in these areas to aid in this process. Once established these monitoring sites will be added to the BOA Monitoring Program described in Section 7. Areas where high mortality rates are recorded will be revegetated and continually monitored.




Legend

-  Offset boundary

Seeding treatment zones


-  A
-  C
-  E
-  F
-  G

0  250 metres

Scale 1:10,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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FIGURE **6.15**

TITLE: **IMPLEMENTATION MEASURES FOR THE NAMOI BOA**

6.3.4 WESTERN OFFSET

6.3.4.1 MAINTENANCE, ENHANCEMENT AND RESTORATION MEASURES

Figure 6.16 illustrates baseline weed densities, monitoring locations, revegetation zones and the proposed layout of permanent fencing and restricted access signage. Target implementation measures for the Western Offset is provided in Table 6.12. It is noted that these measures will be amended as required and reviewed at least every twelve months. Specific implementation measures are detailed in the following sections.

FENCING

The layout of permanent fencing proposed for the Western Offset is illustrated in Figure 6.16. This layout has been developed to exclude livestock from areas within the BOA and delineate areas based on environmental conditions and conflicting management measures.

Redundant interior fencing will be removed over time to reduce the risk of injury to native fauna. Fence line maintenance will be undertaken as required, with issues identified during routine inspections. At present, no feral animal exclusion fencing is proposed within the Western Offset.

All fencing will be installed and maintained in accordance with the overarching management controls detailed in Section 6.2.1.1. A schedule for fencing activities within the Western Offset is provided in Table 6.12.

GRAZING MANAGEMENT FOR CONSERVATION

All livestock will be excluded from the property from late 2015. Following the establishment of planted vegetation (approximately five years from planting), an investigation will be undertaken to identify sustainable livestock carrying capacities. Based on the results of the investigation, a seasonal grazing strategy may be employed in suitable areas.

The use of livestock for weed control within the Western Offset will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.2.

WEED AND PEST CONTROL

Targeted weed and pest control measures will be undertaken as required throughout the Western Offset. Routine inspections will continually monitor the introduction of new weed and pest species and changes to baseline densities, as illustrated in Figure 6.16.

Planned weed control activities include a broad-scale control event scheduled for spring or summer 2016 and targeted spraying or hand-pulling to be completed in revegetation areas before each planting event (Table 6.12). Broad-scale control events will be undertaken regarding the weed density mapping, which will be updated as part of the OMP review process.

Some locations within the Western Offset are subject to extensive infestations of thistles, predominantly Saffron Thistle (*Carthamus lanatus**), Variegated Thistle (*Silybum marianum**) and Maltese Thistle (*Centaurea melitensis**). These thistles appear during spring in response to rain and cover a large portion of the grassland areas and along access tracks. It is recommended that these weeds be targeted as part of the weed control measures to ensure correct management of the site for increased biodiversity. Weed incursions within the Western Offset are generally concentrated within cleared areas subject to livestock grazing and along riparian areas.

Weed and pest control measures within the Western Offset will be undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and the overarching management controls detailed in Section 6.2.1.3.

Table 6.12 Western Offset target implementation schedule

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Fencing			
Construction of permanent fencing	From 2019 to 2020.	Annual	Section 6.2.1.1
Maintenance of fence lines, including removal of interior fences	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of fence lines to occur within one year of required works being identified.	Annual	Section 6.3.4
Grazing management			
Livestock exclusion	Livestock grazing exclusion to commence in late 2015/ early 2016 and phased out over a 5-year period.	Annual	Section 6.2.1.2 Section 6.3.4
Investigation into sustainable livestock carrying capacities and implementation of a seasonal grazing strategy	As required, based on results of annual inspections (i.e. to be determined on an annual basis). If deemed feasible must be undertaken in accordance with this OMP.	Annual	
Weed and pest control			
Broad-scale and targeted weed control in consultation with key stakeholders	Commencement in spring/summer 2016/17. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	Section 6.2.1.3 Section 6.3.4 Appendix B
Targeted pest control - destruction of burrows, shooting, trapping and baiting	Commencement in spring/summer 2016/17. Thereafter, as required based on results of annual inspections and annual weed/pest control results (i.e. to be determined on an annual basis).	Annual	
Fire management for conservation			
Engage the Rural Fire Service and communicate the conservation objectives for the Western Offset. Identify fire risks, access points and watering point locations	Commencement of BOA management and as required based on annual inspections and discussions with Rural Fire Service.	Annual	Section 6.2.1.4 Section 6.3.4

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Inspection of fuel loads and assessment of fire requirements	To be undertaken on an annual basis following commencement of BOA management.	Annual	
Management of human access and disturbance			
Installation of restricted access signs at the designated location	Installation in winter/spring 2016.	Bi-annual	Section 6.2.1.5
Maintenance of restricted access signs	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of restricted access signs to occur within 6 months of required works being identified.	Bi-annual	Section 6.3.4
Maintenance of designated access tracks	As required, based on results of annual inspections (i.e. to be determined on an annual basis). Maintenance of designated access tracks to occur within 1 year of required works being identified.	Bi-annual	
Retention or addition of habitat features			
Preparation of a nest box procedure	In accordance with criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared five years following commencement of active revegetation.	Annual	Section 6.2.1.6 Section 6.3.4
Addition of habitat features	To be determined on an annual basis, following yearly tree clearing operations. Addition dependent upon annual habitat feature availability and habitat feature requirements of other BOAs.	Annual	
Erosion management			
Identification and assessment of high risk areas	To be undertaken on an annual basis following commencement of BOA management.	Annual and after large storm events	Section 6.2.1.8

IMPLEMENTATION MEASURE	TIMING	MONITORING FREQUENCY	FURTHER INFORMATION
Ongoing monitoring and implementation of suitable erosion controls	If erosion control is deemed to be required, control works would commence within one year of being identified. Ongoing monitoring to occur annually. Follow up work to occur as required based on results of annual inspections.	Annual	Section 6.3.4
Thinning			
Monitor thinning requirements, particularly areas of regenerating White Cypress Pine and Shiny Bush	Monitoring to be undertaken annually. Thinning activities if required would commence within one year of required works being identified.	Bi-annual	Section 6.2.1.9 Section 6.3.4
Implementation of thinning activities	As required, based on annual inspections (i.e. to be determined on an annual basis).	Bi-annual	
Revegetation			
Site inspection by a suitably qualified person prior to undertaking revegetation works to determine revegetation required such as weed management, seed and tube stock and soil preparation. Update of BMP as required.	Prior to commencing revegetation works to ensure that the most appropriate measures are being implemented. To be determined an annual basis.	Annual	Section 6.2.2 Section 6.3.4
Hand broadcasting/ niche seeding	To be undertaken in 2021-2022 dependent on annual updates to revegetation schedule across all BOAs.		
Follow-up planting, weed control and deep watering	Monitoring and follow up measures to be implemented bi-annually following initial planting / seeding as required based on monitoring inspections.	Bi-annual	

FIRE MANAGEMENT FOR CONSERVATION

No prescribed burning activities are planned within the Western Offset. Fire management within the BOAs will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.4.

MANAGEMENT OF HUMAN ACCESS AND DISTURBANCE

To prevent unauthorised access (e.g. trail bikes, rubbish dumping) and reduce the risk of introducing or spreading weed and pest species, access gates into the Western Offset will be locked. In 2018, signs will be erected at three locations to advise unauthorised personnel not to enter (Figure 6.16 and Table 6.12).

Management of human access and disturbance within the Western Offset will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.5.

RETENTION OR ADDITION OF HABITAT FEATURES

No habitat features, such as fallen timber will be removed from any areas within the Western Offset. Following clearing for mine development or approved thinning, habitat features will be transported and strategically placed within the Western Offset. Priority areas to receive habitat features include revegetation areas associated with clearings within Habitat Restoration Zones. The placement of habitat features will avoid areas where the threatened plant *Digitaria porrecta* has been recorded.

Rehabilitation activities will be complemented with nest boxes where required to supplement hollows until the rehabilitated areas begin generating. In accordance with the criteria detailed in Section 6.2.1.6 and threatened biodiversity implementation plan (Appendix D), a nest box procedure will be prepared for the Western Offset five years following commencement of active revegetation.

The retention and addition of habitat features within the Western Offset will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.6.

EROSION CONTROL

No targeted erosion control measures are proposed within the Western Offset. Such measures will be undertaken as the need is identified during routine environmental inspections. The following erosion control measures may be employed, depending on the nature and extent of erosion:

- interceptor banks
- sediment fences
- gabions
- drain and bank stabilisation using geofabrics
- mulching.

Ongoing surveillance for erosion management will target high risk areas, as identified in Figure 6.16. All erosion control measures will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.8.

THINNING

No thinning activities are planned within the Western Offset. Densities of White Cypress Pine will be monitored, with thinning completed as the need is identified during routine environmental inspections.

Thinning activities within the Western Offset will be undertaken in accordance with the overarching management controls detailed in Section 6.2.1.9.

REVEGETATION

Revegetation within the Western Offset will focus on the establishment of Box Gum Grassy Woodland and will be undertaken progressively to increase structural diversity and allow for adaptive management.

The extent, timing and methodologies of revegetation to be employed in the Western Offset will be determined on an annual basis. Prior to commencing revegetation works a site inspection would be undertaken by a suitably qualified person to identify areas which should be targeted and the specific methods required (i.e. soil preparation, weed management, thinning and seed/tube stock densities and composition). Revegetation works within the Western Offset will not commence until existing leases have expired (i.e. once grazing has been excluded) as illustrated in the preliminary revegetation plan in Figure 6.16 and Table 6.12.

Revegetation methods to be employed in the Western Offset include mechanical direct seed and tube stock planting, hand spot planting and hand broadcasting / niche seeding. Deep ripping and other soil amelioration will be undertaken in targeted areas to prepare the soil prior for seeding/ planting (Figure 6.16).

Seed procurement will be determined after the site inspection and prior to revegetation works based on seed mix attributes provided in Table 6.5, availability of seed and in accordance with the current condition and regeneration occurring within the Western Offset.

Fertilising of tube stock will be undertaken at the time of planting by adding 100 g of DAP (di-ammonium phosphate) under the soil surface within 250 mm of the tube stock. Planted tube stock will be watered (approximately 5L/plant) at the time of planting and at least three times within the first year of growth (Table 6.12).

6.3.4.2 MONITORING AND EVALUATION

Progress against the completion criteria developed for the Western Offset will be monitored as part of the biodiversity monitoring program. Six permanent monitoring sites (three in Habitat Management Zones and three in Habitat Restoration Zones) will be monitored within the Western Offset, with specific indicators used to compare each site with a corresponding analogue site

Table 6.13 Summary of replicate monitoring sites in the Western Offset

VEGETATION COMMUNITY	MANAGEMENT ZONE	NO. MONITORING SITES
Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range (PCT 610 / BVT NA 245)	Habitat management zone	1
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (PCT 1383 / BVT NA 226)		2
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (PCT 1383 / BVT NA 226) (Derive Native Grassland)	Habitat restoration zone	3

The success of active revegetation activities within Habitat Restoration Zones will be monitored and evaluated on an annual basis as part of routine inspections following the initial planting event. This will be achieved by identifying plant stress and monitoring mortality rates. Permanent monitoring locations will be established in these areas to aid in this process. Once established these monitoring sites will be added to the BOA Monitoring Program described in Section 7 Areas where high mortality rates are recorded will be revegetated and continually monitored.

7 BIODIVERSITY MONITORING

7.1 BOA MONITORING

Biodiversity monitoring within the BOAs commenced in 2012 and 2014. Since the addition of the Jerralong, Goonbri, Nioka North, Sunshine and Braefield BOAs in 2015, biodiversity monitoring within the BOAs has been completed on an annual basis. Collectively the 10 BOAs encompass more than 10,000 ha throughout which 60 permanent monitoring sites have been established (Figure 7.1).

The 2015 biodiversity monitoring session was completed prior to the implementation of management measures and was the first year that the monitoring program encompassed all 10 BOAs. As such, data collected as part of the 2015 monitoring session is used to determine baseline conditions of each BOA and associated management zones. The monitoring sites established within habitat management zones will be used as control sites to monitor changes in biodiversity values.

The objectives behind collecting a 2015 baseline included:

- Identifying baseline condition of vegetation and fauna habitats within each BOA from which changes over time in response to management can be detected and measured (includes determining gains in ecological value and trends towards meeting performance and completion criteria)
- Enable analysis of baseline condition against performance and compliance criteria to inform management actions required to meet targets
- Enable adaptive management in response to targets not being met (i.e. to enable comparisons between baseline and future conditions to determine whether management actions being implemented are effective or require changes).

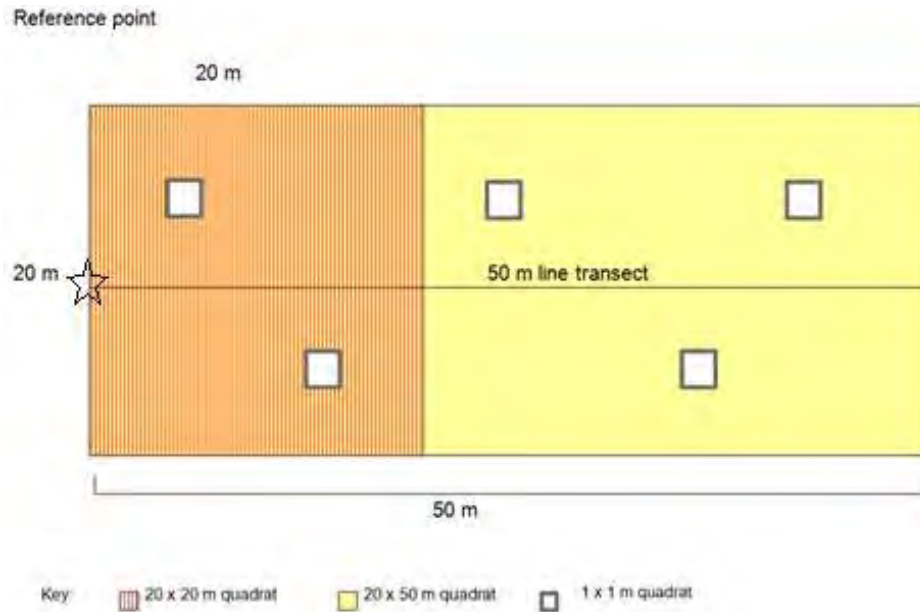
The 2015 baseline condition data for the BOAs is provided in Appendix C.

Annual BOA monitoring involves surveying of both terrestrial flora and fauna species by a qualified ecologist using the techniques prescribed below.

7.1.1 MONITORING SURVEY METHODOLOGY

7.1.1.1 VEGETATION TRANSECTS AND QUADRATS

Flora monitoring involves detailed quantitative site surveys in accordance with the *BioBanking Operation Manual and Biodiversity Assessment Methodology* (Office of Environment and Heritage, 2014, Department of Environment Climate Change, 2009) and photo point monitoring. Details of the survey methodology is provided below and depicted in Insert 5 and Table 7.1.



Inset 5 — Schematic diagram illustrating the layout of the nested 20 x 50 m and 20 x 20 m quadrats used for the assessment of condition attributes at each site

Table 7.1 Variables to be measured during flora monitoring

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
Canopy	Species richness	20 x 20 m plot	A count of the total number of canopy species
	% canopy cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the canopy
	Number of trees with hollows	50 x 20 m plot	A count of the total number of living and dead trees with at least one hollow
	Regeneration	50 x 20 m plot	The proportion of canopy species regenerating (i.e. seedlings / saplings)
Midstorey	Species richness	20 x 20 m plot	A count of the total number of midstorey species

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
	% Midstorey cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the midstorey
Ground layer	Species richness	20 x 20 m plot	A count of the total number of ground cover species
	% native ground cover (grasses)	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	Records of whether native grass intersects defined points along the transect to derive % cover.
	% native ground cover (shrubs)		Records of whether native shrubs intersect defined points along the transect to derive % cover.
	% native ground cover (other)		Records of whether native other (forbs, ferns, etc.) intersects defined points along the transect to derive % cover.
	% basal cover		Record of whether basal cover intersects defined points along the transect to derive % cover.
	Coarse woody debris (fallen logs)		50 x 20 m plot
Weed species	Species richness	20 x 20 m plot	Total number of weed species
	% cover	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	An estimate of percent foliage cover for weed species in the canopy and midstorey Records of whether ground cover weeds intersect defined points along the transect to derive % cover.
	Major weed infestations or invasion of native species	General observations	Record of species, location, size and density.
Groundcover	% cover of leaf litter, vegetation, bare ground, rock, cryptogams	5 1 x 1 m quadrats along either side of 50 m transect	An estimate of percent cover of groundcover attributes to determine groundcover composition
Canopy abundance (stem counts) and stem classes	Abundance of trees per hectare and diversity of stem classes	50 x 20 m plot	Count of number of individual trees by species and stem class ranges (<5 cm, 5-9 cm, 10-19 cm, 20-29 cm, 30-49 cm, 50-79 cm and 80+cm).
Fauna habitat	Brief description of fauna habitat condition type and connectivity	50 x 20 m plot	A qualitative description of habitat condition as well as type and connectivity value

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
Disturbance	Clearing, cultivation (grazing and trampling), storm, flood or fire damage, soil erosion, firewood collection, salinity, feral herbivores.	Within and adjacent monitoring location.	Presence/absence of each attribute will be recorded.
Overall health and structure		Single photograph of 50 m transect	A single photograph taken from the start of the transect in the direction of the transect.

Additional vegetation transects and quadrats may require establishment and monitoring to assess the impacts of fuel reduction control measures (i.e. control burns) particularly for Box Gum Woodland where control burns are deemed necessary. The requirements and monitoring procedures for these additional monitoring sites will be reviewed and provided where needed.

FREQUENCY

Vegetation transects and quadrats will be completed at each replicate monitoring site in spring in conjunction with general vertebrate survey methodologies. In addition, those replicate monitoring sites commensurate with White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland (EEC/ CEEC) will also be sampled in autumn for consistency with the Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017).

STATE AND TRANSITION MODEL

A key element of the monitoring within the BOAs is to determine the condition of White Box Woodland remnants in accordance with the State and Transition model for box gum grassy woodlands. The State and Transition model is a way to think about the condition of woodland, how it got to be that way, and what changes are possible with management actions.

As described in Section 3.2, field survey and assessments were completed over the BOAs to describe existing biodiversity values, including the extent and condition classes of vegetation communities, and to inform potential management actions. These surveys also described and delineated the different states of Box Gum Woodland as follows:

- State 1: grassy woodland
- State 2: native pastures
- State 3: fertilised pastures
- State 4: crops and sown pastures
- State 5: revegetated areas.

The BOA monitoring program was designed so that replicate sites sampled an array of vegetation communities/ fauna habitats and management areas, including those associated with State 1 and State 2 Box Gum Woodland. The 2015 baseline monitoring survey then collected baseline vegetation and vertebrate fauna attribute data associated with replicate monitoring sites, from which future comparisons can be made. Using the State and Transition model during the monitoring of the BOAs, any transition from a state can be detected and hence the effectiveness of management actions can be gauged. The indicators outlined in Table 7.2 will be used to determine the current state of the vegetation within the BOAs (for states 1 – 3) and to determine any transition between states as monitoring progresses.

Table 7.2 Indicator species to be used for states 1, 2 and 3 within BOAs

VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Canopy	A range of ages, from mature trees with hollows to seedlings.	The dominant canopy species are present, with a good representation of tree ages (excludes derived grasslands).	Canopy species are still present in woodlands though there are few young trees and seedlings.
Shrubs	<p>Many of the leguminous (pod-bearing) shrubs are found only in State 1. Due to their high nutritional value, young plants are quickly grazed out in other states.</p> <p>Examples include Wattles (<i>Acacia</i> spp.), Indigos (<i>Indigofera</i> spp.), Common fringe-myrtle (<i>Calytrix tetragona</i>), Bush-peas (e.g. <i>Pultenaea</i> spp., <i>Daviesia</i> spp., <i>Dillwynia</i> spp.), and Cryptandras (<i>Cryptandra</i> spp.).</p>	<p>While many shrubs are still present in State 2, they are most likely to be colonising species, such as Cassinias. Grazing-sensitive shrubs such as most of the wattles, the indigos and cryptandras are probably no longer present unless protected. Examples include some heaths, such as urn heath (<i>Melichrus urceolatus</i>) and peach heath (<i>Lissanthe strigosa</i>) persist where protected, and Grey Guinea-flower (<i>Hibbertia obtusifolia</i>).</p>	<p>Most shrubs in State 3 will be exotic. Native shrubs that persist in State 3 are those that are highly unpalatable due to thorns or other features.</p> <p>Examples include Blackthorn (<i>Bursaria spinosa</i>), and Cassinias, Chinese shrub, sifton bush, etc (<i>Cassinia</i> spp.).</p>
Groundcover – forbs (wildflowers)	<p>Plants with tall, flowering stems which are sensitive to grazing may only be found in State 1 including many lilies, orchids and daisies.</p> <p>Examples include Native flax (<i>Linum marginale</i>), Donkey orchids (<i>Diuris</i> spp.) and sun orchids (<i>Thelymitra</i> spp.), and Yam daisy/murrnong (<i>Microseris lanceolata</i>).</p>	<p>Forbs are transitional in form, between the tall, fleshy plants found in State 1 and those of shorter stature that are often found in State 3. State 2 forbs will often have persistent root stock, tough, rough or hairy leaves, which makes them more resistant to grazing.</p> <p>Examples include Sedges (<i>Carex</i> spp.), Mat-rushes (<i>Lomandra</i> spp.), Early Nancy (<i>Wurmbea dioica</i>), Chocolate lilies (<i>Dichopogon</i> spp.), Common buttons (<i>Chrysocephalum apiculatum</i>), Native plantains (<i>Plantago</i> spp.), Common raspwort (<i>Gonocarpus tetragynus</i>).</p>	<p>In general, the groundcover in State 3 will have traits adapted to elevated nutrients, competition and grazing. These plants will be annuals (a), short-lived perennials (sp), short-flowering (sf), rosette forming (r) or stoloniferous (st).</p> <p>Examples include Bluebells (<i>Wahlenbergia</i> spp.) (sp), New Holland daisies (<i>Vittadinia</i> spp.) (sp), Austral sunray (<i>Triptilodiscus pygmaeus</i>) (a), Blue heron's-bill (<i>Erodium crinitum</i>) (a), Austral bear's-ear (<i>Cymbonotus lawsonianus</i>) (r), Solenogyne (<i>Solenogyne</i> spp.) (r), Kidneyweed (<i>Dichondra repens</i>) (st).</p>
Groundcover — grasses	Grasses that are typically sensitive to grazing will only persist in State 1.	Many of the warm-season and highly grazing sensitive grasses found in	There are many native grasses that become more common with grazing. In State 3, these

	These include Kangaroo grass, Barbed-wire grass (<i>Cymbopogon refractus</i>), Wild sorghum (<i>Sorghum leiocladum</i>).	State 1 are no longer present in State 2. Common State 2 grasses include Nine-awn grass (<i>Enneapogon nigricans</i>), Plume-grasses (<i>Dichelachne spp.</i>) and Common wheat-grass (<i>Elymus scaber</i>).	species will move towards co-dominance with the exotics that are present. Some examples include Weeping grass (<i>Microlaena stipoides</i>), Red grass (<i>Bothriochloa macra</i> or <i>B. decipiens</i>), Wallaby grasses (<i>Austrodanthonia spp.</i>), Purple wire-grass (<i>Aristida ramosa</i>).
Exotic species	Occasional woody weeds from seeds carried in bird droppings.	Shrubs including Blackberry (<i>Rubus fruticosus</i>), Briar rose (<i>Rosa rubiginosa</i>), and African box-thorn (<i>Lycium ferocissimum</i>). Groundcovers including Paterson's curse (<i>Echium plantagineum</i>), Capeweed (<i>Arctotheca calendula</i>), Fescues (<i>Vulpia spp.</i>), Bromes (<i>Bromus spp.</i>), Coolatai grass (<i>Hyparrhenia hirta</i>), African love-grass (<i>Eragrostis curvula</i>), and Thistles (various species).	Exotic species commonly found in State 3 are similar to those in State 2 but more abundant.

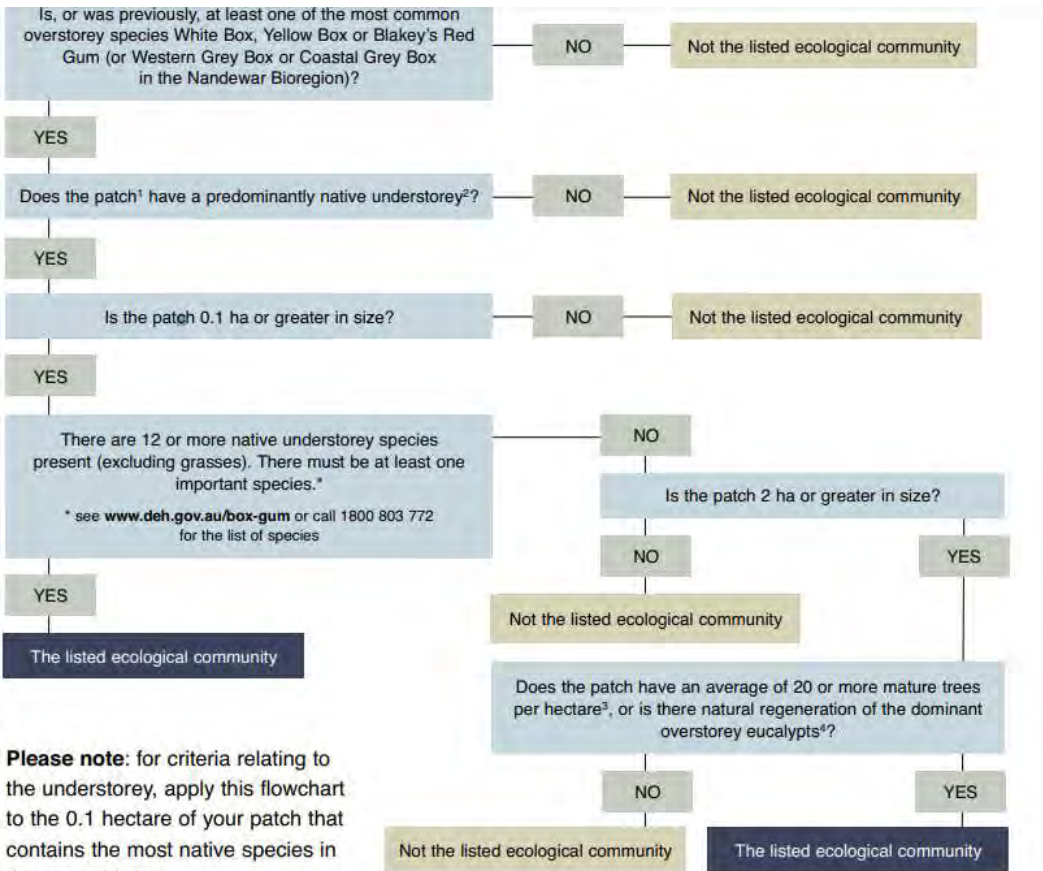
Specifically, the following ecological indicators and associated biodiversity monitoring data collection (described in Table 7.1) will be used to detect changes to and transitions of Box Gum Woodland from a state and hence the effectiveness of management actions:

- Presence, diversity and cover of canopy – canopy species richness and % canopy cover
- Presence/absence and density of tussock grasses – ground layer species richness and % native groundcover (grasses)
- Diversity of native herbs, grasses and forbs – ground layer species richness and % native groundcovers
- Native species diversity/cover – ground layer native and exotic species richness and % ground covers
- Presence/absence and cover of annuals versus perennials – analysis of ground layer native and exotic species richness and cover
- Presence of regeneration –canopy species regeneration.

EPBC ACT POLICY STATEMENT 3.5 – WHITE BOX – YELLOW BOX – BLAKELY'S RED GUM GRASSY WOODLAND AND DERIVED NATIVE GRASSLANDS

To determine whether Box Gum Woodland, within the BOAs, meets the EPBC Act critically endangered listed of White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland monitoring data will be analysed against the 'EPBC Act policy statement 3.5 – White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands' (EPBC Act policy statement 3.5).

Specifically, monitoring data will be analysis against the EPBC Act policy statement 3.5 flow diagram provided in Insert 6. The ecological attributes collected by the vegetation transects and quadrats will aid in this analysis (refer to Table 7.1 for specific attributes collected). This analysis will determine the effectiveness of management actions and identify when management actions require adaption.



- ¹ Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:
- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
 - the area over which the understorey is predominantly native.
- Patches must be assessed at a scale of 0.1 ha (1000m²) or greater.
- ² A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)
- ³ Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.
- ⁴ Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Inset 6 — EPBC Act policy statement 3.5 criteria for White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grassland CEEC

7.1.1.2 GENERAL VERTEBRATE SURVEY

The vertebrate monitoring program has been designed to consider the slow recovery time for species re-colonisation and the time it will take for revegetation areas to develop habitat attributes. The monitoring program is focused on key indicator fauna species as opposed to attempting to monitor all species found on site in a broad-brush approach. The vertebrate monitoring will focus on diurnal birds and microchiropteran bats. A large proportion of the threatened species belong to these groups. Furthermore, monitoring these groups will provide valuable information on the progress of restoration in the BOAs than other fauna groups as they depend on the development of good quality habitats with complex structure for foraging, roosting and breeding habitat.

Details of the vertebrate survey methodology are provided in Table 7.3 and discussed in more detail below.

Table 7.3 Variables to be measured during general vertebrate monitoring

SPECIES / GROUP	METHODS	EFFORT PER SITE	FREQUENCY	SEASON
Diurnal birds	Area search	20 minutes each on separate days	Annually	Spring
Microchiropteran bats	Ultrasonic call detection (Anabat)	2 consecutive nights	Annually	Spring
Nocturnal birds	Call playback	5 minutes of call broadcast, 10 minutes listening at a minimum of one site in each BOA	Biennial	Spring
Nocturnal mammals	Spotlighting	20 minutes at a minimum of one site in each BOA	Biennial	Spring
Terrestrial mammals and vertebrate pest	Infra-red/motion sensor cameras ¹	1 camera per monitoring location for 2 nights	Annually	Spring
Terrestrial mammals and vertebrate pest	Infra-red/motion sensor cameras	TBD	Continuous to be checked every 6 months	N/A

- (1) In addition to infra-red/ motion sensor cameras, observations of pest animals would be recorded opportunistically during any other biodiversity offset inspection. For significant pest animal occurrences or observed pest animal damage, the date, location, activity, density and pest animal species would be recorded and communicated to the Environmental Superintendent.

DIURNAL BIRD SURVEYS – AREA SEARCH

The diversity and abundance of birds will be recorded from each replicate survey site using area searches (in similar habitat) within 80 m of the fixed monitoring sites. Designated surveys will be completed for 20 minutes during periods of high bird activity, predominately early morning or late afternoon, with birds identified to species level based on call recognition and/ or observation. Surveys will be completed at each sample site twice on separate days. Opportunistic records will be collected within each BOA during the entire survey period.

NOCTURNAL BIRDS – CALL PLAYBACK

Call playback is used to survey for the Koala using the methods of Kavanagh and Debus (1994) and Debus (1995). Call playback surveys involve broadcasting recordings of the vocalisations of animals to elicit a response, either vocal or behavioural. At each site an initial ten-minute listening period will be undertaken followed by a five-minute call broadcast and then a five-minute listening and spotlighting period. A final listening period of ten minutes is to be undertaken after call broadcasting is concluded. Calls will broadcast using a portable MP3 player and amplified through a megaphone. Call playback will be completed at a minimum of one replicate monitoring site associated with a habitat management zone within each BOA.

MICROCHIROPTERAN BAT SURVEYS – ANABATS

Passive Ultrasonic Anabat Bat detection (Anabats, Titley Scientific, Brendale, QLD) will be used to record and identify the echolocation calls of microchiropteran bats foraging at each site. Passive monitoring of survey sites will be achieved by setting Anabat bat detectors to record throughout the night over two consecutive nights.

Bat call analysis to be undertaken using the guidelines of the Australasian Bat Society. Bat Calls of the Western Slopes and Plains (Pennay et al. 2004) will be used as a reference collection for bat call identification, as well as species specific reference calls collected in the project locality.

TERRESTRIAL MAMMALS AND PESTS

To aid management practices in the BOAs, passive infra-red motion sensor cameras would be positioned at each replicate monitoring site to target terrestrial mammals and vertebrate pests. Passive monitoring of each BOA will be achieved by arming camera traps to record continuously over two consecutive nights in conjunction with appropriate bait. Furthermore, five long-term infra-red/motion sensor cameras will be established across the BOAs for a period of 12 months (subject to weather conditions and technical operation).

In addition to infra-red/ motion sensor cameras, observations of pest animals would be recorded opportunistically during any other biodiversity offset inspection. For significant pest animal occurrences or observed pest animal damage, the date, location, activity, density and pest animal species would be recorded and communicated to the Environmental Superintendent.

7.1.1.3 TARGETED FAUNA MONITORING

In accordance with the Project's EPBC Approval (EPBC 2009/5256), targeted surveys for Corben's Long-eared Bat, Swift Parrot and Regent Honeyeater are required annually in the BOAs. Monitoring will provide valuable information on the success of management measures as they depend on good quality habitats with complex structure for foraging, roosting and breeding habitat. In addition, nest boxes and salvaged woody debris installed to augment habitat restoration zones within the BOAs require targeted monitoring in accordance with the Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017).

Details of the vertebrate survey methodology are provided in Table 7.4.

Table 7.4 Variables to be measured during targeted fauna monitoring in the BOAs

TARGET	METHODS	EFFORT PER OFFSET AREA ²	FREQUENCY	SEASON
Regent Honeyeater	Targeted searches in suitable habitats ¹	1 day per season	Annually	Autumn/Winter ³
Swift Parrot	Targeted searches in suitable habitats ¹	1 day per season	Annually	Autumn/Winter ³
Corben's Long-eared Bat	Harp trapping ⁴	8 trap nights over 2 nights ⁵	Annually	Spring/Summer
Nest boxes	Inspection camera	Each nest box monitored at least once every five years	Annually	Spring
Salvaged woody debris	Herpetological search	30-minute active search	Annually	Spring

- (1) Targeting areas of heavily flowering eucalypts.
- (2) Offset Area refers to Eastern Offsets (Braefield BOA, Sunshine BOA, Nioka North BOA), Central Offsets (Malle BOA, Myall Plains BOA, Wirrilah BOA, Goonbri BOA), Namoi Offsets (Namoi BOA, Jerralong BOA), Western Offset (Merriendi BOA).
- (3) Key foraging resources for Regent Honeyeater and Swift Parrot in the Boggabri locality is the winter flowering *Eucalyptus albens* (White Box). Therefore, as far as reasonably practicable, surveys will be undertaken annually to coincide with BirdLife Australia's National Regent Honeyeater and Swift Parrot Survey periods in May and August.
- (4) Corben's Long-eared Bat cannot be identified from echolocation call alone and trapping is required to confirm the presence of this species.
- (5) Minimum harp trapping effort in the Western Offset is 4 trap nights.

TARGETED REGENT HONEYEATER AND SWIFT PARROT SURVEYS

Blossom nomads, such as the Swift Parrot and Regent Honeyeater do not reside in discrete areas, because their home range encompasses all the resources they require to survive. Due to variations in the distribution of blossom from year to year their distribution may shift from the western slopes to the coast or tablelands with different areas in each of these regions used as the blossoming interval of different tree species cycle.

Both the Regent Honeyeater and Swift Parrot are relatively cryptic species; with Swift Parrots blending too easily into canopy foliage and Regent Honeyeaters relatively quiet and so not standing out easily for bird surveyors to pick up.

Therefore, survey methodologies for these species, rely heavily on observing the distribution of blossom resources and other indicators, such as the occurrence of high nectarivorous bird densities and diversity as indicators of their likely presence.

With the ecology of the birds and associated nectarivorous species in mind, surveys conducted within the BOA's will concentrate on those patches of tree species, which the birds are most likely to use. During the winter period when Swift Parrots are present on the mainland, the key nectar producing tree species in the Boggabri area is *Eucalyptus albens* (White Box).

Therefore, surveys will involve checking White Box patches throughout the BOAs for the presence of blossom and nectarivorous bird activity to determine the likelihood that Swift Parrots and Regent Honeyeaters might be present locally.

Where blossom and nectarivorous bird densities are detected as being elevated opportunistic surveys in combination with formal 20 minute surveys would be conducted to detect the presence of Swift Parrots or Regent Honeyeaters.

CORBEN'S LONG-EARED BAT SURVEYS

Like other Long-eared Bat species Corben's Long-eared Bat (*Nyctophilus corbeni*) uses understorey strata for foraging and they roost in hollow-bearing trees.

Although many microchiropteran bat species are detectable through use of Anabat call detection methodologies, the differences between *Nyctophilus* spp. are too subtle to reliably differentiate between the various species occurring in the locality of the BOAs. Therefore, surveys for Corben's Long-eared Bat need to be conducted with a methodology that enables bats to be identified in the hand.

Harp traps are excellent for capture and release of microchiropteran bats and they are well suited to the capture of *Nyctophilus* spp. due to their propensity to use lower forest strata for their foraging habits.

Site selection for the setting of harp traps will include a number of rationale, including, targeting of those areas where *Nyctophilus* spp. had been detected during other monitoring programs and where suitable flyways were detected in forest and woodland areas.

Harp traps are to be set at each location over a two-consecutive night period.

NEST BOX MONITORING

Monitoring will occur following the installation of nest boxes within the BOAs. A selection of nest boxes (i.e. Eastern, Central, Namoi and Western Offsets) would be nominated for monitoring in a year, with each nest box monitored at least once every five years.

Monitoring will be achieved using a pole-mounted inspection camera to remove the need for working at height with ladders. The camera would be operated entirely from the ground to approximately 6 m in height. Nest boxes would be monitored for signs of use (i.e. inhabitants, nesting material, chew/scratch marks, feathers/fur) and structural condition, and as far as practicable, would be monitored at consistent times of the year, which preferably is spring.

The following information will be recorded:

- Name of observer
- Date

- Prevailing weather conditions
- Nest box number/identification
- Nest box type
- Host tree species and diameter at breast height (DBH)
- Nest box height
- Nest box orientation
- Assessment of nest box condition (including photograph where necessary)
- Evidence of use (photograph using pole-mounted inspection camera)
- Presence of pest activity.

SALVAGED WOODY DEBRIS MONITORING

Monitoring will occur following the augmentation of habitat restoration zones with salvaged woody debris. Replicate monitoring sites would be selected based on the distribution of material within each offset area and incorporated into this monitoring program. Monitoring sites would be sampled for 30 person minutes within an approximate 1 ha area (~56 m radius) on each of two separate days.

7.1.1.4 TIMING AND FREQUENCY OF BOA MONITORING

To enable scientific and statistical robustness and to minimise the effects of temporal variation, the BOA monitoring program must be undertaken in spring. For consistency with the Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017), replicate monitoring sites consistent with White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland (EEC/ CEEC) require additional vegetation sampling (transects and quadrats) in autumn.

The survey methodologies described in Section 7.1.1.1 and Section 7.1.1.2 (specifically vegetation transects and quadrats, and general vertebrate survey methodologies) will be used to monitor the BOAs annually for five years, up to and inclusive of the year 2022. From the year 2023, monitoring of the BOAs may be considered biennially. It is noted however that surveys for White Box – Yellow Box – Blakely’s Red Gum Woodland and Derived Native Grassland (EEC/ CEEC), Regent Honeyeater, Swift Parrot and Corben’s Long-eared Bat are a requirement of the Project’s EPBC Approval (EPBC 2009/5256) and must be completed annually (unless otherwise agreed in writing by the Department of Environment and Energy).

7.1.2 ANNUAL BOA INSPECTIONS

The BOA’s will be inspected by undertaking a visual assessment of a sample of each the BOA’s each year to detect:

- Maintenance requirements (e.g. fencing, signage and access tracks)
- Disturbance factors including fire and unauthorised access (e.g. fire wood collection)
- Presence of weeds and pests
- Grazing pressure from over-abundant native herbivores
- Areas requiring thinning and erosion management
- Assessment of fuels loads and requirements for strategic grazing or control burns.

7.2 PERFORMANCE AND COMPLETION CRITERIA

Under Condition 13 (d) of the Project Approval, performance and completion criteria for the evaluation of the performance of the biodiversity offset strategies is required. The completion criteria for highly degraded areas are to be "trending towards benchmark condition". Benchmark conditions refer to either BBAM (2014) benchmarks, Biodiversity Assessment Methodology (BAM) (2016) benchmarks and/or appropriate monitoring analogue reference sites representative of each vegetation type as outlined in Table 2.3 of the Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (Umwelt (Australia) Pty Limited, 2017). Replicate monitoring sites in the BOAs where established in accordance with BBAM (Office of Environment and Heritage, 2014). Therefore, to ensure consistency, the benchmarks used to assess completion of performance criteria will include:

- BBAM (2014) benchmarks – used to analyse vegetation attributes such as native species richness; strata foliage cover and recruitment; structural characteristics such as hollow-bearing tree and woody debris density per hectare (Table 7.6).
- Long-term replicate monitoring sites associated with annual Leard State Forest monitoring will be employed as analogue reference sites to determine locality specific fauna species richness/ abundance benchmarks.

In addition to the above benchmarks, Box Gum Woodland will also be analysed against the State and Transition Model and EPBC Act Policy statement 3.5 to detect changes in the CEEC.

Detailed management actions and performance criteria have been prepared for biodiversity management within the BOAs (Table 7.5) as well as for threatened species and communities in the BOAs (Appendix D).

Objectives to complete the performance and completion criteria have been separated into the following three broad timeframes:

- Short-term – 0 to 5 years
- Medium-term – 5 to 15 years
- Long-term - >15 years.

Table 7.5 summarises the performance and completion criteria for biodiversity management within the Project Boundary and BOAs.

Table 7.5 Performance and completion criteria for the management of biodiversity values within the BOAs

OBJECTIVE	MANAGEMENT ZONE	PERFORMANCE AND COMPLETION CRITERIA	TIMEFRAME	
			ONGOING PERFORMANCE MEASURED/MONITORED	COMPLETION
Biodiversity management within the BOAs				
Natural regeneration	Habitat restoration zone	<p>100% of Box Gum Woodland BOA monitoring sites within the habitat restoration zone show locally occurring canopy species recruiting for example <i>Eucalyptus albens</i> and/or <i>Eucalyptus melliodora</i>. Given monitoring is undertaken in accordance with BBAM 2014, sampling for natural regeneration is to occur across the entire vegetation zone. Further management actions may be required if natural regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after five years, supplementary planting of canopy species (i.e. active regeneration) would commence at a density approximate to BBAM 2014 benchmarks.</p> <p>Naturally regenerated areas of Box Gum Woodland conform to condition assessment outlined on page five of the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely’s Red Gum Grassy Woodlands and Derived Native Grasslands within the habitat restoration zones.</p> <p>100% of Box Gum Woodland within habitat restoration zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites</p> <p>100% of Box Gum Woodland BOA monitoring sites within habitat restoration zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>If the targets above for Box Gum Woodland are not met by year 10 active regeneration has commenced.</p> <p>Naturally regenerated areas to be managed to encourage a range of fauna habitats to encourage use by a variety of fauna species (for example open woodland, grassland areas, shrubby woodland, allow for uptake of mistletoe species etc.) as described in Appendix D.</p>	<p>Annual monitoring of vegetation attributes in accordance with BBAM 2014 at each BOA Box Gum Woodland monitoring location.</p> <p>Annual monitoring of fauna usage in accordance with monitoring methodology detailed in Section 7.1.1.2 and Section 7.1.1.3.</p> <p>Monitoring of natural regeneration across management zones on a five-yearly basis to determine whether active revegetation is required.</p> <p>Monitoring results to be provided within Biodiversity Offset Area Monitoring Report and Annual Environmental Management Report.</p>	Short to medium term – by year 10.
Collect and propagate seed	All management zones	<p>Seed is collected from a range of sites across the locality to capture local variations within both the BOAs and Project Boundary in accordance with relevant guidelines.</p> <p>Seed collection records, location of plantings and success rates documented.</p>	After each seed collection event. Seed collection report to be completed and included in each Annual Environmental Management Report (where applicable).	Short to medium term – ongoing.
Active revegetation	Habitat restoration zones and corridor enhancement zones	<p>100% of Box Gum Woodland at BOA monitoring locations within the habitat restoration zones show locally occurring canopy species recruiting for example <i>Eucalyptus albens</i> and/or <i>Eucalyptus melliodora</i>. Given monitoring is undertaken in accordance with BBAM 2014, sampling for natural regeneration is to occur across the entire vegetation zone.</p> <p>Actively revegetated areas of Box Gum Woodland conform to condition assessment outlined on page five of the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely’s Red Gum Grassy Woodlands and Derived Native Grasslands within the habitat restoration zones.</p> <p>100% of Box Gum Woodland within Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites following active revegetation.</p> <p>100% of Box Gum Woodland BOA monitoring sites within habitat restoration zones area within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark following active revegetation.</p> <p>Actively revegetated areas to be managed to encourage a range of fauna habitats to encourage use by a variety of fauna species (for example open woodland, grassland areas, shrubby woodland, allow for update of mistletoe species etc.) as described in Appendix D.</p>	<p>Annually monitored following active revegetation in accordance with biodiversity monitoring procedure detailed in Section 7.1.1.</p> <p>Monitoring results to be provided within Biodiversity Offset Area Monitoring Report and Annual Environmental Management Report.</p>	<p>Medium to long term:</p> <p>Criteria 1 & 2 - by year 15.</p> <p>Criteria 3 & 4 – by year 20.</p>

Restoration of native grasslands derived from Box Gum Woodland (DNG)	Habitat restoration zones	<p>At least 1,483.2 ha of Box Gum Woodland DNG across all BOAs are actively being restored back to Box Gum Woodland in accordance with Condition 7 of EPBC Project Approval (refer to Figures presented in Section 3.2 regarding State 2 Box Gum Woodland, Table 6.2 and BOA management measures described in Section 6.2 and Section 6.3 for areas of Box Gum Woodland DNG to be restored).</p> <p>Natural regeneration and active revegetation performance and completion criteria identified above have been met.</p> <p>Active revegetation to commence within 10 years of control measures being implemented (refer to Figure 6.6 for indicative revegetation program across the BOAs).</p> <p>Survival rate of revegetation (i.e. tubestock planting) at least 80% after five years following planting event (taking into consideration drought and seasonal conditions). Where 50% is not achieved supplementary tubestock planting or direct seed is completed.</p> <p>Nest boxes incorporated into restoration areas until natural regeneration of tree hollows predominate. Nest box installation to occur in accordance with Section 6.2.1.6 and Appendix D. 100% of nest boxes installed within 15 years of offset establishment.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report.	Short to long term – ongoing.
Long-term maintenance of Box Gum Woodland	All management zones	<p>All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.</p> <p>Annual biodiversity monitoring undertaken in accordance with Section 7.1 to measure the success of restoration and maintenance of Box Gum Woodland against BBAM 2014 benchmark data and analogue sites.</p> <p>Monitoring to include photograph point monitoring.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report.	Short to long term – ongoing.
Salvage of habitat resources	Project Boundary, rehabilitation areas and BOAs	Salvaged resources (Section 6.2.1.6) are reused and relocated to rehabilitated areas and BOA habitat restoration zones and are in structurally good condition.	Annually following placement of salvaged resources.	Short term – by year five following placements of salvaged resources.
Provision of artificial/supplementary habitat suitable for breeding (i.e. habitat augmentation and nest box installation)	Habitat restoration zone	<p>A nest box procedure would be developed for each offset area (Eastern, Central, Namoi and Western) five years following commencement of active restoration.</p> <p>50% of nest boxes installed from a rehabilitation age of 10 years, or once regenerating canopy species are commensurate with criteria detailed in Appendix D, where practicable.</p> <p>100% of nest boxes (remaining 50%) incorporated from a rehabilitation age of 15 years, or once regenerating canopy species are commensurate with criteria detailed in Appendix D.</p> <p>80% of nest boxes installed are being utilised or show signs of use by native species within BOAs.</p> <p>Utilisation of nest boxes by pest species such European Honey Bee, Common Myna, Common Starling and feral rodent species (Rattus and Mus spp.) will be recorded.</p> <p>Nest boxes structurally in good condition and functioning in the landscape. Where nest boxes are no longer in structurally good condition they are replaced within a year of being identified.</p>	A selection of nest boxes (i.e. Eastern, Central, Namoi or Western Offsets) would be nominated for monitoring in a year, with each nest box monitored at least once every five years.	Short to long term – ongoing.
Access control for the protection of existing habitats	All management zones	<p>Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with Section 6.2.1.2 when appropriate to meet environmental goals. Temporary fences will be used during crash grazing events to prevent livestock from entering sensitive areas.</p> <p>Appropriate wildlife fencing installed and/or maintained around BOA boundaries.</p> <p>Appropriate locks and signage is maintained in good legible condition and designated access roads and tracks are maintained to prevent unauthorised access.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report.	Short to long term – ongoing. Fences installed by year 10 and maintained.
Maintenance, enhancement and	All management zones	Annual monitoring of diurnal bird and microchiropteran bat species richness and abundance completed as part of the BOA monitoring program.	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report.	Short to long term - ongoing. Habitat management zones – five years.

restoration of fauna habitat and habitat usage		<p>Habitat management zones show no observed significant decrease (i.e. greater than 40 % reduction sustained over three consecutive sampling periods) in bird species richness across the BOAs that cannot be attributed to natural variation against baseline monitoring site data.</p> <p>Habitat restoration zones and corridor enhancement zones show an observed increase in bird species richness and/or abundance across the BOA, to within at least 80% of the benchmark for Leard State Forest analogue reference sites.</p> <p>Threatened bird species occupancy and habitat usage continues.</p> <p>Salvaged resources are reused and relocated to BOA habitat restoration areas and are in structurally good condition.</p>		Habitat restoration zones and corridor enhancement zones - >10 years.
Weed and pest communication and control	All management zones	<p>Weed trends and control schedules communicated across to other coal mines within the locality (i.e. Tarrawonga Coal Project and Maules Creek Coal Project).</p> <p>Annual BOA Biodiversity Monitoring Report provides annual summary report of weed and pest information including records on trends and issues.</p> <p>Key weed and pest issues effectively communicated to other coal mines, relevant land owners, managers and other stakeholders.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report. Reports to include summary of weed and pest records, trends and issues and provided to other coal mines and stakeholders within the locality.	Short to long term – ongoing.
Weed prevention and control	All management zones	<p>Annual BOA Biodiversity Monitoring Report shows an overall reduction in exotic plant cover following implementation of control measures across all BOAs.</p> <p>Weed species within native vegetation communities comprise less than 20% of any strata across the BOAs within 10 years of control measures being implemented.</p> <p>White Cypress Pine and Shiny Bush thinning undertaken across BOAs. Endeavour to achieve the following targets:</p> <ul style="list-style-type: none"> — Reduced to less than 80% of original distribution by end of year 5 — Reduced to less than 50% of original distribution by end of year 10 — Reduced to less than 30% of original distribution by end of year 15 <p>Maintenance thinning to occur in years following initial thinning events.</p> <p>Weed control undertaken in accordance with the relevant practises and guidelines specified in the Weed and Pest Management Strategy (Appendix B).</p> <p>Where significant or new weed infestations are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification, where applicable.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report. Reports to include summary of weed records, trends and issues and provided to other coal mines within the locality.	Short to long term – ongoing.
Pest prevention and control	All management zones	<p>Annual BOA Biodiversity Monitoring Report shows an overall reduction in pest animal species and population sizes targeted by control measures implemented across all management zones across all BOAs (taking into consideration potential drought conditions and seasonal trends).</p> <p>Pest animal control is undertaken in accordance with relevant Codes of Practise and Standard Operating Procedures as detailed in the Weed and Pest Management Strategy (Appendix B).</p> <p>Where significant or new pest occurrences are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification, where applicable.</p>	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report. Reports to include summary of pest records, trends and issues and provided to other coal mines within the locality.	Short to long term ongoing. Annual biodiversity monitoring shows overall reduction in pest animals within five years of control measures being implemented.
Management of fuel loads and implementation of appropriate fire regime for conservation	All management zones	<p>Strategic grazing is implemented in the appropriate management zones to reduce fuel loads if deemed suitable following monitoring recommendations or as recommended by NSW Rural Fire Service.</p> <p>Controlled burns are used to manage fuel loads (as per management actions detailed in Section 6.2.1.4) as deemed necessary and in consultation with the NSW Rural Fire Service.</p> <p>Impacts of controlled and mosaic burns within the BOAs on native and weed species diversity is documented and made available to other coal mines within the locality (i.e. Tarrawonga Coal Project and Maules Creek Coal Project). Records to include information on location, intensity and time-period burn was undertaken.</p>	<p>Crash grazing to be implemented where identified during BOA monitoring as bring required or as recommended by NSW Rural Fire Service. Review of crash grazing requirements to occur every two years.</p> <p>Requirements to use control burns to reduce fuel loads will be investigated every five year. Control burns to occur in accordance with Section 6.2.</p>	Short to long term – ongoing.

		Access tracks and fire breaks maintained in accordance with Section 6.2.1.4 and in consultation with NSW Rural Fire Service.	Monitoring of control burns to occur within a year after each burn event.	
Nutrient management	Habitat Restoration Zone	Nutrient loads are reduced across all BOAs (i.e. all fertilisers and other soil amelioration measures associated with agriculture have ceased and livestock grazing excluded). Only soil improvement measures and crash grazing required for revegetation/regeneration as well as fuel load and weed management of native vegetation communities to occur. Annual BOA Biodiversity Monitoring Report shows an overall reduction in weed species (such as broadleaf weeds and annual pasture grasses) following reduction of fertiliser use across all BOAs. Weed species within native vegetation communities comprise less than 20% of any strata across the BOAs.	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report. Reports to include summary of measures undertaken to reduce nutrient loads and success of this by providing weed records, trends and issues.	Short term – prior to revegetation and regeneration works commencement.
Mine rehabilitation and vegetated buffer corridor for habitat connectivity	Mine rehabilitation area and edge of Project Boundary	Rehabilitated habitat within the mine rehabilitation areas and BOAs as well as the vegetated buffer corridor provides a wildlife corridor linking habitat from conservation areas in the east, through Leard State Forest and to the west towards the Namoi River.	Annually following rehabilitation as part of the Annual Environmental Management Report, Mine Rehabilitation Area Monitoring Report, Biodiversity Corridor Monitoring Report and BTM Complex Summary Report.	Short to long term – by year 30 (subject to relinquishment of mining lease).
Connectivity to landscapes and broader regional corridors	All management zones	BOA corridor weed and pest management and control is undertaken in accordance with the Weed and Pest Management Strategy (Appendix B) and meet all performance and completion criteria detailed above in the following BOA objectives: — Weed and pest communication and control — Weed prevention and control — Pest prevention and control. Targeted fauna monitoring indicates that the BOAs provide habitat for native fauna species within the locality (as per monitoring methods detailed in Section 7.1.1.2 and Section 7.1.1.3).	As per timing outlined above in weed and pest management objectives. Native fauna utilisation will be monitored annually following rehabilitation as part of the Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report.	Short to long term – ongoing. Native fauna utilisation by year 10.
Monitoring of overall ecosystem health and structure	All management zones	Annual biodiversity monitoring undertaken annually across the BOAs in accordance with the methodology detailed in Section 7.1.1. BOA Biodiversity Monitoring Report to include details of the current health and structure of all management zones across all BOAs against relevant BBAM 2014 benchmarks and analogue sites. Additionally, report will provide recommendations on management requirements to fulfil BOA performance and completion criteria detailed in this table. Native vegetation communities within BOAs met at least 80% of lower BBAM 2014 benchmark values for corresponding vegetation types.	Annually as part of Biodiversity Offset Area Monitoring Report and Annual Environmental Management Report.	Short to long term – ongoing.
Biodiversity management consultation	All management zones	Targeted consultation with key stakeholders, land managers and relevant government authorities regarding biodiversity issues is demonstrated through the development of resources and workshops. A summary report is prepared detailing overall biodiversity performance and outcomes across the BTM Complex.	Annually as part of Annual Environmental Management Report and Biodiversity Offset Area Monitoring Report. BTM Complex summary report to be completed annually detailing overall biodiversity performance and outcomes of the offset sites across the region.	Short to long term – ongoing.

(1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.

Table 7.6 BBAM 2016 vegetation attribute benchmarks for habitat restoration areas

VEGETATION COMMUNITY	NATIVE SPECIES RICHNESS	NATIVE OVER-STOREY % COVER		NATIVE MID-STOREY % COVER		NATIVE GROUNDCOVER % COVER						NO. OF TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER
		Lower	Upper	Lower	Upper	Grasses		Shrubs		Other			
						Lower	Upper	Lower	Upper	Lower	Upper		
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226)	23	6	25	0	5	30	40	0	0	3	5	1	30
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion (NA237)	23	6	25	0	5	30	40	0	0	3	5	1	30
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197)	25	6	25	0	5	30	40	3	10	3	5	1	15
Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (NA225)	20	6	25	0	5	20	30	0	0	3	5	1	15
River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (NA193)	28	25	40	3	25	20	30	0	0	3	5	2	20
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (NA179)	30	25	40	6	25	20	30	3	10	3	5	2	20
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA 228)	30	25	40	6	25	20	30	3	10	3	5	2	20
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229)	30	25	40	6	25	20	30	3	10	3	5	2	20

Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion (NA138)	30	25	40	6	25	20	30	3	10	3	5	2	20
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA225)	26	6	25	6	25	20	30	3	10	3	5	1	15

Source: DPI&E (formerly OEH) Vegetation Classification Information System (Office of Environment & Heritage, 2016)

7.3 TRIGGER ACTION RESPONSE PLAN

A Trigger Action Response Plan (TARP) is a tool which provides a threshold or ‘trigger’ of a variable. When the trigger is observed during monitoring it indicates that additional actions are required to rectify a problem. A TARP, based on the Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report, for all the BOAs is provided in Table 7.7.

Table 7.7 BOA Trigger Action Response Plan

VARIABLE	TRIGGER	ACTION AND RESPONSE
Natural regeneration	<p>Canopy species not recruiting across 100% of Habitat Restoration Zones after five years following offset establishment.</p> <p>Naturally regenerated areas to not conform to the definition of Box Gum Woodland in the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grasslands after 10 years following offset establishment.</p>	<p>Investigate likely reasons for failure via review of successful naturally regenerating areas.</p> <p>Implement appropriate supplementary plantings (i.e. active revegetation) and consider targeted removal of non-characteristic species and weeds, following supplementary planting, if deemed required.</p> <p>Consider additional monitoring to examine the establishment and success of active revegetation i.e. tubestock planting and direct seeding.</p>
	<p>Naturally regenerating Box Gum Woodland DNG regenerating into vegetation community other than Box Gum Woodland.</p>	<p>Undertake consultation with DPI&E (formerly OEH) on whether actions are required.</p> <p>If required, targeted removal of non-characteristic species, followed by supplementary planting with characteristic species (i.e. tube stock planting and direct seeding).</p> <p>Consider additional monitoring to examine progress of areas regenerating to Box Gum Woodland.</p>
	<p>Native fauna species do not show at least 80% evidence of occupation or presence across 100% of Habitat Restorations Zones after 10 years following offset establishment.</p>	<p>Investigate likely causes of failure and develop strategy to prioritise habitat argumentation of habitat resources such as salvaged timber and nest box installation for targeted threatened and locally occurring species.</p>
	<p>Vegetation cover scores within all Habitat Restoration Zones do not meet or are not within BBAM 2014 benchmark values for Box Gum Woodland after 10 years following offset establishment.</p> <p>Native species richness within all Habitat Restoration Zones do not meet at least 80% of the BBAM 2014 benchmark value for Box Gum Woodland after 10 years following offset establishment.</p>	<p>Investigate likely reasons for below benchmark performance via review of successful naturally regenerating areas.</p> <p>Undertake consultation with DPI&E (formerly OEH) on whether actions are required.</p> <p>Determine whether supplementary tubestock planting and/or direct seeding is required to increase vegetation attributes to benchmarks.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
	Naturally regenerating areas are not being managed to encourage a range of fauna habitats to encourage use by a variety of fauna species (for example open woodland, shrubby woodland etc.).	Review of actively revegetated areas by ecologist to determine what management is required to encourage a variety of fauna habitats. Management identified is implemented and monitored as part of annual biodiversity monitoring.
Collect and propagate seed	Seed collection records are not reported within Annual Review.	Make appropriate notations in the Annual Summary Report on environmental documentation performance.
	Seeds cannot be sourced within the locality due to environmental influences such as drought or disease.	Review available seed sources and investigate whether appropriate seed from bordering localities/regions are available for use.
	Seed is not collected over a range of sites across the locality and variations in seed mixes are not captured.	Review seed inventory and propagated plants and investigate where there is a need to collect seed from other areas. Review the success, trends of failure of rehabilitation/revegetation that has occurred to date using seed and tubestock to determine whether greater diversity is required. Seed tested annually for viability. Where greater diversity is required.
Active revegetation	Canopy species not recruiting across 100% of Habitat Restoration Zones after 15 years following offset establishment.	Investigate likely reasons for failure via review of successful actively revegetated areas.
	Actively regenerated areas to not conform to the definition of Box Gum Woodland in the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grasslands after 15 years following offset establishment.	Implement appropriate non-characteristic species and weeds, following supplementary planting, if deemed required. Consider additional monitoring to examine the establishment and success of active revegetation i.e. tubestock planting and direct seeding.
	Native fauna species do not show at least 80% evidence of occupation or presence across 100% of Habitat Restorations Zones after 15 years following offset establishment.	Investigate likely causes of failure and develop strategy to prioritise habitat argumentation of habitat resources such as salvaged timber and nest box installation for targeted threatened and locally occurring species.

VARIABLE	TRIGGER	ACTION AND RESPONSE
	<p>Vegetation cover scores within all Habitat Restoration Zones do not meet or are not within BBAM 2014 benchmark values for Box Gum Woodland after 15 years following offset establishment.</p> <p>Native species richness within all Habitat Restoration Zones do not meet at least 80% of the BBAM 2014 benchmark value for Box Gum Woodland after 15 years following offset establishment.</p> <p>Survival rate of supplementary tubestock planting less than 80% after five years following planting event.</p>	<p>Investigate likely reasons for below benchmark performance via review of successful naturally regenerating areas.</p> <p>Undertake consultation with DoEE on whether actions are required.</p> <p>Determine whether additional supplementary tubestock planting and/or direct seeding is required to increase vegetation attributes to benchmarks.</p> <p>Test seed annually for viability</p> <p>Complete soil testing and if necessary, amelioration in poor performing areas.</p> <p>Where 50% survival rate is not achieved review possible causes of failure (for example drought) and undertake additional supplementary planting to meet benchmark values.</p>
	<p>Actively revegetated areas not managed to encourage a range of fauna habitats to encourage use by a variety of fauna species (for example open woodland, shrubby woodland etc.).</p>	<p>Review of actively revegetated areas by ecologist to determine what management is required to encourage a variety of fauna habitats.</p> <p>Management identified is implemented and monitored as part of annual biodiversity monitoring.</p>
<p>Severe or prolonged drought leading to widespread failure of revegetation</p>	<p>Monitoring or vegetation assessments highlight inadequate ground cover and or paucity in species diversity/distribution</p>	<p>Amelioration of dispersive soils where required during seeding/planting works to improve infiltration and water holder capacity</p> <p>Control of grazing to minimize erosion, soil compaction and maintain soil surface cover</p> <p>Targeted seeding/planting of impacted areas.</p>
<p>Restoration of native grasslands derived from Box Gum Woodland (DNG)</p>	<p>Less than 1,483.3 ha of Box Gum Woodland DNG has been restored.</p> <p>Natural regeneration and active revegetation triggers are not being met.</p>	<p>Review restoration work areas and determine where additional restoration is required to ensure 1,483.3 ha is restored.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
Long-term maintenance of Box Gum Woodland	Fencing, signage, gates and locks not installed or not in good condition. Annual biodiversity monitoring not undertaken in accordance with Section 7.1.	Review existing infrastructure presence and condition and determine what is required to rectify the issue. Review of biodiversity monitoring procedure and reporting template. Where appropriate update report to include required items. Recommendations provided in report to be implemented to reach benchmark and performance criteria.
Salvage of habitat resources	Salvaged materials are no longer present, have been damaged or have deteriorated.	If appropriate, re-establish salvaged resources. Review whether additional habitat resources require salvaging during future tree clearing operations to compensate for loss of resources in BOAs. Review and identify the need to replace hollow loss with nest boxes. Review and identify appropriate measures to reduce loss, damage or deterioration of salvaged resources in the future.
Provision of artificial/ supplementary habitat suitable for breeding i.e. habitat augmentation and nest box installation	Loss or damage of nest boxes and/or deterioration of nest box condition.	Identify and replace all lost or damaged nest boxes. Review and identify appropriate measures to reduce loss, damage and deterioration of nest boxes in the future.
	Less than 80% of the nest boxes installed show evidence of use across BOAs after five years following installation.	Review performance of nest boxes and naturally occurring hollows at reference sites to investigate whether alterations to nest box design, replacements or locations require change. Review current literature.
	Nest boxes are no longer in good structural condition or found to be utilised by pest species such as European Honey Bee, Common Starlings or rodents.	Remove pest species identified. Consider the need to replace or repair nest box.

VARIABLE	TRIGGER	ACTION AND RESPONSE
Access control for the protection of existing habitats	<p>Livestock are accessing and causing damage to areas where they should be excluded.</p> <p>Monitoring or vegetation assessments identify impact from grazing animals.</p>	<p>Identify location and where entry has occurred and repair/alter fencing.</p> <p>Destock areas identified as being affected by livestock grazing</p> <p>Specifically, monitor livestock occupancy within conservational areas and areas where livestock has been found where they should have been excluded once identified</p> <p>Pest control undertaken in accordance with Weed and Pest Management Strategy (Appendix B).</p>
	<p>Reports of native wildlife being injured as a result of barbed wire on fences.</p>	<p>Review and investigate incident(s) and advise on whether alternative fencing materials or fencing styles are required to reduce native fauna injury.</p>
	<p>Locks, signage and access tracks in poor condition.</p> <p>Reports of unauthorised access and illegal pest hunting occurring with BOAs</p>	<p>Review incidents(s) and advise on whether additional methods are required to limit unauthorised access and to prevent damage to locks,</p>
Damage to vegetation communities from erosion.	<p>Significant gully or tunnel erosion identified during monitoring.</p>	<p>Target seeding/planting in high erosion risk areas where required</p> <p>Monitoring of erosion condition and success / failure of erosion control measurements implemented</p> <p>Appropriate treatment of identified erosion</p> <p>Amelioration of dispersive soils during seeding/planting activities.</p>
Maintenance, enhancement and restoration of fauna habitat and habitat usage	<p>Annual BOA monitoring indicates that there is an overall decrease (greater than 40 % reduction sustained over three consecutive sampling periods) in bird species richness that cannot be attributed to natural variation against benchmark data.</p> <p>Absence of a range of habitat features across all management zones within BOAs being utilised by fauna species.</p>	<p>Review fauna habitat utilisation and fauna habitat attributes which occur and investigate likely reasons for failure versus success.</p> <p>Investigate the need for further habitat augmentation (such as relocation of salvaged fallen timber and installation of nest boxes) to provide and/or increase habitat within the BOA corridors.</p> <p>Consider additional monitoring to examine the success of further habitat augmentation, as appropriate.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
Weed and pest communication and control	Weed trends and control schedules not communicated across within other coal mines, stakeholders and land managers within the locality (i.e. Tarrawonga Coal Project and Maules Creek Coal Project).	BCOPL Environmental Superintendent responsible for making information available for meeting and forums as appropriate.
Impact of weeds and/or invertebrate pest animal leading to wide spread failure of revegetation ecosystems	Monitoring or vegetation assessments identify increased weed competition or degradation by pest animal species	<p>Management of weeds and pest animals in accordance with the Weed and Pest Management Strategy (Appendix B)</p> <p>Modification to seeding/planting techniques</p> <p>Low intensity burning regimes where required to control weeds, manage nutrients in the biomass and trigger growth.</p>
Weed prevention and control	<p>Annual BOA monitoring indicates that there is an overall increase in exotic plant cover following control measures implemented across all BOAs.</p> <p>Weed species comprise greater than 20% cover of any strata cross all BOA native vegetation communities during any year following offset establishment.</p> <p>Pine thinning targets are not met.</p>	<p>Identify location of weed issues and review the need to implement additional or alternative control measures such a physical removal, herbicides, strategic grazing and/or control burns.</p> <p>Consider additional monitoring to examine success or otherwise of additional control measures implemented.</p> <p>Consider the potential impact of drought, high rainfall events and other seasonal trends when reviewing weed control and management.</p>
	Weed control is not undertaken in accordance with Weed and Pest Management Strategy (Appendix B).	<p>Review methods being used and consult with relevant authorities on whether there are other suitable control measures available.</p> <p>Discuss alternative control methods with contractors hired to undertake weed control.</p>
	Significant weed invasions or newly identified weed significant species identified within BOAs during site inspections and biodiversity monitoring.	Review issues and implement appropriate control measures within one year of identifying issue.

VARIABLE	TRIGGER	ACTION AND RESPONSE
Pest prevention and control	Annual BOA monitoring indicates that there is an overall increase in pest animal species following control measures implemented across all BOAs.	<p>Identify location of pest animal issues and review the need to implement additional or alternative control measures in accordance with Weed and Pest Management Strategy (Appendix B).</p> <p>Consider additional monitoring to examine success or otherwise of additional control measures implemented.</p> <p>Consider the potential impact of drought, high rainfall events and other seasonal trends when reviewing weed control and management.</p>
	Pest animal control is not undertaken in accordance with Weed and Pest Management Strategy (Appendix B).	<p>Review methods being used and consult with DPI on whether there are other suitable control measures available.</p> <p>Discuss alternative control methods with contractors hired to undertake pest control.</p>
	Significant pest animal occurrences or newly identified pest species identified within BOAs during site inspections and biodiversity monitoring.	Review issues and implement appropriate control measures within one year of identifying issue.
Management of fuel loads and implementation of appropriate fire regime for conservation	Fuel loads are assessed as being moderate or high risk for intense and damaging fires as part of BOA inspections/NSW Rural Fire Service assessment.	<p>Undertake controlled burning in accordance with Section 6.2.1.4 and in consultation with NSW Rural Fire Service.</p> <p>Consider implementation of strategic grazing in appropriate management zones identified with a moderate to high risk where control burns are not considered suitable.</p>
	Impacts of control and mosaic burning of weed and native species diversity is found to be detrimental.	<p>Review fire regime implemented and investigate suitable actions and reinstate restoration activities.</p> <p>Review and utilise most current control burning advice for Box Gum Woodland and fauna habitats. Update OMP and control measures.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
	Fuel reduction control burns not undertaken in accordance with Section 6.2.1.4	<p>Review BOA monitoring reports and inspection reports to determine the level of fuel loads within the BOAs. Discuss whether control burns are an appropriate control measure with the NSW Rural Fire Service and adjacent land managers.</p> <p>Review and utilise most current control burning advice for Box Gum Woodland and fauna habitats. Update OMP and control measures.</p> <p>Consider implementation of strategic grazing in appropriate management zones identified with a moderate to high risk where control burns are not considered suitable.</p>
	Unplanned high intensity bush fire	<p>Inspection and maintenance of Asset Protection Zones</p> <p>Active encouragement of staff involvement with the Rural Fire Services</p> <p>Low intensity burning regimes where required to control weeds and fuel loads</p> <p>Targeted seeding/planting of impacted areas.</p>
Nutrient management	<p>Annual BOA monitoring indicates that there is an overall increase in exotic plant cover following control measures implemented across all BOAs.</p> <p>Weed species comprise greater than 20% cover of any strata across all BOA native vegetation communities during any year following offset establishment.</p>	<p>Identify location of nutrient issues and review the need to implement additional or alternative control measures such as alternative weed management methods.</p> <p>Consider additional monitoring to examine success or otherwise of additional/alternative control measures implemented.</p> <p>Consider the potential impact of drought, high rainfall events and other seasonal trends when reviewing nutrient management.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
Mine rehabilitation and vegetated buffer corridor for habitat connectivity	Mine rehabilitation areas and biodiversity buffer corridor does not provide linking habitat from conservation areas in the east, through to Leard State Forest and west towards the Namoi River after 30 years following the approval of the Leard Forest Biodiversity Regional Biodiversity Strategy Stage 2 – Strategy Report.	<p>Investigate the need for further habitat augmentation (such as relocation of salvaged fallen timber and installation of nest boxes) to provide and/or increase habitat within the BOA corridors.</p> <p>Review the mine rehabilitation status (refer to RMP) and confirm whether supplementary canopy planting or other control measures are required.</p> <p>Investigate opportunities to secure other land holdings which could increase habitat connectivity.</p>
	Do not demonstrate a coordinated approach to monitoring the vegetated biodiversity corridor.	Undertake annual meeting with Maules Creek Coal Mine representatives to discuss and coordinate the vegetation biodiversity corridor.
Connectivity to landscapes and broader regional corridors	<p>Weed and pest control is not undertaken in accordance with Weed and Pest Management Strategy (Appendix B) and as detailed in the following variables above:</p> <ul style="list-style-type: none"> — Weed and pest communication and control — Weed prevention and control — Pest prevention and control. 	As per weed and pest communication and control, weed prevention and control and pest prevention and control variables above.
	Monitoring indicates that offset corridors do not provide habitat for native fauna species in the locality within 10 years following offset establishment.	<p>Investigate the need for further habitat augmentation (such as relocation of salvaged fallen timber and installation of nest boxes) to provide and/or increase habitat within the BOA corridors.</p> <p>Consider additional fauna monitoring required to investigate fauna utilisation and movement within the BOA locality.</p>
Monitoring of overall ecosystem health and structure	Annual biodiversity monitoring is not undertaken in accordance with Section 7.1 and does not report on the health and structure of all management zones against relevant benchmarks and performance criteria.	<p>Review of biodiversity monitoring procedure and reporting template. Where appropriate update report to include required items.</p> <p>Recommendations provided in report to be implemented to reach benchmark and performance criteria.</p>

VARIABLE	TRIGGER	ACTION AND RESPONSE
Biodiversity management consultation	<p>Targeted consultation with key stakeholders, land managers and relevant government authorities regarding biodiversity issues is not undertaken through development of resources and workshops.</p> <p>Meetings have not included relevant authorities and agencies (i.e. DoEE, DPI&E (formerly OEH and DP&E), LLS and NPWS and Community Consultative Committee.</p>	BCOPL Environmental Superintendent responsible for invitations to be sent out to relevant parties with adequate lead time to allow appropriate parties to attend and/or engage in issues.

7.4 RISK ASSESSMENT

A risk assessment (Table 7.9) has been completed to assess potential risks against the performance criteria detailed in Table 7.5. The risk assessment is based on the risk matrix provided in Table 7.8. The risk assessment identifies the potential risk, likelihood of occurrence and consequence. Once the level of the risk has been determined contingency measures have been provided to mitigate the risk. The risk assessment has been completed for the management within the BOAs.

Table 7.8 Risk matrix

		LIKELIHOOD					CONSEQUENCE RATING
		Almost certain	Likely	Moderate	Unlikely	Rare	
Consequence	5	Critical	Critical	High	High	Mod	Intense local impacts, medium term effects, major potential for irreversible widespread impacts
	4	Critical	High	High	Mod	Low	Major local impacts with short term effects, moderate potential for widespread impacts
	3	High	High	Mod	Low	Low	Moderate impacts with medium term effects, low potential for widespread medium term impacts
	2	High	Mod	Low	Low	Low	Minor local impacts with short term effects or minor widespread impact
	1	Mod	Low	Low	Low	Low	Minor impact with negligible effects

Table 7.9 Assessment of potential risks to successful management against performance criteria

RISK FACTOR (HAZARD)	IMPACT	BEFORE MANAGEMENT			ACTION AND RISK MITIGATION MEASURE	AFTER MANAGEMENT		
		Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Substrate	Erosion and sedimentation	Likely	2	Mod	Targeted revegetation along drainage lines and scalded areas to minimise risk erosion. Restriction of livestock access BOAs, particularly including erosion prone areas. Maximise the use of existing BOA infrastructure (i.e. access roads). Locate new BOA management infrastructure (such as access roads) in stable location.	Mod	2	Low
	Soil compaction inhibiting germination of seeds or growth of seedlings	Likely	2	Mod	Livestock will be excluded from areas subject to active revegetation Vehicle access predominately restricted to designated access tracks Site preparation (such as ripping) in habitat restoration zones and corridor enhancement zones including. Growth and survival rates of revegetated areas will be monitored.	Mod	2	Low
	Ground disturbance	Mod	2	Low	Fencing and signage installed and maintained around perimeter of BOAs Vehicle access predominately restricted to designated access tracks Low disturbance revegetation techniques in restoration areas adjacent to remnant vegetation.	Unlikely	2	Low
Floristics	Poor floristic diversity (including seed mix/ tube stock)	Mod	3	Mod	Favour for natural regeneration in habitat restoration zones, followed by seeding or planting as required and determined by monitoring. Procedures for strategic and long-term seed collection, management and storage (Section 6.2.2.2). Collect seed from the three broad native vegetation classes (native grasslands, grassy woodland on fertile soils and shrubby woodlands/ open forest on skeletal soils) (Section 6.2.2.2).	Unlikely	3	Low

					<p>Management of weed and pests in accordance with the Weeds and Pests Management Strategy (Appendix B).</p> <p>Pine thinning and native woody weed management (Section 6.2.1.9, Section 6.2.1.10).</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>			
Native plant growth	Poor native plant growth/ germination	Mod	3	Mod	<p>Implement procedures for the preferential use of local endemic species.</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Unlikely	3	Low
	Dense overstorey and midstorey revegetation	Mod	3	Mod	<p>Implement management techniques to assist natural regeneration measures in habitat restoration zone and corridor enhancement zones, such as pine thinning and native woody weed management (Section 6.2.2).</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Mod	2	Low
	Fungi or pathogens – seed germination failure	Mod	2	Low	<p>Implement procedures for the preferential use of local endemic species.</p> <p>Collect native seed for the establishment of native vegetation in accordance with Section 6.2.2 and Florabank Guidelines.</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Mod	2	Low
Fauna habitat	Lack of fallen timber/ hollow logs	Mod	2	Low	<p>Describe procedures to reuse timber/hollow logs salvaged during vegetation clearing events in the Project Boundary (Section 6.2.1).</p> <p>Specify protocols for salvage of habitat features from the Project Boundary (refer to Biodiversity Management Plan)</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Mod	2	Low
	Lack of structural diversity	Mod	2	Low	<p>Specify protocols for salvage of habitat features from the Project Boundary (refer to Biodiversity Management Plan)</p> <p>Specify protocols for the provision of supplementary habitat in BOAs (Section 6.2.1.6).</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Mod	2	Low

	Lack of suitable vegetation for foraging and/or roosting	Mod	2	Low	<p>Include the planting (in appropriate landscapes) of a variety of eucalypt species, particularly box and ironbark species endemic to the locality and described in Section 6.2.2 and Table 6.5.</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Mod	2	Low
Weather	Drought	Likely	3	High	<p>Growth and survival rates of revegetated areas will be monitored. Where possible additional deep water events will occur where survival rates are low (i.e. <80% survival rates).</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Likely	2	Mod
	Wind	Mod	2	Low	Options for using tree guards to limit effects of wind on seedling and soil moisture.	Mod	2	Low
Clearing	Incidental clearing, collection of firewood	Likely	2	Mod	<p>Permanent fencing will be used in the BOAs to exclude cattle and unauthorised access.</p> <p>Installation of appropriate signage.</p> <p>Consideration given to avoiding or minimising clearing of native vegetation when installing new fences in BOAs.</p> <p>Access gates to BOAs will be locked and key distribution controlled by nominated BCOPPL representative.</p> <p>Firewood collection not permitted in BOAs.</p> <p>Annual monitoring of active restoration zones as detailed in Section 7.1.</p>	Unlikely	2	Low
Livestock	Grazing by cattle – ground disturbance, remove or destroy seedlings/ plantings	Mod	4	High	<p>Livestock will be excluded from areas undergoing active revegetation.</p> <p>Permanent fencing to be installed around BOAs to limit access.</p> <p>As necessary, implement controlled strategic cattle grazing.</p>	Unlikely	3	Low
Introduced plant species	Weed invasion	Mod	4	High	<p>Implement weed management procedure (Appendix B).</p> <p>Weed trends and control schedules to be communicated across the Leard Forest Mining Complex.</p>	Unlikely	3	Low

Herbicide	Excessive herbicides	Mod	2	Low	Herbicides minimised through spray-topping, cut and paint method, stem injection or spot-spraying application methods. spot-spraying, basal spraying, stem injection or cut and paint application methods.	Mod	2	Low
Impacts from exotic and native animals	Grazing by feral goats and pigs	Likely	3	High	Options for using tree guards to protect young seedlings. Implement procedures to prevent, monitor and control feral animals (Appendix B).	Likely	2	Mod
	Rabbits and hares							
	Grazing by native fauna (i.e. Kanagaroos)							
	Foxes							
	Feral cats							
Fire	Uncontrolled bushfire	Likely	4	High	Maintain access tracks. Schedule for maintenance of access/fire trails. Schedule for assessing fuel loads. Low intensity burning regimes where required to control weeds and fuel loads. Review and utilise most current control burning advice for Box Gum Woodland and fauna habitats. Option for using controlled grazing to reduce biomass. Option for implementing strategic grazing in appropriate management zones where control burns are not considered suitable. Targeted seeding/planting of impacted areas.	Mod	3	Mod

8 REPORTING AND AUDITING

Various reports regarding the management of biodiversity at the Boggabri Coal Mine will be prepared at regular intervals. These reports are discussed in detail below.

8.1 ENVIRONMENTAL INCIDENT REPORTS

All environmental incidents, complaints, non-conformance or exceedance of performance criteria as identified by annual monitoring or reporting will be managed as per the requirements of the BCOPL Environmental Incident Response Management Protocol.

8.2 REPORTING SURVEY DATA

In accordance with Condition 26 of the Project Approval (2009/5256), survey data collected for the project will be recorded so as to conform to data standards notified from time to time by DoEE. When requested by the DoEE, BCOPL will provide all species and ecological survey data and related survey information from ecological surveys undertaken for MNES. The survey data will be provided within 30 business days of request, or in a timeframe agreed to by DoEE in writing.

8.3 ANNUAL COMMONWEALTH APPROVAL COMPLIANCE REPORT

In accordance with Condition 28 of the Project Approval (2009/5256), a report pertaining to the annual compliance with the Project's Conditions of Approval will be published on the Boggabri Coal Mine website by the end March each year. Documentary evidence providing proof of the date of publication and non-compliance with any of the Conditions of Approval will be reported to the DoEE at the same time the report is published.

8.4 ANNUAL REVIEW REPORT

In accordance with Condition 13(d)(viii) of the Project Approval (2009/5256), BCOPL will prepare and submit an annual review report detailing the progress of management activities undertaken in the offset areas and the outcome of those activities, including identifying any need for improved management activities to undertake such improvement. The annual review report will be completed by the end of March each year.

8.5 ANNUAL BIODIVERSITY MONITORING REPORTS

The Project Ecologist prepares and submits annual biodiversity monitoring reports to the BCOPL Environmental Superintendent to inform biodiversity issues, trends and performance for inclusion in the State Annual Environmental Management Report. Due to their direct relevance to the Project's Conditions of Approval (2009/5256) and upon request from the DoEE, the following monitoring reports will be provided:

- Biodiversity Corridor Monitoring Report
- Mine Rehabilitation Area Monitoring Report
- BOA Monitoring Report.

Biodiversity monitoring reports will be completed in draft format by the end of February each year for inclusion in annual monitoring reports.

8.6 BMP

8.6.1 PREPARATION

As with the preparation of other EMPs at the Boggabri Coal Mine, the development of this OMP and supporting strategies and procedures has been undertaken through a consultative approach (refer Section 1.3.2). Regulatory authorities and other key stakeholders engaged throughout this process include DoEE, DPI&E (formerly DP&E, OEH, DRG and DP&I), North West LLS and the CCC.

8.6.2 REVISION

Revision of this OMP may be triggered:

- If BCOPL wishes to carry out an activity otherwise than in accordance with the plans, as specified in the Conditions of Approval. A revised version of this OMP must be submitted to DoEE for the Minister’s written approval and the varied activity shall not commence until the Minister has approved the revised plan in writing. The Minister will not approve the revised plan, unless the revised plan would result in an equivalent or improved environmental outcome (Condition 30 of Project Approval 2009/5256).
 - If DoEE believes that it is necessary or convenient for the better protection of listed threatened species and communities or listed migratory species (Condition 31 of Project Approval 2009/5256).
 - If performance reports (i.e. BOA Monitoring Reports) indicate completion criteria may not be achieved.
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8.7 INDEPENDENT BMP AUDIT

In accordance with Condition 29 of the Project Approval (EPBC 2009/5256) and upon the direction of DoEE, BCOPL will conduct an independent audit of compliance with the conditions of approval and a report submitted to DoEE. Prior to the commencement of any audit the independent auditor and audit criteria must be agreed to by DoEE.

9 ROLES AND RESPONSIBILITIES

Key management personnel and their relevant roles and responsibilities regarding implementation of this OMP are detailed below in Table 9.1.

Table 9.1 Roles and responsibilities for implementation of the BMP

ROLE	RESPONSIBILITY
BCOPL General Manager	Providing sufficient environment resources to ensure the effective implementation of the requirements of this plan.
BCOPL Mining Manager	Ensure the mining and biodiversity activities are undertaken in accordance with the commitments in this plan
BCOPL Environmental Superintendent	<p>Liaising with regulatory authorities regarding BCOPL biodiversity management obligations as detailed in this plan</p> <p>Reviewing and updating this plan</p> <p>Ensuring all employees and contractors are aware of their environment management obligations in accordance with this plan</p> <p>Engaging specialist to undertake specific monitoring and environmental management activities in accordance with the commitments outlined in this plan</p> <p>Communicating the rehabilitation requirements outlined in this plan to all affected parties at BCOPL</p>
Mining Contractor's Project Manager	<p>Implementing biodiversity obligations in accordance this plan</p> <p>Developing and implementing specific procedures for the employees and subcontractors under their responsibility as required to facilitate compliance with this plan</p> <p>Ensuring all employees and subcontractors under their responsibility are aware of their environment management obligations</p> <p>Providing relevant environment data to assist BCOPL with environment reporting</p>

9.1 CONTACT DETAILS

The names and contact details of key Project personnel are provided in Table 9.2.

Table 9.2 Site contacts

TITLE	COMPANY	CONTACT NO
General Manager Operations	Boggabri Coal Operations Pty Ltd	02 6743 4775
Environment Superintendent	Boggabri Coal Operations Pty Ltd	02 6743 4775
Mine Manager	Boggabri Coal Operations Pty Ltd	02 6749 6006

10 REFERENCES

10.1 INTERNAL REFERENCES

The BMP refers to the other relevant management plans required by the Project Approval and forms a part of the BCOPL Environment Management System. The below plans provide further detailed information on environmental management at Boggabri Coal Mine:

- BCOPL Rehabilitation Management Plan
 - BCOPL Cultural Heritage Management Plan
 - BCOPL Mining Operations Plan
 - BCOPL Environmental Incident Response Management Plan.
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10.2 EXTERNAL REFERENCES

- DEPARTMENT OF ENVIRONMENT AND CLIMATE CHANGE 2008. Principles for the use of Biodiversity Offsets in NSW.
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APPENDIX A

MONITORING, INSPECTION AND
REPORTING PROGRAM



Table A.1 Biodiversity monitoring, inspection and reporting program

ACTIVITY	AREA	RESOURCES	RESPONSIBILITY	FREQUENCY	REPORTED TO
ROUTINE MONITORING					
People					
1. Ensuring all employees and subcontractors under their responsibility are aware of their environment management obligations	N/A	Boggabri Coal database	— Contract Owner/ Supervisors — Contractors	Prior to commencement of activity	— Environment Superintendent
2. All Project personnel are appropriately qualified to complete relevant tasks	N/A	Boggabri Coal database	— Contract Owner/ Supervisors — Contractors	Prior to commencement of activity	— Environment Superintendent
3. All operations are contained within the designated works area	Project Boundary and adjoining land	Operational plans with defined work limits	— Contract Owner/ Supervisors — Contractors	Prior to commencement of activity	— Environment Superintendent
4. Environmental complaints have been recorded and appropriately managed	Project Boundary, BOAs and adjoining land		— Contract Owner/ Supervisors — Contractors	As required	— Environment Superintendent
Biodiversity					
5. Operations are complying with the Weed and Pest Management Strategy (Appendix B)	Project Boundary and BOAs	Weed and Pest Management Strategy (Appendix B)	— Contract Owner/ Supervisors — Contractors	As required	— Environment Superintendent

ACTIVITY	AREA	RESOURCES	RESPONSIBILITY	FREQUENCY	REPORTED TO
ROUTINE MONITORING					
6. Weed and pest infestations are identified and controlled in accordance with the Weed and Pest Management Strategy (Appendix B)	Project Boundary and BOAs	Weed and Pest Management Strategy (Appendix B)	— Environment Superintendent — Contract Owner/ Supervisors — Contractors	As required	— Environment Superintendent
7. Vegetation clearing is undertaken in accordance with the Clearing and Fauna Management Procedure	Vegetation clearing areas	Clearing and Fauna Management Procedure	— Environment Superintendent — Project Ecologist — Contract Owner/ Supervisors — Clearing Contractors	As required	— Environment Superintendent
8. Any injured animals are recorded and are dealt with in accordance with the Clearing and Fauna Management Procedure	Project Boundary	Clearing and Fauna Management Procedure	— Environment Superintendent — Project Ecologist — Clearing Contractors	As required	— Environment Superintendent
Biodiversity Monitoring program					
9. Biodiversity monitoring completed as described in Section 8 of main BMP document	Project Boundary, Biodiversity Corridor and BOAs	Main BMP document – Section 8	— Environment Superintendent — Project Ecologist	Annually	— Environment Superintendent
Inspections					

ACTIVITY	AREA	RESOURCES	RESPONSIBILITY	FREQUENCY	REPORTED TO
ROUTINE MONITORING					
10. Clearing extent and site feature survey and pre-clearing survey	Vegetation clearing areas	Clearing and Fauna Management Procedure	<ul style="list-style-type: none"> — Environment Superintendent — Project Ecologist — Project Surveyor — Contract Owner/ Supervisors 	As required	— Environmental Superintendent
11. BOA inspections	BOAs	Main BMP document	<ul style="list-style-type: none"> — Environment Superintendent 	Annually	— General Manager
12. Independent BMP audit	Project Boundary and BOAs	Main BMP document	<ul style="list-style-type: none"> — Independent Auditor commissioned by the Environment Superintendent and approved by the Secretary 	By the end of 2017	— Regulatory authorities
Reporting					
13. Environmental incident reports	Locality	Incident report form	<ul style="list-style-type: none"> — All Project personnel 	As required	<ul style="list-style-type: none"> — Environment Superintendent — General Manager
14. Biodiversity Monitoring Report	Project Boundary, Biodiversity Corridor and BOAs		<ul style="list-style-type: none"> — Environment Superintendent — Project Ecologist 	Annually	— Environment Superintendent
15. Annual Environmental Monitoring Report	Project Boundary	<ul style="list-style-type: none"> — Biodiversity monitoring report — Tree Clearing Reports 	<ul style="list-style-type: none"> — Environment Superintendent 	Within 28 days of the end of the reporting period	— Regulatory authorities

APPENDIX B

WEED AND PEST MANAGEMENT STRATEGY



B1 INTRODUCTION

Weed and pest species are effective competitors for food and habitat resources and have the potential to exclude native species and modify the composition and structure of vegetation communities. Disturbance associated with vegetation clearing, vehicle traffic and general day to day operations of the Project increase the potential for the introduction and establishment of weed and pest species.

This Weed and Pest Management Strategy provides a framework for managing these species within the Project Boundary and BOAs. Specifically, this strategy aims to ensure that:

- weeds and pests are managed in accordance with relevant regulatory requirements and guidelines and the Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt 2017)
- the introduction and spread of weed and pest species are monitored and controlled as required.

control measures are undertaken by trained and experienced personnel, in consultation with relevant key stakeholders, including North West Local Land Services, Narrabri Shire Council and adjoining land managers.

B2 WEED MANAGEMENT

For the purposes of this strategy, a weed is defined as any plant species listed under the following:

- Priority Weed declarations under the *Biosecurity Act 2015* (Biosecurity Act) for the North West weed management region
- National Weeds Strategy – Weeds of National Significance (WoNS).
- National Weeds Strategy – National Environmental Alert List.

Seven weeds of concern listed on the above registers have been recorded within the Project Boundary and/or BOAs during past and ongoing surveys. These species are identified below in Table B2.1

Table B2.1 Weeds of concern identified within the Project Boundary and BOAs (September 2009 onwards)

FAMILY	SCIENTIFIC NAME	COMMON NAME	BIOSECURITY ACT DUTY	WONS	NATIONAL ENVIRONMENTAL ALERT LIST
Cactaceae	<i>Opuntia aurantiaca</i>	Tiger Pear	Prohibition on dealings Regional Recommended Measure	-	-
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear	Prohibition on dealings	-	-
Cactaceae	<i>Opuntia tomentosa</i>	Velvet Tree Pear	Prohibition on dealings	-	-
Oleaceae	<i>Olea europea var. cuspidata</i>	African Olive	-	-	-
Rosaceae	<i>Rosa rubiginosa</i>	Sweet Briar	Regional Recommended Measure	-	-
Rosaceae	<i>Rubus fruticosus</i>	Blackberry	Prohibition on dealings	Yes	-

FAMILY	SCIENTIFIC NAME	COMMON NAME	BIOSECURITY ACT DUTY	WONS	NATIONAL ENVIRONMENTAL ALERT LIST
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	Prohibition on dealings	Yes	-

Note:

Duty for priority weeds under the *Biosecurity Act 2015*:

General Biosecurity Duty (all priority weeds): All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Prohibition on dealings: Must not be imported into the State or sold

Regional Recommended Measure: Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.

Most of the weeds identified above occur within habitat restoration and corridor enhancement zones. Exceptions to this include Tiger Pear and Prickly Pear which occur across all management zones in low densities. Specific weed control measures for each BOA are included in the specific BOA Management Plans in the main OMP document and are reviewed on an annual basis based on observations and records of weed infestations collected as part of annual inspections, implementation of ongoing management activities and monitoring programs.

B2.1 STATUTORY REQUIREMENTS AND GUIDELINES

Legislation and information sources relevant to weed management within the Project boundary and BOAs are listed and summarised in Table B2.2.

Table B2.2 Legislative controls and information sources for weed management

LEGISLATION / INFORMATION SOURCE	NOTES	REFERENCE
NSW Biosecurity Act 2015	<p>The <i>Biosecurity Act 2015</i> came into effect on the 1 July 2017 repealing and replacing the <i>Noxious Weeds Act 1993</i>.</p> <p>Plants may be declared as 'priority weeds' under the Biosecurity Act 2015. These are species which typically have the potential to cause harm and spread within and to other areas.</p> <p>In NSW, the administration of priority weed control is the responsibility of the Minister for Primary Industries under the Act. The Act is implemented and enforced by the Local Control Authority for the area (Narrabri Shire Council for the North West region). The Act imposes obligations on occupiers of land to control priority weeds declared for their area.</p>	https://www.legislation.nsw.gov.au/#/view/act/2015/24
Pesticides Act 1999	This Act regulates and provides for the control and use of pesticides. Records should be kept of any pesticides used during the Project.	https://www.legislation.nsw.gov.au/#/view/act/1999/80
Pesticide Regulation 1999	This Regulation specifies training requirements for personnel handling and/or applying pesticides.	http://www.legislation.nsw.gov.au/sessionalview/sessional/sr/2009-417.pdf

LEGISLATION / INFORMATION SOURCE	NOTES	REFERENCE
Pesticide Permits and Registration	The use of herbicides during weed control will require registration permits which can be obtained online from the Australian Pesticides and Veterinarian Medicines Authority (APVMA) website. Weed control must only be undertaken with herbicides registered for treatment of each specific weed, and in accordance with manufacturer's directions.	https://apvma.gov.au/node/1060
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report	Regional strategy which provides a framework for the development, implementation and management of biodiversity offset programs resulting from mining within the Leard Forest region. Specifically, the strategy details objectives, management actions as well as performance and completion criteria for the management of weeds and pests in offset properties within the region.	https://www.idemitsu.com.au/wp-content/uploads/2016/02/Leard-Forest-Biodiversity-Strategy-Stage-2.pdf
Narrabri Shire Council Weed Management Plans	The Narrabri Shire Council has developed management plans for 18 noxious weed species (including Blackberry, Blue Heliotrope, Hemlock and Prickly Pear).	http://narrabri.cfm.predelegation.com/index.cfm?page_id=1195
North West Regional Strategic Weed Management Plan 2017 - 2022	This weed management plan was developed in response to the legislative reform to provide a strategic plan for the management of weeds within the North West region.	http://www.narrabri.nsw.gov.au/biosecurity-weeds-1114.html
Noxious and environmental weed control handbook – a guide to weed control in non-crop aquatic and bushland situations (6th Edition)	This guide provides an overview of best practise weed management methods for noxious and environmental weeds in non-crop, aquatic and bushland situations.	https://www.griffith.nsw.gov.au/cp_themes/default/page.asp?p=DOC-ONU-14-07-70
Actively managing for better ecological outcomes in Brigalow and Nandewar State Conservation Areas	This guide provides an overview of best practise guidelines for the active and adaptive management of cypress pine forests in the Brigalow and Nandewar State Conservation Areas.	http://www.nrc.nsw.gov.au/publications
Narrabri Shire Council website	This website contains information and links to the identification and control of weeds within the Narrabri Shire Council and North West region.	http://www.narrabri.nsw.gov.au/biosecurity-weeds-1114.html
The DPI NSW WeedWise website	This website provides an overview of weed management in NSW. The status of weeds and control information is updated regularly. The DPI has also produced a range of fact sheets for land management, including species specific profiles. These profiles detail species characteristics, threats and control measures which can be accessed through the NSW WeedWise website.	http://weeds.dpi.nsw.gov.au/

B2.2 MANAGEMENT ACTIONS

Priority weeds within the Project boundary and BOAs will aim to be controlled in accordance with the requirements of the *Biosecurity Act 2015*. The implementation of the Monitoring, Inspection and Reporting Program (refer Appendix A) and specific BOA measures (main OMP document) will reduce the potential for weed introduction and spread and allow ongoing monitoring and control.

The introduction and spread of weed species will be minimised within the Project boundary by complying with the Clearing and Fauna Management Procedure during clearing activities, restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings.

B2.3 CONTROL METHODS FOR NOXIOUS AND PRIORITY WEEDS

Detailed methods and chemical application rates for the control of noxious weeds (now referred to as ‘priority weeds’ under the Biosecurity Act) are provided in specific weed management plans prepared by Narrabri Shire Council or contained in the *Noxious and Environmental Weed Control Handbook* (Ensby & Johnson 2009) and *Noxious and environmental weed control handbook – a guide to weed control in non-crop aquatic and bushland situations (6th Edition)* (Natural Resources Commission 2014).

B2.4 HERBICIDE USE PROTOCOL

Safety directions, first aid, storage and disposal, protection of non-targeted plants, protection of wildlife, fish, crustacea and the environment shall be as described by the manufacturer and detailed on the product label and Safety Data Sheet (SDS). Personnel or contractors using herbicides must carry the product label and SDS for all herbicides and related chemicals carried (including herbicide dyes and wetting agents). Personnel using herbicides will be adequately trained.

Chemical treatment is to be carried out with regard to the following matters:

- the use of herbicide is generally the most efficient means of controlling weeds on site, however other appropriate techniques of weed control will not be discounted (i.e. hand pulling seedlings in proximity to native plants)
- the use of herbicides will be undertaken in consideration of impacts to adjoining properties and where required in consultation with adjoining landholders
- non-residual herbicides will be used in preference to residual herbicides unless these are required and appropriate control measures are assessed
- herbicides will not be sprayed over any open water unless appropriate control measures have been assessed
- chemical use will be undertaken in accordance with product label and SDS requirements
- different herbicides will not be mixed or used contrary to the uses prescribed on the product label
- chemicals will be stored, transported or used in accordance with relevant label information and Australian Standards so as to ensure compliance with Environment Protection Legislation
- disposal of empty chemical containers will comply with label, SDS, and local government requirements
- herbicide will be applied carefully to avoid damage to non-target species, if native species are growing close to target weed species they will be shielded from spray damage
- foliar spraying will not be undertaken during or preceding unsuitable weather conditions such as rain or wind that may cause spray drift

- following the use of pesticides, the Pesticide Application Record Sheet will be completed and provided to the Environment Superintendent (Table B2.3).

Table B2.3 Pesticide application record sheet

PESTICIDE USE INFORMATION	
Date and time:	
Personnel applying pesticide:	
Treatment area coordinates	Easting: Northing: Datum:
Treatment area description:	
Target weed species:	
Equipment used:	
Chemical name, concentration and rate:	
Area covered by application:	
Wind speed and direction:	
Other weather details:	
Other notes:	

B3 PEST MANAGEMENT

Site inspections completed within each BOA indicated that evidence of pest infestations throughout the properties is relatively minor. Pest species previously identified within the BOAs include Common Starling, Fox, Brown Hare, Rabbit, Cat, Pig, Camel and Goats.

B3.1 STATUTORY REQUIREMENTS AND GUIDELINES

Legislation and information sources relevant to pest management within the Project Boundary and BOAs are listed and summarised in Table B3.4.

Table B3.4 Legislative controls and information sources for pest management

LEGISLATION / INFORMATION SOURCE	NOTE	REFERENCE
Biosecurity Act 2015	The <i>Biosecurity Act 2015</i> replaces the <i>Rural Lands Protection Act 1998</i> and Section 210 (a) of the <i>Local Land Services Act 2013</i> . Under the Act landholders are obligated to control feral pest species. The North West Branch of the Local Land Services are charged with enforcing the controls. The Project Boundary and BOAs are located within the Northern Plains regional pest management area.	https://www.legislation.nsw.gov.au/#/view/act/2015/24
NSW Threat Abatement Plan for Predation by the Red Fox	This plan establishes priorities for fox control for the conservation of biodiversity across NSW. The plan is coordinated by OEH. In particular, the plan identifies which threatened species are most likely to be impacted by fox predation and the sites at which these impacts are predicted to be most critical.	http://www.environment.nsw.gov.au/resources/pestsweeds/110791FoxTAP2010.pdf
Pesticides Act 1999	This Act regulates and provides for the control and use of pesticides. Pesticide Control Orders are required for the use of certain pesticides (e.g. 1080 fox bait).	https://www.legislation.nsw.gov.au/#/view/act/1999/80
Pesticide Regulation 1999	Specifies the training requirements for personnel handling and/or applying pesticides.	http://www.legislation.nsw.gov.au/sessionalview/sessional/sr/2009-417.pdf
DPI NSW Codes of Practices and Standard Operating Procedures	A model Code of Practices and Standard Operating Procedures for the humane control of key vertebrate pest species.	http://www.pestsmart.org.au/animal-welfare/humane-codes/
Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report	Regional strategy which provides a framework for the development, implementation and management of biodiversity offset programs resulting from mining within the Leard Forest region. Specifically, the strategy details objectives, management actions as well as performance and completion criteria for the management of weeds and pests in offset properties within the region.	https://www.idemitsu.com.au/wp-content/uploads/2016/02/Leard-Forest-Biodiversity-Strategy-Stage-2.pdf

LEGISLATION / INFORMATION SOURCE	NOTE	REFERENCE
Regional Pest Management Strategy 2012 – 17 Northern Plains Region	This strategy provides an overview of the targeted pest species, programs and controls within the Northern Plains pest management region.	http://www.environment.nsw.gov.au/resources/pestsweeds/20120376nprpms.pdf
FeralScan	This website is a free resource for landholders and the community to record and map feral pest species activity and control. The site is separated by pest species and can be viewed online or as a phone application.	https://www.feralscan.org.au/
Vertebrate Pesticide Manual 2018	This manual provides information and guidance on vertebrate pest control procedures in NSW in addition to those specified in the Pesticide Control Orders issued under the <i>Pesticides Act 1999</i> .	https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/713879/Vertebrate-Pesticide-Manual-2018.pdf
Ecology and Management of Vertebrate Pests in NSW	This manual provides information on vertebrate pests and the most suitable and best practice approaches to managing pests in NSW.	https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/439200/Ecology-and-Management-of-Vertebrate-Pests-in-NSW-March-2018-web.pdf
Local Land Services – North West Branch	The North West LLS website contains media releases relating to pest management and contact details of local staff.	https://northwest.lls.nsw.gov.au/
DPI pest animals website	This website provides an overview of pest management in NSW. Information regarding pest species and their management is updated regularly. This website also contains links to pest species specific profiles which detail pest characteristics and controls.	https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/pest-animals-in-nsw
OEH pest animals website	Similarly to the DPI website, this website provides an overview of pest management in NSW.	http://www.environment.nsw.gov.au/pestsweeds/pestanimals.htm

B3.2 MANAGEMENT ACTIONS

Pest animals within the Project Boundary and BOAs will be identified and controlled as part of the Monitoring, Inspection and Reporting Program (refer Appendix A) and specific BOA measures detailed in the main BMP document. The potential for the introduction and spread of pest animals will be minimised by implementing the following measures within 1 year of the pest infestations being identified.

B3.3 CONTROL METHODS AND DECLARED PESTS

Pest control measures will be implemented to control any infestations in consultation with key stakeholders including the North West Local Land Services, Narrabri Shire Council and adjoining land managers. Control strategies may include the destruction of burrows, shooting, trapping and baiting.

Pest control actions will be undertaken with reference to Code of Practices and Standard Operating Procedures found at the above websites (refer to Table B3.4).

APPENDIX C

2015 BASELINE BOA MONITORING REPORT



IDEMITSU BOGGABRI COAL PTY LIMITED

Boggabri Coal Mine 2015 Biodiversity Offset Area Monitoring Report




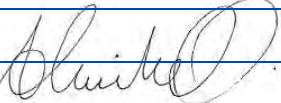
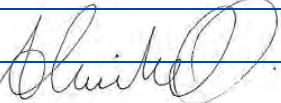
Boggabri Coal Mine 2015 Biodiversity Offset Area Monitoring Report

Idemitsu Boggabri Coal Pty Limited

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- Appendix C Flora data
- Appendix D Fauna data
- Appendix E Vegetation benchmark data
- Appendix F Replicate monitoring site photographs

GLOSSARY

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: <ul style="list-style-type: none"> → Genetic diversity — the variety of genes (or units of heredity) in any population → Species diversity — the variety of species → Ecosystem diversity — the variety of communities or ecosystems.
Biodiversity Offset Strategy	Continuation of Boggabri Coal Biodiversity Offset Strategy.
BOAs	Biodiversity Offset Areas
Boggabri Coal	Boggabri Coal Pty Limited
DoE	Department of the Environment formerly known as the Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC)
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Microbat	This report uses the term microbat (microchiropteran bats) to refer to small mostly insectivorous bats that use echolocation to navigate and find food.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include the Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
MNES	Matters of National Environmental Significance
Noxious weed	An introduced species listed under the Noxious Weeds Act 1993. Under the Act, noxious weeds have specific control measures and reporting requirements.
OEH	Office of the Environment and Heritage
The Project	Boggabri Coal Project
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as vulnerable, endangered or critically endangered (collectively referred to as threat-listed) under the EPBC Act, TSC Act or the FM Act.

1 INTRODUCTION

This report presents the findings of the first year of the biodiversity monitoring event completed on all ten of the Biodiversity Offset Areas (BOAs) associated with the Boggabri Coal Project (the Project). The BOAs are managed by Boggabri Coal Pty Limited (Boggabri Coal) in order to compensate for the impacts associated with the Project.

This monitoring event follows the 2012 and 2014 baseline monitoring surveys conducted by (Parsons Brinckerhoff 2014), which highlighted the baseline biodiversity values associated with the five BOAs outlined in the Biodiversity Offset Strategy (Parsons Brinckerhoff 2010). Since these monitoring sessions the Continuation of Boggabri Coal Biodiversity Offset Strategy (Biodiversity Offset Strategy) has outlined five distinct additional BOAs that create direct linkages or key stepping stones for a Regional East-West Wildlife Corridor (refer Figure 1.1). The ten BOAs contain large patches of remnant vegetation and high quality habitats adjoining existing vegetated lands.

The 2015 biodiversity offset monitoring event represents the first year of monitoring to encapsulate all ten BOAs that form part of the Project's Biodiversity Offset Strategy. Given that no habitat management or vegetation restoration works have been completed within any of the BOAs and that this represents the baseline monitoring session for five of the ten BOAs, the 2015 monitoring event has been treated as a baseline monitoring session for the ten Boggabri Coal's BOAs. This will provide a more ecologically and statistically robust ecological monitoring program leading into the future.

Each BOA has been divided into management zones as outlined in Table 1.1.

Table 1.1 Biodiversity offset areas and restoration zones

BIODIVERSITY OFFSET AREA	HABITAT MANAGEMENT ZONE (AREA ha)	HABITATION RESTORATION ZONE (AREA ha)	CORRIDOR ENHANCEMENT ZONE (AREA ha)	AGRICULTURAL LANDS (AREA ha)	TOTAL AREA (ha)
Existing BOAs					
Mallee	2025.9	40.3	0	0	2,066
Merriendi	329.4	211.7	0	5.8	547
Myall Plains	373.6	62.9	0	43.9	481
Namoi	2,301.9	1,766.9	21.0	230.4	4,229
Wirrilah	467.5	441.3	164.8	12.1	1,047
New BOAs					
Braefield	1,283.6	117.2	0	0	1,400.8
Nioka North	527.6	322.6	17.7	0	867.6
Sunshine North	356.6	360.0	12.4	0.0	738
Goonbri ¹	141.0	71.0	-	11.5	223.6
Jerralong ¹	324.0	245.4	-	0.6	570.0
Totals	8131	3639	216	304	12170

(1) Areas based on preliminary desktop assessment and regional vegetation mapping subject to field validation.

Specific management measures will be implemented for each management zone in order to achieve the overall objective of meeting an 'improve or maintain' outcome (as defined in the Native Vegetation Regulation 2005 and the Biobanking Assessment Methodology). The aim of monitoring biodiversity within the BOAs is to assess the outcomes of management measures employed by Boggabri Coal and to measure progress towards, and achievement of, the completion criteria outlined in the Biodiversity Offset Strategy.

The specific management measures and regulatory approvals are outlined below:

- Specific management measures will be implemented for each management zone in order to achieve the overall objective of meeting an 'improve or maintain' outcome (as defined in the *Native Vegetation Regulation 2005* and the *Biobanking Assessment Methodology* {Department of Environment and Climate Change, 2008 #7254}. The aim of monitoring biodiversity within the BOAs is to assess the outcomes of management measures employed by Boggabri Coal and to measure progress towards, and achievement of, the completion criteria outlined in the Biodiversity Offset Strategy.
- Furthermore, following the granting of approval for the Boggabri Coal Mine Extension (EPBC 2009/5256) on 11 February 2013 under Section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, several conditions were imposed by the (then) Minister for Sustainability, Environment, Water, Populations and Communities (SEWPaC), now known as the Department of the Environment (DoE). Conditions specifically relating to biodiversity surveys for Matters of National Environmental Significance (MNES) included:
 - 13(c): a detailed survey and description (prior to management activities, hence a baseline) of the current condition of the extant vegetation of each offset area, which must be consistent with the State and Transition Model. And surveys for the Regent Honeyeater, Swift Parrot and Greater Long-eared Bat.
 - 14: Baseline surveys (identified in the surveys required by condition 13(c)) must be conducted in accordance with the department's *Survey Guidelines for Australia's Threatened Birds and the Survey Guidelines for Australia's Threatened Bats* (Department of Environment Water Heritage and the Arts 2010a).

1.1 Background to monitoring and management

As part of the Project's approval Boggabri Coal are required to monitor the biodiversity values associated with the five BOAs outlined in the Biodiversity Offset Strategy. Specifically, they are required to monitor biodiversity within the BOAs to ensure that the biodiversity management measures employed by Boggabri Coal are progressively working towards and/or achieving the criteria outlined in the Biodiversity Offset Strategy.

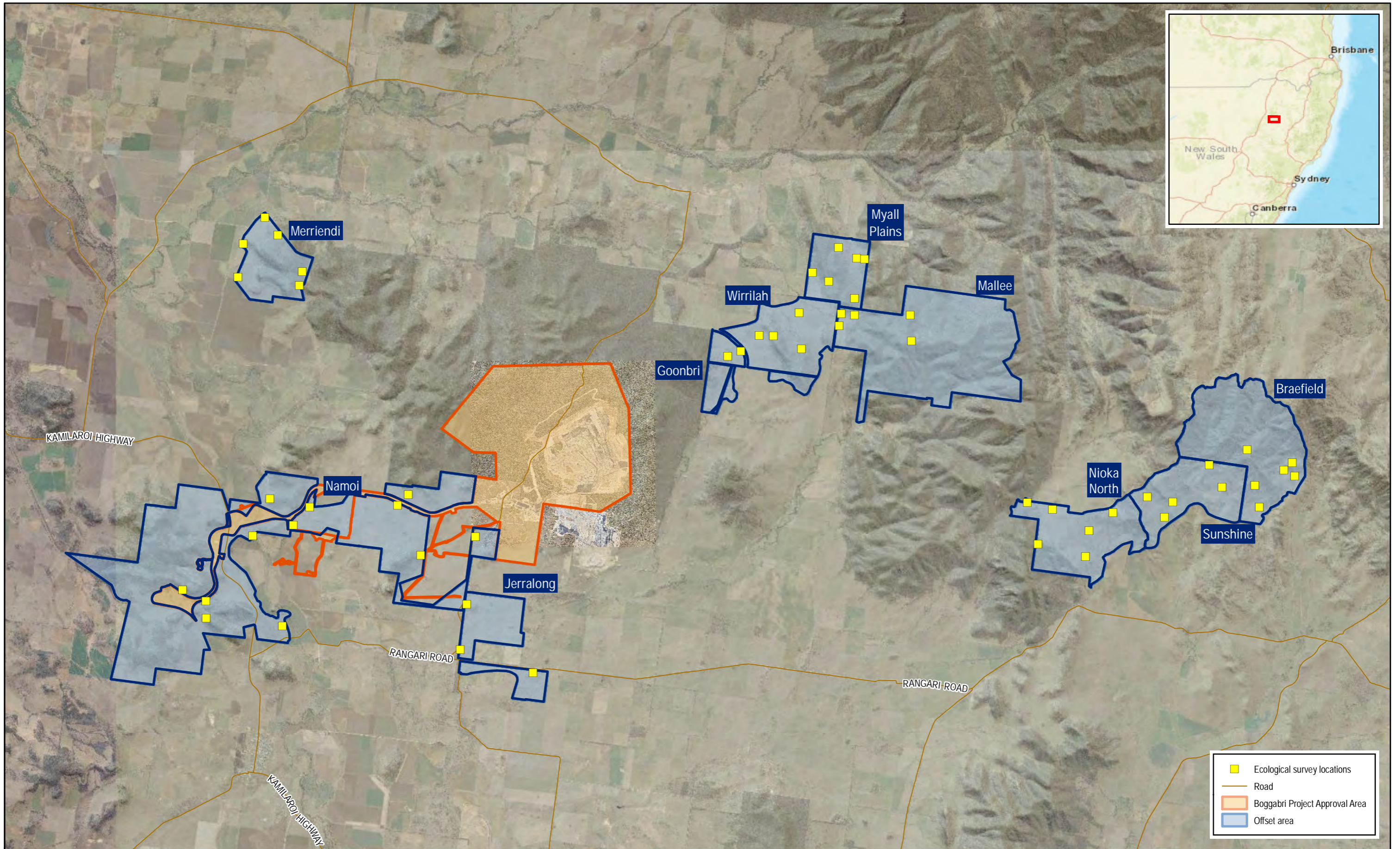
The baseline monitoring session for the five BOAs (Mallee, Merriendi, Myall Plains, Namoi and Wirrilah) was undertaken in 2012 and 2014 by (Parsons Brinckerhoff 2014). These baseline surveys involved the establishment of 39 monitoring sites across the five BOAs. The location of the 39 monitoring sites were selected to represent each vegetation community, condition class and management zone. It was anticipated that the results of this 2012 survey would provide the baseline biodiversity benchmark criteria for performance criteria of which successive monitoring sessions can be compared. 2015 represents the first year of biodiversity monitoring of all ten BOAs.

Since the 2012 and 2014 baseline monitoring events no habitat management or vegetation restoration works have been completed within any of the management zones or of the five BOAs.

1.2 Aims of this report

The aims of this report are outlined below:

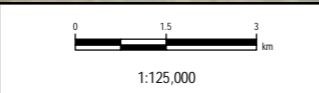
- Outline the baseline monitoring results for the 10 BOAs that form part of Boggabri Coal's Biodiversity Offset Strategy.
- Outline the results of targeted surveys for Regent Honeyeater, Swift Parrot and Greater Long-eared Bat.
- Provide baseline results of White Box – Yellow Box – Blakely's Red Gum grassy Woodland and Derived native Grassland Community against Plant Community Types and the State and Transition Model.
- Provide baseline biodiversity benchmarks as performance criteria of which successive monitoring sessions can be compared.
- Recommend potential mitigation or management actions that may be required based on the results of the 2015 baseline biodiversity offset monitoring results.



	Ecological survey locations
	Road
	Boggabri Project Approval Area
	Offset area

Map: 2267029A_GIS_F002_A1
 Date: 30/06/2016

Author: mitchellem
 Approved by: -



Data source: © Land and Property Information 2015
 Copyright © 2014 Esri

Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 1.1
 Locality plan

2 METHODOLOGY

This chapter details the field methods used in undertaking the baseline and first year of biodiversity monitoring at each BOA as well as methods for data analysis.

2.1 Contributors and qualifications

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2.1.

Table 2.1 Contributors and their roles

NAME	QUALIFICATION	ROLE
Troy Jennings	BBioCons	Ecologist – field surveys
Paul Shelley	N/A	Ecologist – field surveys
Allan Richardson	BSc (Hons)	Senior Ecologist – field surveys
Paul Rossington	BSc, MWildlifeMgt	Senior Ecologist – field surveys
Tanya Bangel	BSc (Hons 1), DipConsLdMgt	Ecologist – field surveys and reporting
Nathan Cooper	BEnvSc, Grad Dip Ornith	Senior Ecologist – project management, field surveys and reporting
Alex Cockerill	BSc (Hons)	Lead Ecologist - technical review

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974*, Animal Research Authority issued by the Department of Industries and Investment NSW (Agriculture).

2.2 Field survey

The first year of biodiversity monitoring of Boggabri Coal's BOAs was completed over one monitoring event. This monitoring event involved four Parsons Brinckerhoff Ecologists completing flora and vertebrate fauna surveys over 12 days and 11 nights between 12 October and 23 October 2014. This field survey encompassed the survey methodology outlined in Sections 2.2.2 to 2.2.11.

A summary of the monitoring sites for each BOA is provided in Appendix B.

2.2.1 Weather conditions

Weather conditions during the 2015 monitoring survey were typical of local weather conditions for October. Weather conditions were generally hot with maximum temperatures reaching between 24.6 and 34.0 °C with the occasional thunderstorm experienced on the 14 and 22 of October. Temperatures ranged between 10.3 °C and 34.0 °C. Rainfall was recorded on five days, 12, 14, 15, 22 and 23 October, with 0.4 mm, 6.4 mm, 0.2 mm, 17.6 mm and 3.0 mm recorded respectfully. Detailed weather conditions for the survey period sourced from the Gunnedah Airport AWS weather station (station 055024) (Bureau of Meteorology 2016) are provided in Appendix A.

2.2.2 Baseline monitoring and site selection

The baseline methodology adopted a 'Beyond BACI' style experimental design (Underwood 1992) to measure environmental change in response to various biodiversity management measures. This design utilises multiple control sites to account for natural spatial and temporal variability, with BACI referring to Before/After Control/Impact and the 'beyond' element relating to the use of multiple control sites instead of just one.

The use of a 'Beyond BACI' style experimental design allows for the quantification of changes to biological assemblages through time. The detection of change is measured as an interaction between spatial and temporal components of variation against a variable background. To determine baseline conditions sample and replicate sites were surveyed in each vegetation community and condition class (vegetation zone); including representation of each management zone. Following successive monitoring events, it is anticipated that sample sites in the habitat management zones and values within the BioBanking Vegetation Benchmarks Database (Office of Environment and Heritage 2014b) will be adopted as a benchmark for the performance criteria.

Importantly, the location of replicate monitoring sites and subsequent discussion of 2015 baseline monitoring results followed vegetation mapping and community descriptions for BOAs outlined in Boggabri Coal's Biodiversity Offset Strategy (Parsons Brinckerhoff 2010). An outcome of an audit of Boggabri Coal's BOAs was a modified vegetation community map; a corollary of which included some modification to the occurrence of Box Gum Woodland and respective state and transition models. Accordingly, discussion of vegetation attributes and the location and state of Box Gum Woodland is not necessarily reflected in the modified vegetation map.

2.2.2.1 MONITORING LOCATIONS

The location of each existing monitoring site is illustrated in Section 3 to Section 10 for each BOA. Within each vegetation zone, monitoring sites were placed randomly by marking points on satellite imagery. In the field, transects/plots were established at the predetermined locations or where necessary repositioned to achieve a representative sample of the vegetation. Due to safety and access restrictions, not all vegetation types were able to be sampled.

MONITORING OF EXISTING BOA PROPERTIES

Biodiversity monitoring of Boggabri Coal's BOAs began in 2012 within each of the five original BOAs (Mallee, Merriendi, Myall Plains, Namoi and Wirrilah). During the 2012 baseline monitoring surveys 39 monitoring sites were established across these BOAs using the methodology detailed below. During the 2014 monitoring session two of these monitoring sites were relocated as specified below:

- Namoi Site 15 – stake removed and relocated immediately adjacent within similar Yellow Box - Blakely's Red Gum grassy woodland.
- Wirrilah Site 2 – removed by Goonbri Road Upgrade and relocated immediately to adjacent paddock within similar grassland vegetation.

During the 2015 monitoring session a further three monitoring locations from the Namoi BOA were relocated into the new Jerralong BOA situated in proximity to the Boggabri – Manilla Road and Leard State Forest Road (Figure 4.1) including:

- Namoi Site 1
- Namoi Site 2
- Namoi Site 7.

MONITORING OF NEW BOA PROPERTIES

Five additional BOAs were introduced into Boggabri Coal's Biodiversity Offset Package in 2015 (Nioka North, Sunshine, Braefield, Jerralong and Goonbri). Subsequently, during the 2015 monitoring surveys 17 monitoring sites were established, including:

- Nioka North – six monitoring sites established
- Sunshine – five monitoring site established
- Braefield – six monitoring sites established
- In addition to these monitoring sites three sites from the Namoi property were moved into the Jerralong BOA.

2.2.3 Flora survey

The flora monitoring employed quantitative transect/ plot surveys as outlined in the methodology contained within BioBanking Assessment Methodology {Department of Environment and Climate Change, 2008 #7254}. Transects/plots were surveyed at each of the monitoring sites that represent each vegetation type and each management zone where practicable.

Table 2.2 Attributed measures in each transect/plot

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
Canopy	Species richness	20 x 20 m plot	A count of the total number of canopy species
	percentage canopy cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the canopy
	Number of trees with hollows	50 x 20 m plot	A count of the total number of living and dead trees with at least one hollow
	Regeneration	50 x 20 m plot	The proportion of canopy species regenerating (i.e. seedlings / saplings)
Midstorey	Species richness	20 x 20 m plot	A count of the total number of midstorey species
	percentage Midstorey cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the midstorey
Ground layer	Species richness	20 x 20 m plot	A count of the total number of ground cover species
	percentage native ground cover (grasses)	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	Records of whether native grass intersects defined points along the transect to derive percentage cover.
	percentage native ground cover (shrubs)		Records of whether native shrubs intersects defined points along the transect to derive percentage cover.
	percentage native ground cover (other)		Records of whether native other (forbs, ferns, etc.) intersects defined points along the transect to derive percentage cover.
	Coarse woody debris (fallen logs)	50 x 20 m plot	Total number and combined length of all sections of dead fallen timber ≥ 10 cm diameter, ≥ 0.5 m in length, and completely detached from living or dead standing trees
Weed species	Species richness	20 x 20 m plot	Total number of weed species
	percentage cover	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	An estimate of percent foliage cover for weed species in the canopy and midstorey Records of whether ground cover weeds intersect defined points along the transect to derive percentage cover.

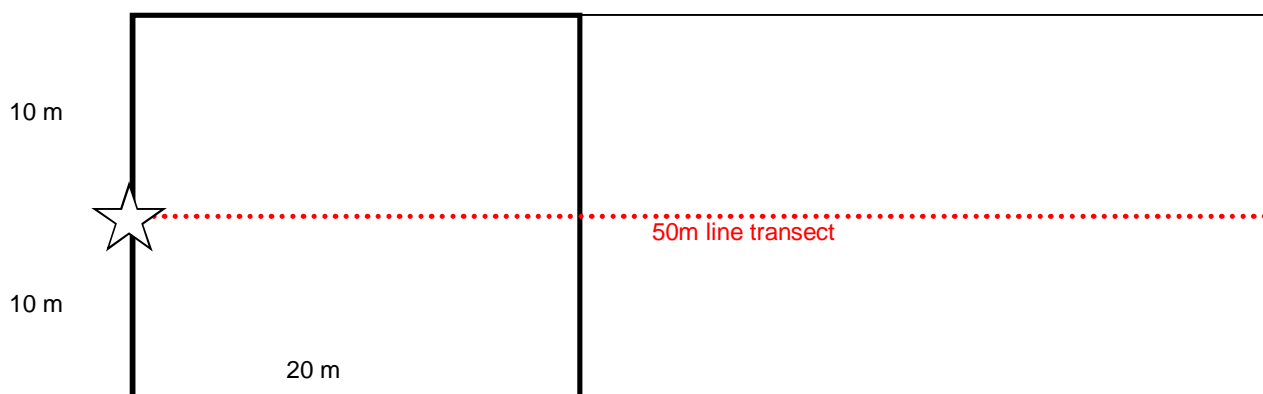


Figure 2.1 Transect/plot design

A key element of the monitoring within the BOAs was to determine the condition of White Box Woodland remnants in accordance with the State and Transition model for box gum grassy woodlands. The box gum woodland vegetation within the BOAs was delineated into States as follows:

- State 1: Grassy woodland
- State 2: Native pastures and woodland
- State 3: Fertilised pastures
- State 4: Crops and sown pastures
- State 5: Revegetated areas.

The State and Transition model was used during the monitoring of the BOAs to develop a baseline for box gum woodland patches to enable any transition from a state to be detected in the future after management actions have begun. The indicators outlined in Table 2.3 were used to determine the current state of the vegetation within the BOAs (for States 1–3) and will be used to determine any transition between states as monitoring progresses. The current states of box gum woodland within each BOA is mapped in Section 3 to Section 10 for each BOA.

Table 2.3 Indicator species to be used for states 1-3 within BOAs

VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Canopy	A range of ages, from mature trees with hollows to seedlings.	The dominant canopy species are present, with a good representation of tree ages (excludes derived grasslands).	Canopy species are still present in woodlands though there are few young trees and seedlings.
Shrubs	<p>Many of the leguminous (pod-bearing) shrubs are found only in State 1. Due to their high nutritional value, young plants are quickly grazed out in other states.</p> <p>Examples include Wattles (<i>Acacia</i> spp.), Indigos (<i>Indigofera</i> spp.), Common fringe-myrtle (<i>Calytrix tetragona</i>), Bush-peas (e.g. <i>Pultenaea</i> spp., <i>Daviesia</i> spp., <i>Dillwynia</i> spp.), and Cryptandras (<i>Cryptandra</i> spp.).</p>	<p>While many shrubs are still present in State 2, they are likely to be mostly the colonising species like Cassinias. Grazing-sensitive shrubs such as most of the wattles, the indigos and cryptandras are probably no longer present unless protected. Examples include some heaths, such as urn heath (<i>Melichrus urceolatus</i>) and peach heath (<i>Lissanthe strigosa</i>) persist where protected, and Grey Guinea-flower (<i>Hibbertia obtusifolia</i>).</p>	<p>Most shrubs in State 3 will be exotic. Native shrubs that persist in State 3 are those that are highly unpalatable due to thorns or other features.</p> <p>Examples include Blackthorn (<i>Bursaria spinosa</i>), and Cassinias, Chinese shrub, sifton bush, etc. (<i>Cassinia</i> spp.).</p>

VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Groundcover – forbs (wildflowers)	<p>Plants with tall, flowering stems which are sensitive to grazing may only be found in State 1 including many lilies, orchids and daisies.</p> <p>Examples include Native flax (<i>Linum marginale</i>), Donkey orchids (<i>Diuris spp.</i>) and sun orchids (<i>Thelymitra spp.</i>), and Yam daisy/murrnong (<i>Microseris lanceolata</i>).</p>	<p>Forbs are transitional in form, between the tall, fleshy plants found in State 1 and those of shorter stature that are often found in State 3. State 2 forbs will often have persistent root stock, tough, rough or hairy leaves, which makes them more resistant to grazing.</p> <p>Examples include Sedges (<i>Carex spp.</i>), Mat-rushes (<i>Lomandra spp.</i>), Early Nancy (<i>Wurmbea dioica</i>), Chocolate lilies (<i>Dichopogon spp.</i>), Common buttons (<i>Chrysocephalum apiculatum</i>), Native plantains (<i>Plantago spp.</i>), Common raspwort (<i>Gonocarpus tetragynus</i>).</p>	<p>In general, the groundcover in State 3 will have traits adapted to elevated nutrients, competition and grazing. These plants will be annuals (a), short-lived perennials (spp.), short-flowering (sf), rosette forming (r) or stoloniferous (st).</p> <p>Examples include Bluebells (<i>Wahlenbergia spp.</i>) (spp.), New Holland daisies (<i>Vittadinia spp.</i>), Austral sunray (<i>Triptilodiscus pygmaeus</i>) (a), Blue heron's-bill (<i>Erodium cicutarium</i>) (a), Austral bear's-ear (<i>Cymbonotus lawsonianus</i>) (r), Solenogynes (<i>Solenogyne spp.</i>)(r), Kidneyweed (<i>Dichondra repens</i>) (st).</p>
Groundcover — grasses	<p>Grasses that are typically sensitive to grazing will only persist in State 1.</p> <p>These include Kangaroo grass, Barbed-wire grass (<i>Cymbopogon refractus</i>), Wild sorghum (<i>Sorghum leiocladum</i>).</p>	<p>Many of the warm-season and highly grazing sensitive grasses found in State 1 are no longer present in State 2.</p> <p>Common State 2 grasses include Nine-awn grass (<i>Enneapogon nigricans</i>), Plume-grasses (<i>Dichelachne spp.</i>) and Common wheat-grass (<i>Elymus scaber</i>).</p>	<p>There are many native grasses that become more common with grazing. In State 3, these species will move towards co-dominance with the exotics that are present.</p> <p>Some examples include Weeping grass (<i>Microlaena stipoides</i>), Red grass (<i>Bothriochloa macra</i> or <i>B. decipiens</i>), Wallaby grasses (<i>Austrodanthonia spp.</i>), Purple wire-grass (<i>Aristida ramosa</i>).</p>
Exotic species	<p>Occasional woody weeds from seeds carried in bird droppings.</p>	<p>Shrubs including Blackberry (<i>Rubus fruticosus</i>), Briar rose (<i>Rosa rubiginosa</i>), and African box-thorn (<i>Lycium ferocissimum</i>).</p> <p>Groundcovers including Paterson's curse (<i>Echium plantagineum</i>), Capeweed (<i>Arctotheca calendula</i>), Fescues (<i>Vulpia spp.</i>), Bromes (<i>Bromus spp.</i>), Coolatai grass (<i>Hyparrhenia hirta</i>), African love-grass (<i>Eragrostis curvula</i>), and Thistles (various species).</p>	<p>Exotic species commonly found in State 3 are similar to those in State 2 but more abundant.</p>

2.2.4 Vertebrate survey

Baseline vertebrate fauna monitoring focused on microchiropteran bat surveys (Anabat recordings), diurnal bird surveys and remote sensing camera traps. Spotlighting and call playback for nocturnal birds and mammals was also completed, however they were typically completed at one replicate monitoring site in each BOA. This reduced effort for spotlighting and call playback was a result of time constraints, fatigue management and the remote access of some replicate monitoring sites. Each method employed is described in the following sections. Table 2.4 provides an overview of fauna survey methods used.

Table 2.4 Variables measured during fauna monitoring

SPECIES / GROUP	METHODS	EFFORT PER SITE	FREQUENCY	SEASON
Diurnal birds	Point bird census	20 minutes each for two mornings / afternoons per monitoring site	Annually	Spring-Summer
Nocturnal birds	Call playback	5 minutes of call broadcast, 10 minutes listening in habitat management zone per BOA	Annually	Spring-Summer
Microchiropteran bats	Ultrasonic call detection (Anabat)	2 consecutive nights of passive recording per monitoring site	Annually	Spring-Summer
Nocturnal Mammals	Spotlighting	20 min in habitat management zone per BOA	Bi-Annually	Spring-Summer

2.2.5 Diurnal bird surveys

Daytime area bird surveys were undertaken within 100 m of fixed monitoring sites, over a period of 20 minutes. Designated surveys were completed during periods of high bird activity, predominately early morning or late afternoon. Surveys were completed at each sample site twice on separate days by two experienced ecologists. Opportunistic records were collected within each BOA during the entire monitoring period.

2.2.6 Microchiropteran bat surveys

Passive Ultrasonic Anabat Bat detection (Anabat SD1 CF Bat Detector – Titley Electronics, Ballina) was used to record and identify the echolocation calls of microchiropteran foraging at each replicate monitoring site. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night over two consecutive nights.

2.2.7 Spotlighting

Spotlighting was completed at each sample site on foot by two Ecologists, targeting arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. At least one person hour of survey effort was completed in each BOA.

2.2.8 Call playback

Call playback was used to survey for the Barking Owl, Powerful Owl, Masked Owl, Squirrel Glider and Koala using the methods of Kavanagh and Debus (1994) and Debus (1995). Call playback surveys involved broadcasting recordings of the vocalisations of animals to elicit a response, either vocal or behavioural. At each call playback site an initial ten minute listening period was undertaken followed by a five minute call broadcast and then a five minute listening and spotlighting period. For each additional species the 2 x 5 minute periods were repeated. A final listening period of ten minutes was undertaken after call broadcasting was concluded. Calls were broadcast using a portable MP3 player and amplified through a megaphone. Call playback was completed in conjunction with spotlighting surveys by two Ecologists.

2.2.9 Remote Camera Traps

Remote motion sensing infra-red cameras were positioned at each replicate monitoring site at Merriendi, Namoi, Wirrilah, Myall Plains, Mallee, Nioka North, Sunshine and Braefield BOAs to gain an understanding of terrestrial mammals and vertebrate pests, to aid management strategies. Camera traps were set with chicken necks, and left out for three nights at each replicate monitoring site in each BOA.

2.2.10 Targeted Swift Parrot and Regent Honeyeater surveys

Blossom nomads, such as the Swift Parrot and Regent Honeyeater do not reside in discrete areas, because their home range encompasses all the resources they require to survive, which for these species includes large areas of NSW and adjacent States. Due to variations in the distribution of blossom from year to year their distribution may shift from the NSW western slopes to the coast or tablelands with different areas in each of these regions used as the blossoming interval of different tree species cycle.

Both the Regent Honeyeater and Swift Parrot are relatively cryptic species; with Swift Parrots blending all too easily into canopy foliage and Regent Honeyeaters characterised by relatively quiet dispositions and so not easily detectable for bird surveyors to pick up.

Therefore survey methodologies for these species, rely heavily on observing the distribution of blossom resources and other associated indicators, such as the occurrence of high nectarivorous bird density and diversity.

With the ecology of the birds and associated nectarivorous species in mind, surveys conducted within the BOA's concentrate on patches of tree species, which the birds are likely to use. During the winter period when Swift Parrots are present on the mainland, the key nectar producing tree species in the Boggabri area is White Box *Eucalyptus albens*.

Therefore surveys involve checking White Box patches throughout the BOAs for the presence of blossom and nectarivorous bird activity to determine the likelihood that Swift Parrots and Regent Honeyeaters might be present locally.

Where blossom and nectarivorous bird densities were elevated opportunistic surveys in combination with formal 20 minute surveys were conducted to detect the potential presence of Swift Parrots or Regent Honeyeaters.

2.2.11 Targeted Corben's Long-eared Bat surveys

Like other Long-eared Bat species Corban's Long-eared Bat (*Nyctophilus corbeni*) uses understorey strata for foraging and they roost in hollow-bearing trees.

Although many microchiropteran bat species are detectable through use of Anabat call detection methodologies, the vocal differences between *Nyctophilus* spp. are too subtle to reliably differentiate between the various species occurring in the locality of the BOAs. Therefore surveys for *N. corbeni* needed to be conducted with a methodology that enabled bats to be identified in the hand.

Harp traps are excellent for capture and release of microchiropteran bats and they are well suited to the capture of *Nyctophilus* spp. due to their propensity to use lower forest strata for their foraging habits.

Site selection for the setting of harp traps included a number of rationale, such as, targeting of those areas where *Nyctophilus* sp. had been previously detected during other monitoring programs, woodland habitats in areas where hollow-bearing trees provide potential roosting sites and where suitable flyways were detected in forest and woodland areas.

Harp traps were set at each location over a two consecutive night period.

Captured bats were identified to species level, sexed, measured and weighed. Bats were released immediately after processing if during dark conditions or held in a cool, dark and quiet location until release in the dark was possible. This included placing bats in sections of hollow trees out of the sun near the capture sites, so they could remain secure until their night activities resumed.

3 MERRIENDI BOA – BASELINE RESULTS

3.1 Introduction

The Merriendi property encompasses an area of 546.9 ha and is located approximately 8.3 km north-west of the Project. The Merriendi property forms the north-west corner of the Regional East-West Wildlife Corridor. The north east boundary of the property adjoins approximately 1.7 km the Leard State Conservation Area.

The vegetation and management zones within the Merriendi BOA are illustrated in Figure 3.1.

3.1.1 Flora

107 plant species were recorded within the Merriendi BOA during the 2015 monitoring session. Of these, 80 (75%) were native and 27 (25%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 22 species followed by Asteraceae with 21 species. No threatened plant species were recorded.

Of the 27 exotic species that were recorded in the Merriendi BOA, *Opuntia stricta* (Prickly Pear) is the only species of plant listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area (Table 3.1). No weed species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2015). Other highly invasive species that occurred abundantly within the Merriendi BOA included *Chondrilla juncea** (Skeleton Weed), *Carthamus lanatus** (Saffron Thistle), *Medicago polymorpha** (Burr Medic), *Vulpia myuros** (Rats Tail Fescue) and several *Trifolium* species* (Clover).

Table 3.1 Noxious weeds recorded within the Merriendi BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Prickly Pear	<i>Opuntia stricta</i>	4	No

No threatened flora species were recorded within the Merriendi BOA.

3.1.2 Fauna

Baseline monitoring recorded 92 species of animal within the Merriendi BOA, including 90 native species and two introduced species (Table 3.2 and Table D1.1 of Appendix D).

Table 3.2 Summary of terrestrial animal species identified in the Merriendi BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	82	2
Microbats	7	-
Reptiles	1	-
Total	90	2

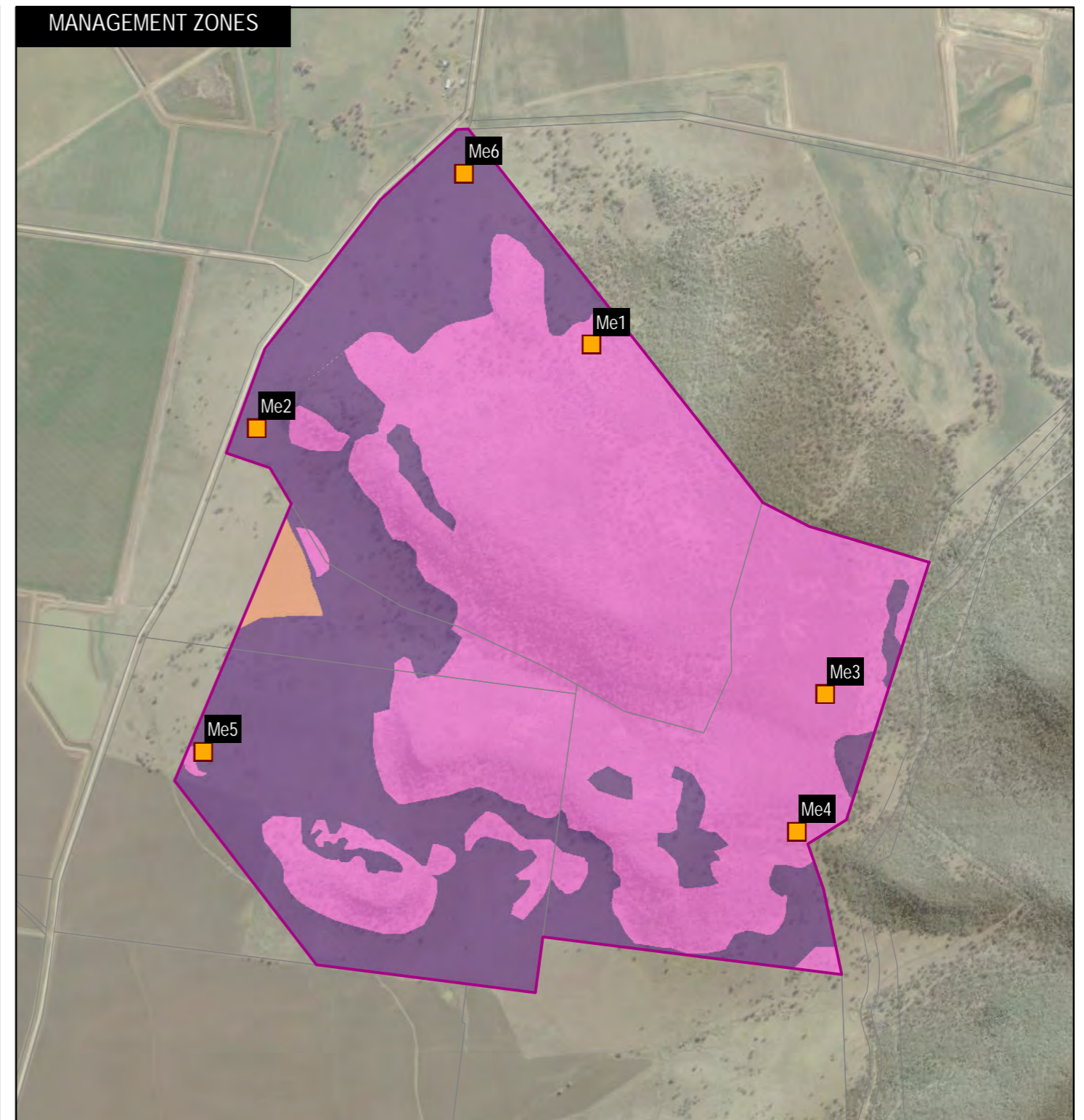
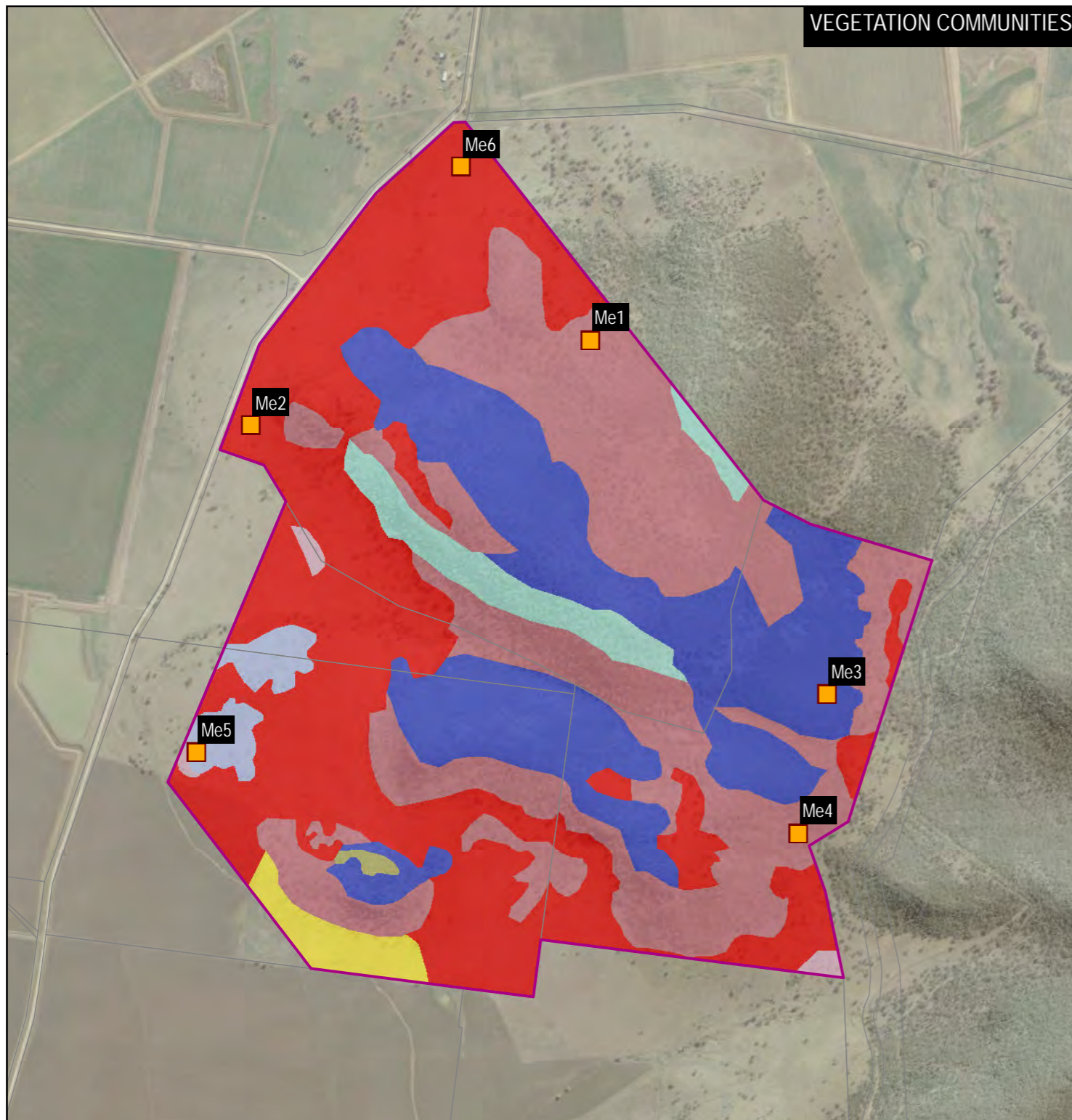
A total of eight threatened species were recorded within the Merriendi BOA during the 2015 baseline monitoring session (Table 3.3, Table D1.1 of Appendix D).

Table 3.3 Threatened species recorded in the Merriendi BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	-	V
Diamond Firetail	<i>Stagonopleura guttata</i>		V
Hooded Robin (South Eastern)	<i>Melanodryas cucullata</i>		V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis</i>	-	V
Masked Owl	<i>Tyto novaehollandiae</i>		V
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Vegetation community	Weeping Myall Woodland	Management zones
Offset boundary	Belah alluvial woodlands (Low condition)	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	Habitat management zone
	Dwyer's Red Gum woodland	White Box - White Cypress Pine grassy woodland (Low condition)	Habitat restoration zone
	Pilliga Box - Poplar Box-White cypress pine grassy open forest (Low condition)		Other land for agriculture zone
	Regrowth - White Cypress Pine (Low condition)		

Map: 2267029A_GIS_F001_A1
 Author: SuansriR
 Date: 6/06/2016
 Approved by: -

1:20,000
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 3.1
 Vegetation communities and management zones
 - Merriendi BOA

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3.2 Habitat management zones

3.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Merriendi BOA habitat management zones was highest at Site 1 and lowest at Site 3. Site 1 and Site 4 both exceeded the native species benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Site 3 did not however meet the native species richness benchmark value for the White Cypress Pine – Silver-leaved Ironbark – Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 3.4).

Native overstorey percentage cover within the Merriendi BOA habitat management zones was highest at Site 4 and lowest at Site 1. Site 4 was within the lower and upper native overstorey percentage cover benchmark values for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Both Site 1 and Site 3 however did not meet their associated vegetation type benchmark values (Table 3.4).

Native midstorey percentage cover within the Merriendi BOA habitat management zones was highest at Site 4 and lowest at Site 1 where native midstorey cover was absent. Site 1 and Site 3 were both within their lower and upper native midstorey percentage cover benchmark values for each of their associated vegetation types. Site 4 however exceeded the upper native midstorey percentage cover benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 3.4).

Native grass percentage cover within the Merriendi BOA habitat management zones was highest at Site 1 and lowest at Site 3. Both Site 3 and Site 4 fell within the lower and upper native grass percentage cover benchmark values for their associated vegetation types. Site 1 exceeded the upper benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 3.4).

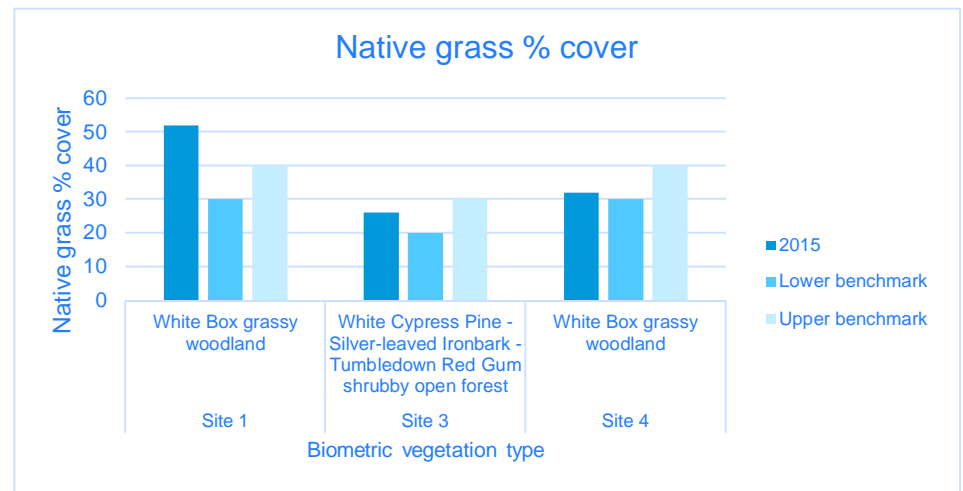
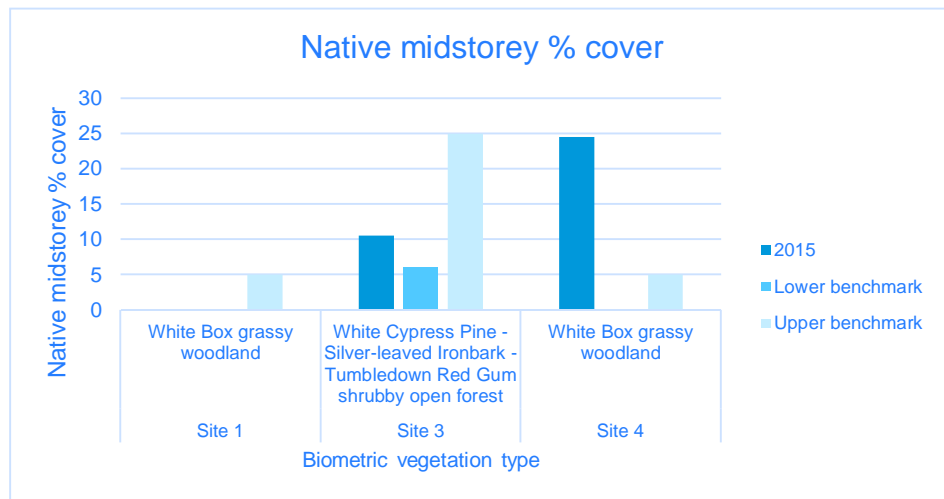
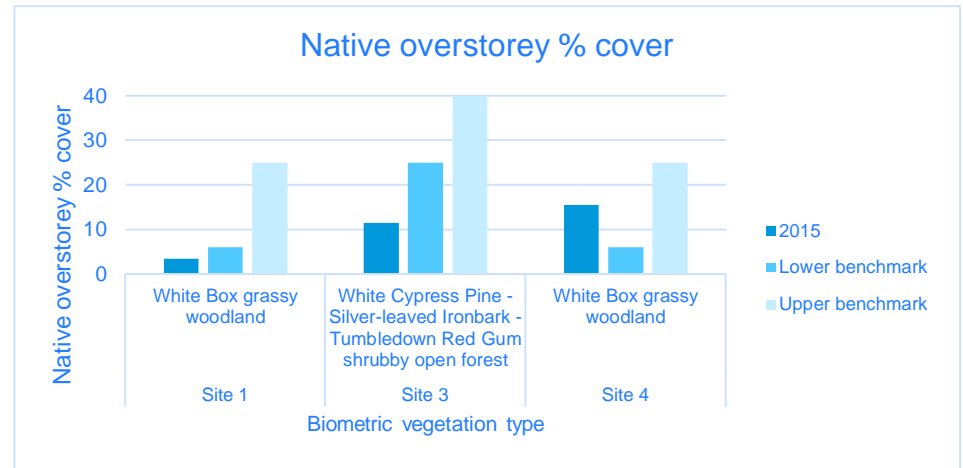
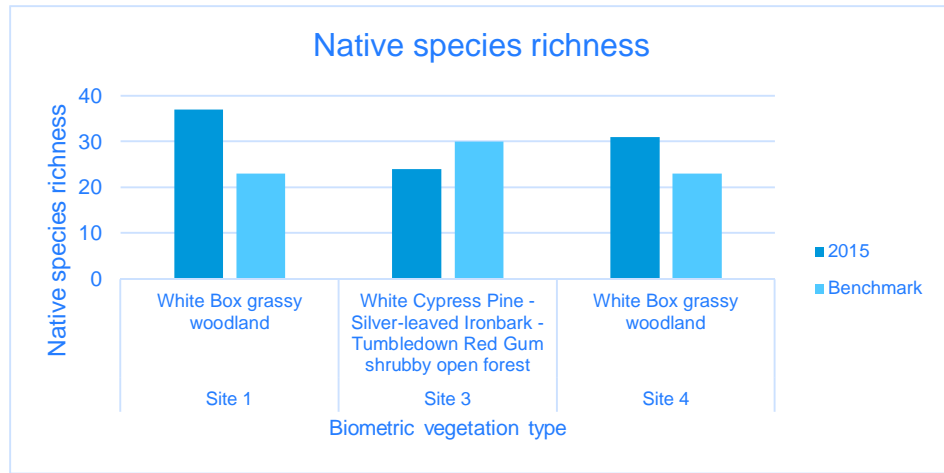
Native shrub percentage cover within the Merriendi BOA habitat management zones was highest at Site 3. Native shrub cover was absent from both Site 1 and Site 4 subsequently has the lowest percentage cover. All monitoring sites fell within the lower and upper native shrub percentage benchmark values for their associated vegetation types (Table 3.4).

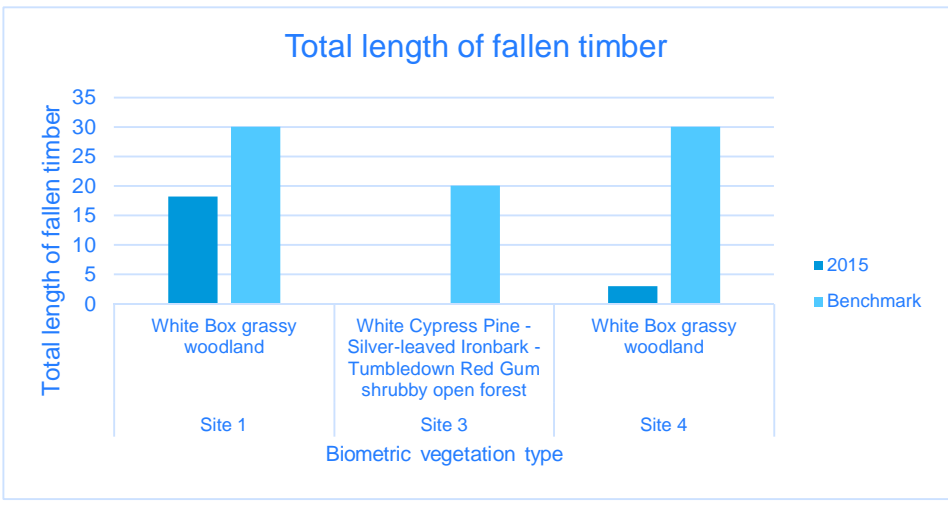
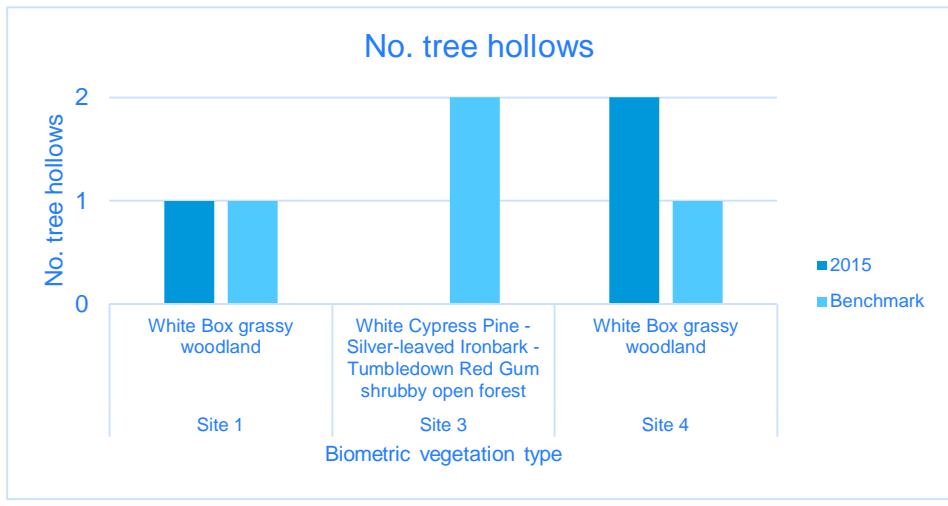
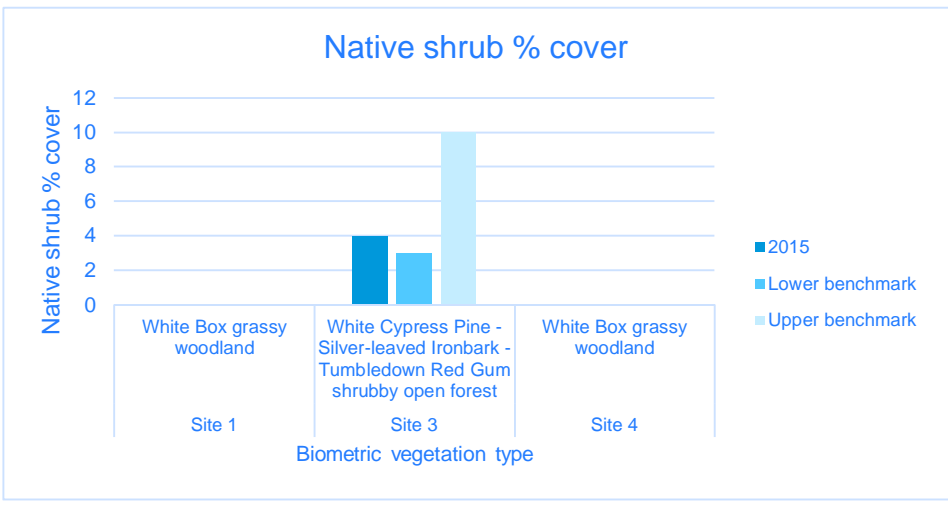
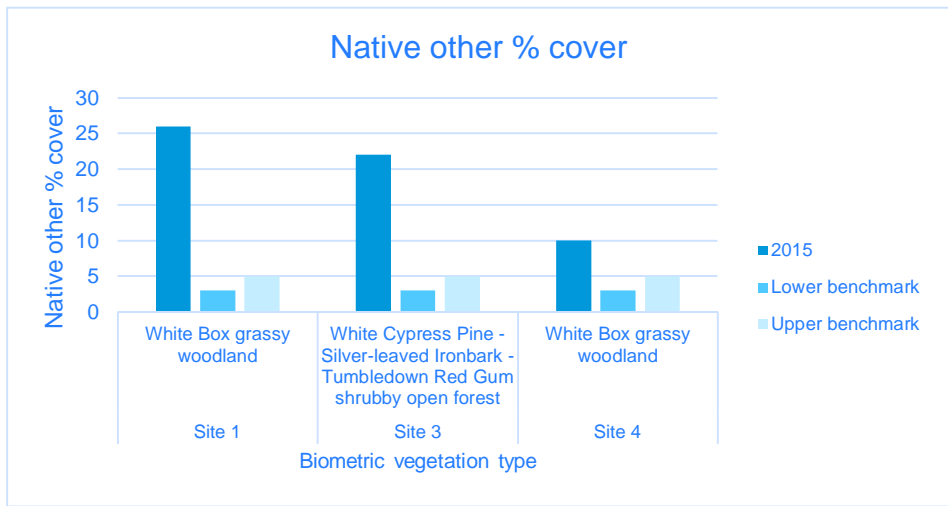
Native other percentage cover within the Merriendi BOA habitat management zones was highest at Site 1 and lowest at Site 4. All monitoring sites exceeded the upper native shrub percentage cover benchmarks for their associated vegetation types (Table 3.4).

The number of hollow bearing trees within the Merriendi BOA habitat management zones was highest at Site 4. Hollow bearing trees were however absent from Site 3 (Table 3.4). The absence of hollow bearing trees from Site 3 is thought to be attributed to previous storm damage and firewood collection of which evidence was observed whilst undertaking monitoring surveys. Both Site 1 and Site 4 met the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Due to the absence of hollow bearing trees Site 3 did not meet the benchmark value for the White Cypress Pine – Silver-leaved Ironbark – tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 3.4).

The total length of fallen timber within the Merriendi BOA habitat management zones was highest at Site 1 and lowest at Site 3 where no hollow bearing trees were recorded (Table 3.4). The absence of fallen timber from Site 3 is thought to be attributed to previous storm damage and firewood collection of which evidence was observed whilst undertaking monitoring surveys. None of the monitoring sites met the total length of fallen timber vegetation benchmarks for their associated vegetation types (Table 3.4). Evidence of firewood collection was observed at all three monitoring sites which is thought to be why the total length of fallen timber was low across all sites.

Table 3.4 Merriendi BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





3.2.2 Baseline fauna assemblage benchmarks

3.2.2.1 DIURNAL BIRDS

Diurnal bird species richness was high in habitat management zones with replicate monitoring site Me1 recording the highest average bird species richness at 21.5 birds recorded from duplicate surveys (Table 3.5). Replicate survey site Me3 and Me4 both recorded an average bird species richness of 19.5. Diurnal birds commonly encountered at replicate monitoring sites included, Apostlebird, Rufous Whistler, Striated Pardalote and Striped Honeyeater (Table D1.1 of Appendix D). Due to the presence of high quality woodland habitat, five threatened species of woodland bird, including Brown Treecreeper, Speckled Warbler, Diamond Firetail, Hooded Robin and Grey-crowned Babbler were recorded therein.

3.2.2.2 MICROCHIROPTERAN BATS

Six species of microbat were recorded from replicate monitoring site Me4, comprising species common to the north-west slopes and plains and two threatened species, Yellow-bellied Sheath-tail-bat and Eastern False Pipistrelle (Table D1.1 of Appendix D). A mean microbat species richness of five was recorded from monitoring site Me4 (Table 3.5). No data was collected from monitoring site Me1 and Me3 during passive Anabat surveys this monitoring session.

3.2.2.3 REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at replicate monitoring sites within habitat management zones of the Merriendi BOA. No native or introduced species of animal were recorded.

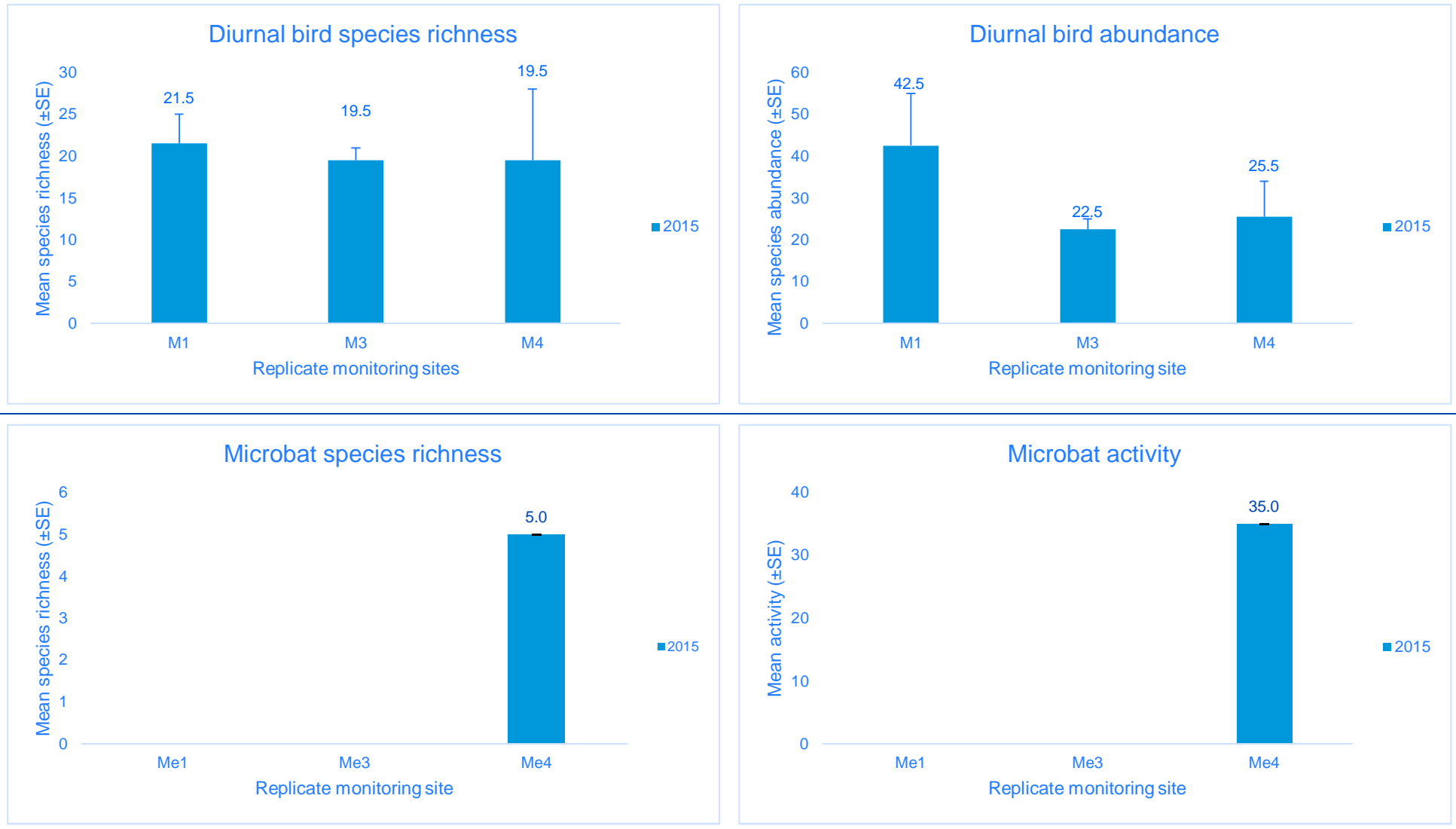
3.2.2.4 NOCTURNAL BIRDS

Nocturnal call playback and spotlighting was completed at replicate monitoring site Me1 and Me3. One threatened large forest owl, Masked Owl, was heard and observed at monitoring site Me3. Another three nocturnal birds were recorded during spotlight events, including Southern Boobook (Me1) and White-throated Nightjar and Australian Owlet Nightjar (Me3).

3.2.2.5 NOCTURNAL MAMMALS

Spotlighting was completed at replicate monitoring site Me1 and Me3. No nocturnal mammals were recorded therein.

Table 3.5 Merriendi BOA habitat management zone – 2015 baseline fauna monitoring



3.3 Habitat restoration zones

3.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Merriendi habitat restoration zones was highest at Site 2 and lowest at Site 5. Both Site 5 and Site 6 did not meet the native species richness benchmark values for their associated vegetation types. Site 2 did however exceed the benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 3.6).

Native overstorey cover was entirely absent from all monitoring sites within the Merriendi BOA habitat restoration zones. None of the monitoring sites met the lower or upper native overstorey percentage cover benchmarks for their associated vegetation types (Table 3.6). The void of native canopy cover is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

Native midstorey cover was absent from all monitoring sites within the Merriendi BOA habitat restoration zones. None of the monitoring sites met the lower or upper native midstorey percentage cover benchmarks for their associated vegetation types (Table 3.6). The void of native midstorey cover is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

Native grass percentage cover within the Merriendi BOA habitat restoration zones was highest at Site 5 closely followed by Site 6 and Site 2 respectively (Table 3.6). All monitoring sites exceeded the native grass cover benchmark values for their associated vegetation types (Table 3.6). This is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland and therefore have higher native grass percentage cover.

Native shrub cover was entirely absent from all monitoring sites within the Merriendi BOA habitat restoration areas. Although native shrub cover was entirely absent all monitoring sites were within the lower and upper benchmark values for their associated vegetation types (Table 3.6).

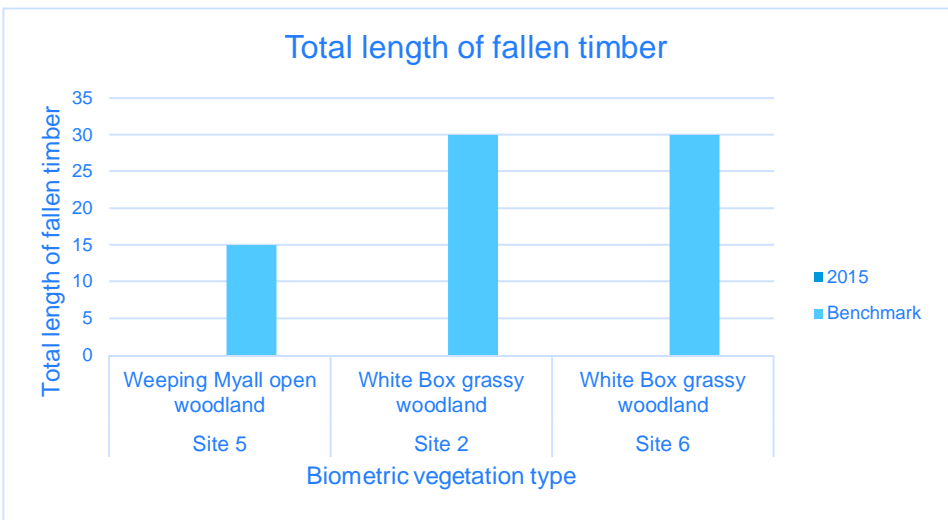
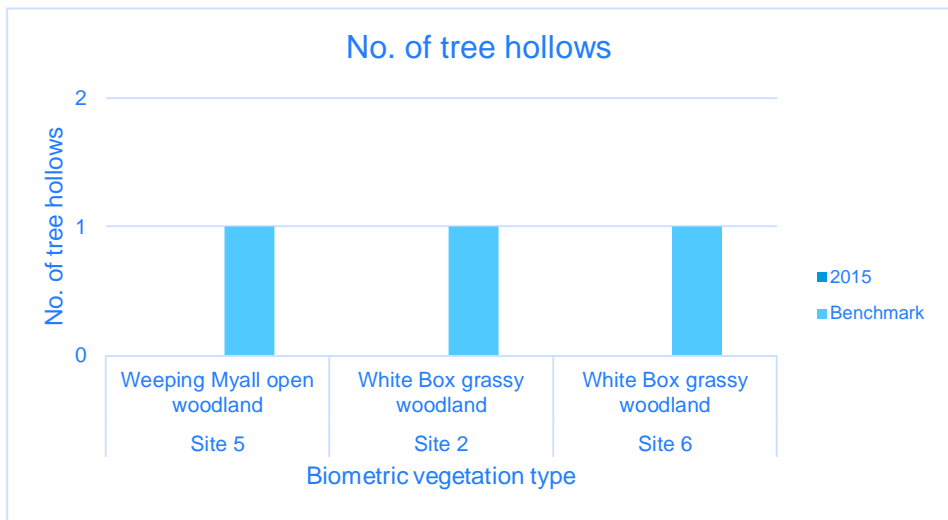
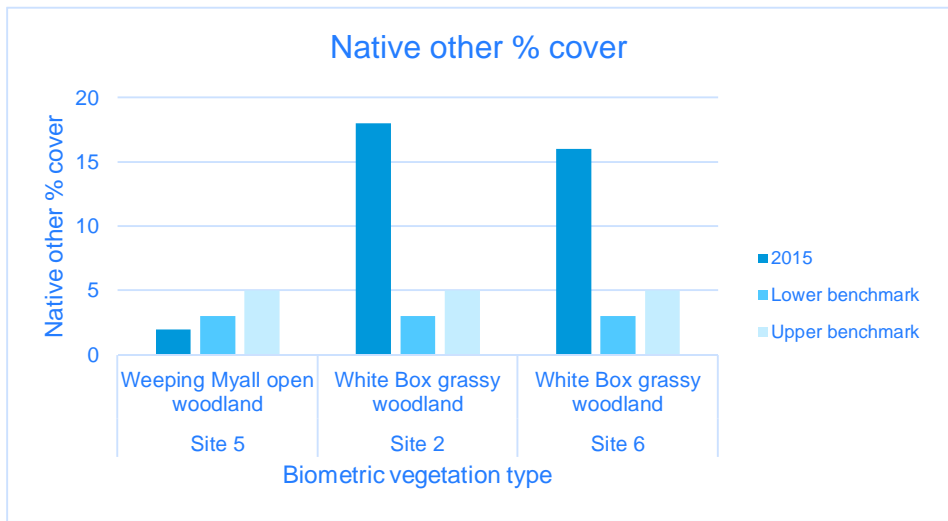
Native other percentage cover within the Merriendi BOA habitat restoration zones was highest at Site 2 and lowest at Site 5. Both Sites 2 and Site 6 exceeded the upper native other percentage cover benchmarks values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Site 5 however did not meet the lower benchmark value for the Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions vegetation type (Table 3.6).

No hollow bearing trees were recorded from within any of the Merriendi BOA habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the hollow bearing tree benchmark values for their associated vegetation types (Table 3.6). The absence of hollow bearing trees is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

No fallen timber was recorded within any of the Merriendi habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the hollow bearing tree benchmark values for their associated vegetation types (Table 3.6). The absence of fallen timber is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 3.6 Merriendi BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





3.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Replicate monitoring site Me6 recorded the highest mean diurnal bird species richness with an average of 17.5 birds, whilst sites Me5 and Me2 recorded an average of 17 and 10.5 birds respectively (Table 3.7). Diurnal birds commonly recorded at monitoring sites within habitat restoration zones included open country generalist species such as the Australian Magpie, Sulphur-crested Cockatoo, Little Corella and Galah (Table D1.1 of Appendix D). One threatened species of bird, Grey-crowned Babbler, was recorded from monitoring site Me5.

MICROCHIROPTERAN BATS

Two species of microbat, Gould's Wattled Bat and Chocolate Wattled Bat, were recorded from replicate monitoring site Me2 and Me5 (Table D1.1 of Appendix D). A mean microbat species richness of 0.5 was recorded from monitoring site Me2 and Me5 (Table 3.7). No data was collected from monitoring site Me6 during passive Anabat surveys this monitoring session.

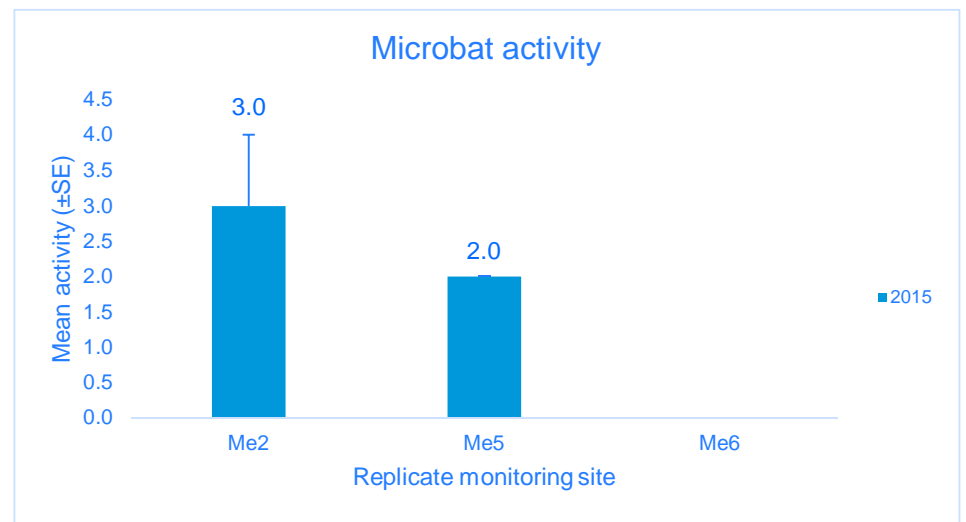
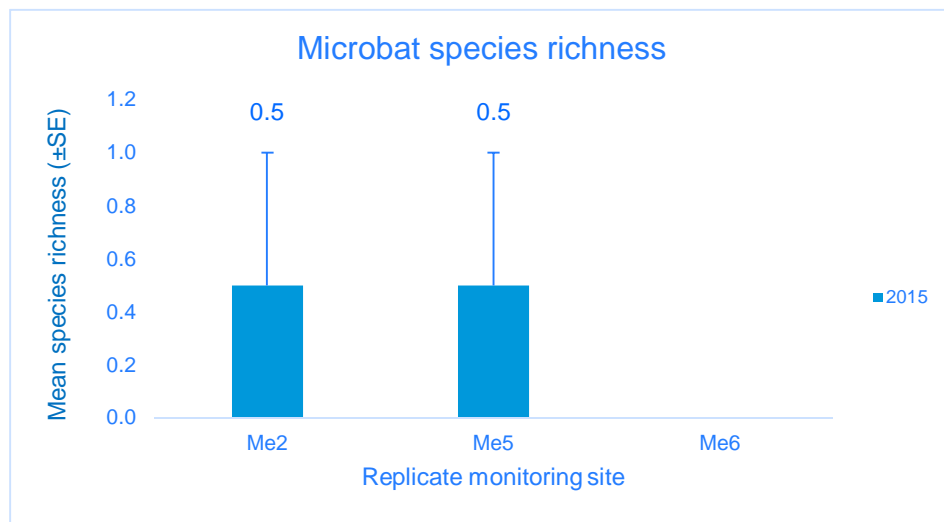
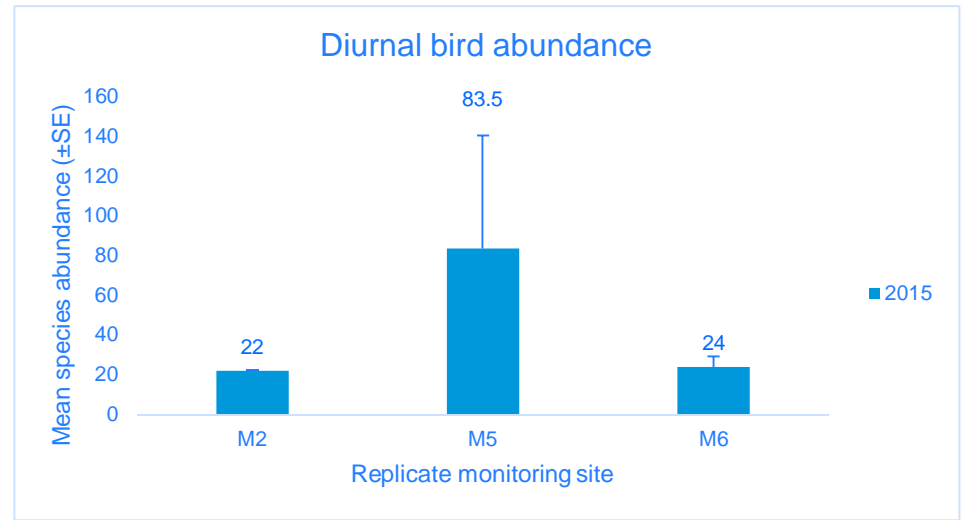
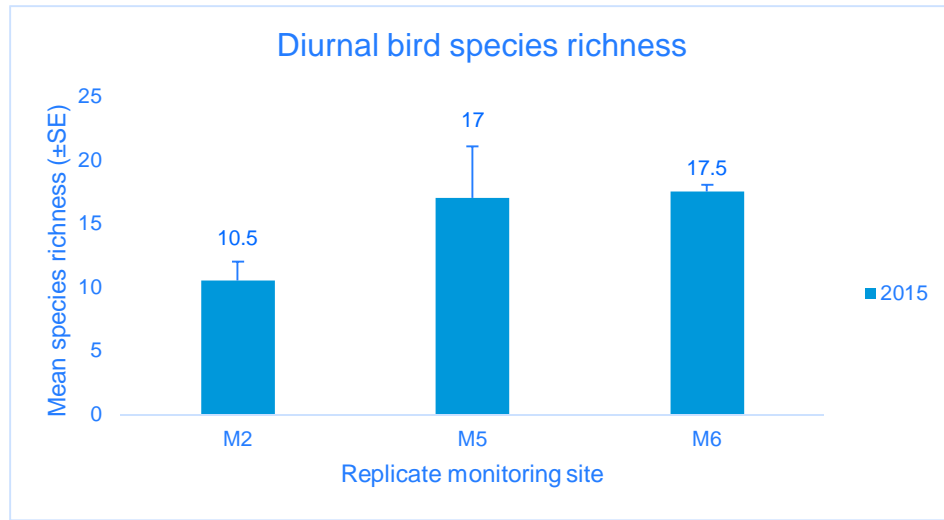
REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at each replicate monitoring location within habitat restoration zones of the Merriendi BOA. Native species recorded included; Swamp Wallaby, Common Wallaroo, Eastern Grey Kangaroo, and Apostlebird. One threatened species, Grey-crowned Babbler, was recorded via remote camera trap at monitoring site Me5 (Photo 3.1). Introduced species recorded included Fox and Hare.



Photo 3.1 Grey-crowned Babbler captured via remote camera at replicate monitoring site Me5

Table 3.7 Merriendi BOA habitat restoration zone – 2015 baseline fauna monitoring



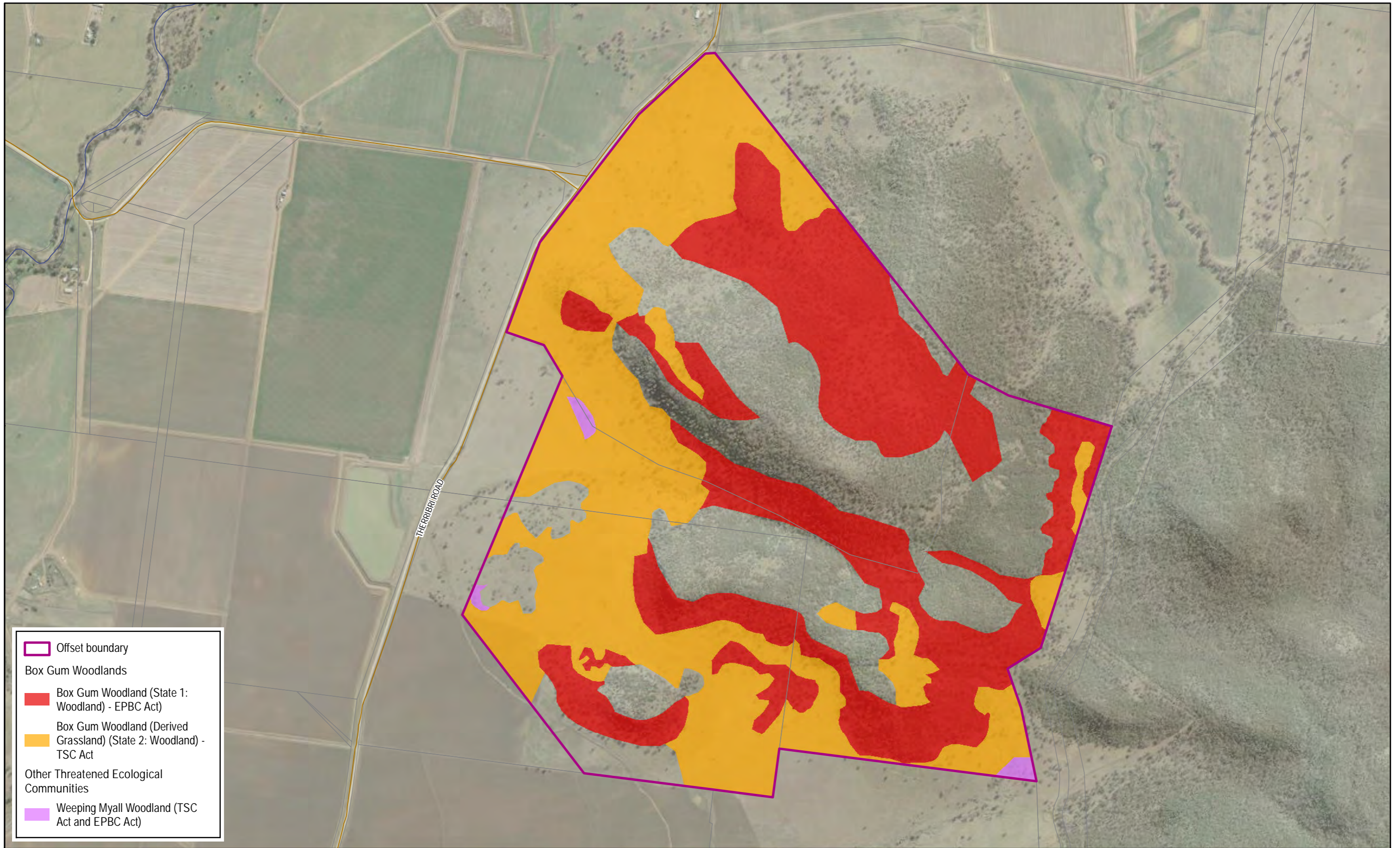
3.4 State of Box Gum Woodland

The Merriendi BOA contains approximately 372.3 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Merriendi BOA on lower slopes and flatter land (Figure 3.2).

Within the Merriendi BOA the Box Gum Woodland occurs in two states:

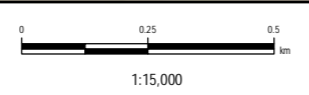
- Box Gum Woodland – State 1: Woodland – occupies approximately 177.4 ha.
- Box Gum Woodland – State 2: Native Pastures (derived native grassland) – occupies approximately 194.9 ha.

Four monitoring sites within the Merriendi BOA (two within habitat management zone and two within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 3.8.



	Offset boundary
Box Gum Woodlands	
	Box Gum Woodland (State 1: Woodland) - EPBC Act
	Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act
Other Threatened Ecological Communities	
	Weeping Myall Woodland (TSC Act and EPBC Act)

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -



Data source: © Land and Property Information 2015
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Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



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Figure 3.2
 Box Gum Woodland within Merriendi BOA

Table 3.8 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Merriendi BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage			
Habitat management zones									
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1	X 2.5 below	✓		✓		✓	Box Gum Woodland - State 2 (Woodland). Native over storey PFC is below benchmark value. All remaining vegetation attributes are within or above the benchmark values. Dominant canopy (including hollows and regeneration), shrub and groundcover species present however exotic species are also in low numbers (6). Evidence of past agricultural and present feral herbivore (rabbits) grazing was observed on site.	
	4	✓		✓	✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributed within or above benchmark values. Dominant canopy (including hollows and regeneration), shrub and groundcover species present however exotic species are also (11). Evidence of past firewood collection and current feral herbivore (goats) grazing was observed on site.	

		VEGETATION ATTRIBUTES						BOX GUM WOODLAND STATE & GRAZING PRESSURES
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	2	X 6 below	✓		✓		✓	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native PFC is below benchmark value. All remaining vegetation attributes are within or above the benchmark values. Canopy and shrub stratum absent (no hollows or regeneration). Native groundcover species present however exotic species are also (19) and evidence of past agricultural grazing pressures still evident.
	6	X 6 below	✓		✓		X 7 below	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native PFC and native species richness are below benchmark value. All remaining vegetation attributes are within or above the benchmark values. Canopy and shrub stratum absent (no hollows or regeneration). Native groundcover species present however exotic species are also in high numbers (14). Evidence of past agricultural grazing pressures still evident.

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

4 NAMOI BOA – BASELINE RESULTS

4.1 Introduction

The Namoi River Floodplain property (Namoi property) encompasses an area of 4,320.2 ha, with the eastern extent of the property located approximately 1.9 km from the Project. The Namoi property forms the south-west area of the Regional East-West Wildlife Corridor, linking the Namoi River Floodplain with Leard State Forest. The property supports significant areas of floodplain vegetation including numerous natural soaks and approximately 7 km of the Namoi River. The western portion of the Namoi property contains significant areas of grassy and shrubby woodland with relatively few disturbances.

The vegetation and management zones within the Namoi BOA are illustrated in Figure 4.1.

4.1.1 Flora

164 plant species were recorded within the Namoi BOA during the 2015 monitoring session. Of these, 121 (74%) were native and 43 (26%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 36 species followed by Asteraceae with 27 species and Fabaceae with 17 species. No threatened plant species were recorded.

Of the 43 exotic species that were recorded in the Namoi BOA, three species of plant are listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area (Table 4.1). Of these one species (African Boxthorn) is also listed as Weed of National Significance (Australian Weeds Committee 2015).

Other highly invasive species that occurred abundantly within the Namoi BOA included thistles such as *Carthamus lanatus* (Saffron Thistle), *Centaurea melitensis* (Cockspur Thistle), *Centaureum tenuiflorum* as well as other herbaceous and grass weeds which included *Lolium perenne** (Perennial Ryegrass), *Medicago polymorpha** (Burr Medic), *Hedypnois rhagadioloides** (Cretan Weed), *Vulpia myuros** (Rats Tail Fescue), *Lepidium africanum** (Common Peppergrass), *Echium plantagineum** (Paterson's Curse) and several *Trifolium* species* (Clover).

Table 4.1 Noxious weeds recorded within the Namoi BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Prickly Pear	<i>Opuntia stricta</i>	4	No
African boxthorn	<i>Lycium ferocissimum</i>	4	Yes
Lippia or Fog-Fruit	<i>Phyla canescens</i>	4	No

No threatened flora species were recorded within the Namoi BOA.

4.1.2 Fauna

Baseline monitoring recorded 117 species of animal within the Namoi BOA, including 114 native species and three introduced species (Table 4.2 and Table D2.1 of Appendix D).

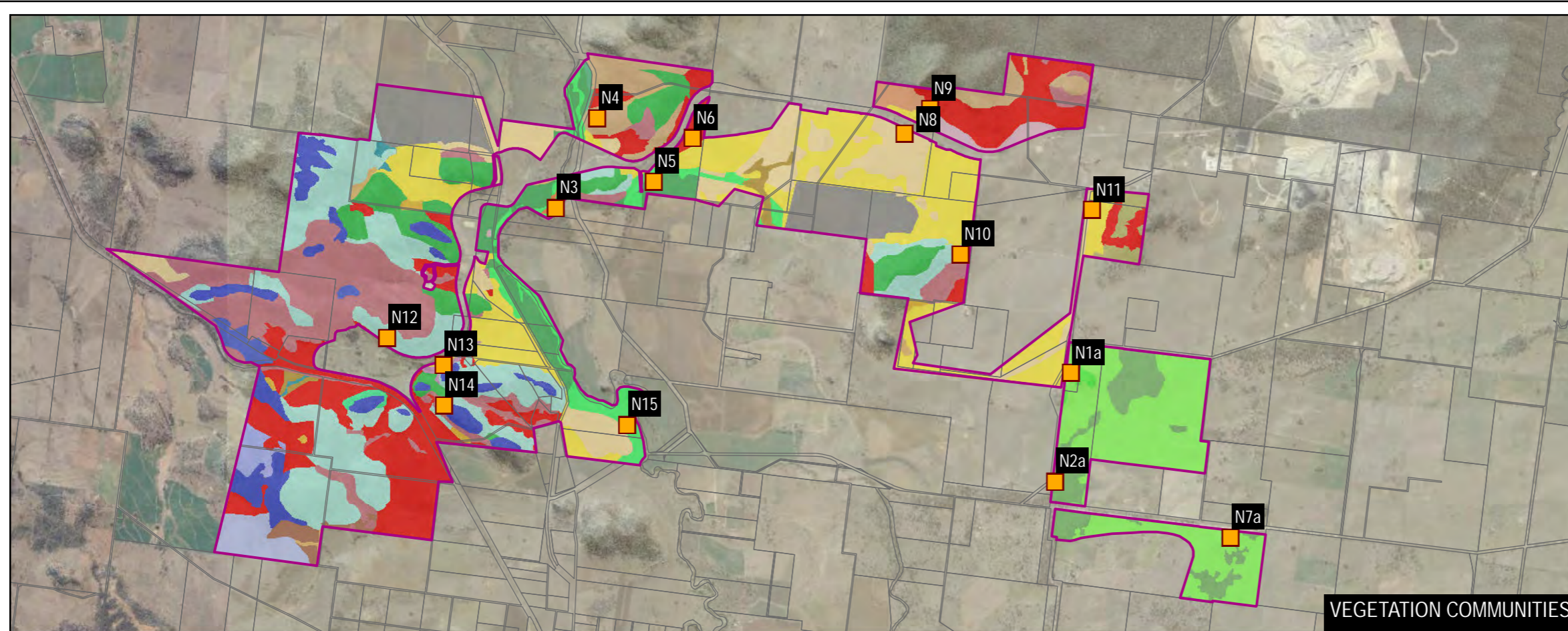
Table 4.2 Summary of terrestrial animal species identified in the Namoi BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	101	3
Microbats	11	-
Frogs	2	-
Total	114	3

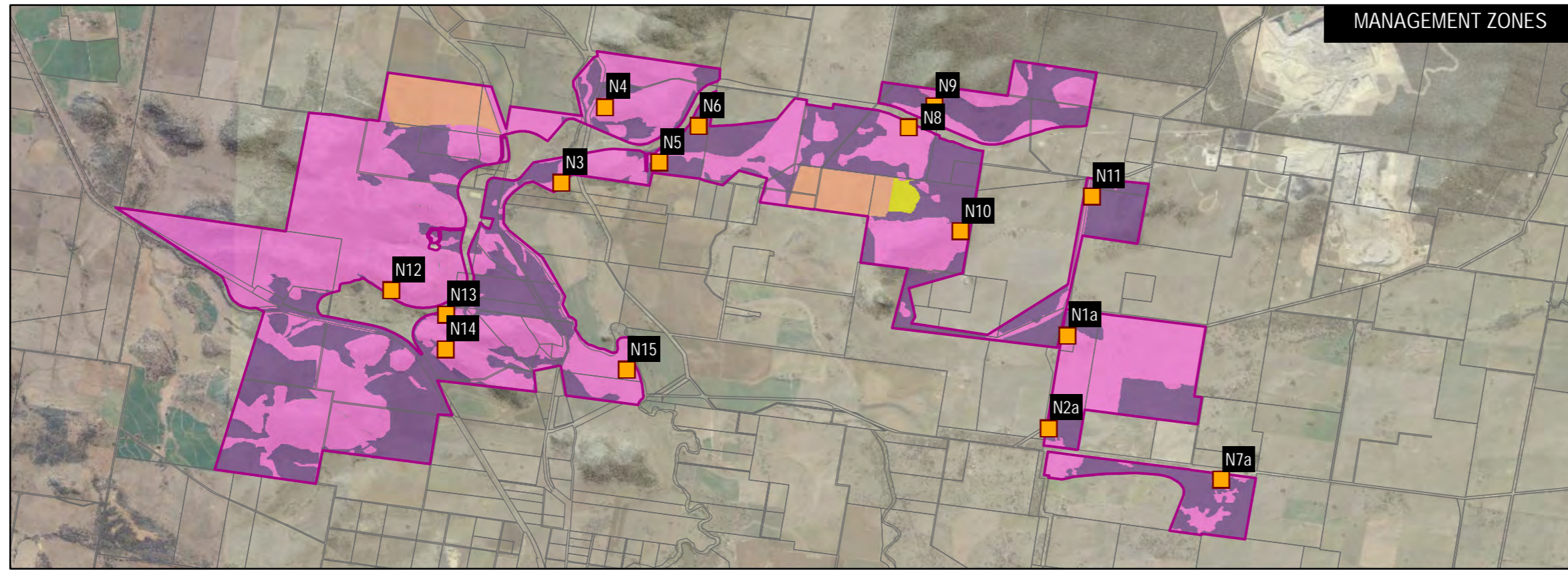
A total of 10 threatened species were recorded in the Namoi BOA during the 2015 baseline monitoring session (Table 4.3, Table D2.1 of Appendix D).

Table 4.3 Threatened species recorded in the Namoi BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Spotted Harrier	<i>Circus assimilis</i>	-	V
Little Eagle	<i>Hieraaetus morphnoides</i>		V
Painted Honeyeater	<i>Grantiella picta</i>	V	V
Varied Sittella	<i>Daphoenositta chrysoptera</i>		V
Speckled Warbler	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>		V
Diamond Firetail	<i>Stagonopleura guttata</i>		V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Little Lorikeet	<i>Glossopsitta pusilla</i>		V
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>		V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

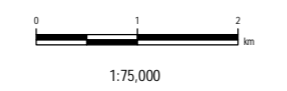


- Ecological survey locations
- Offset boundary
- Vegetation community
- Belah alluvial woodlands
- Belah alluvial woodlands (Low condition)
- Dwyer's Red Gum woodland
- Dwyer's Red Gum woodland (Low condition)
- Exotic grassland
- Freshwater marsh in flood channels
- Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland
- Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland (Low condition)
- Pilliga Box - Poplar Box-White cypress pine grassy open forest
- Pilliga Box - Poplar Box-White cypress pine grassy open forest (Low condition)
- Plains Grassland
- Regrowth - White Cypress Pine
- Regrowth - White Cypress Pine (Low condition)
- River Red Gum Riparian woodland and forest
- River Red Gum Riparian woodland and forest (Low condition)
- Rough-barked Apple Riparian Forb/Grass Open Forest; widespread
- Silver-leaved Ironbark heathy woodland
- Silver-leaved Ironbark heathy woodland (Low condition)
- Weeping Myall Woodland
- Weeping Myall Woodland (Low condition)
- White Box - Melaleuca riparian forest
- White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Low condition)
- White Box - White Cypress Pine grassy woodland
- White Box - White Cypress Pine grassy woodland (Low condition)
- White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west
- White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west (Low condition)
- Yellow Box - Blakely's Red Gum grassy woodland
- Yellow Box - Blakely's Red Gum grassy woodland (Low condition)
- Not specified
- Management zones
- Corridor enhancement zone
- Habitat management zone
- Habitat restoration zone
- Other land for agriculture zone



Map: 2267029A_GIS_F003_A1
 Date: 30/06/2016

Author: mitchellem
 Approved by: -



Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3

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Boggabri Coal

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Figure 4.1
 Vegetation communities and management zones
 - Namoi BOA

4.2 Habitat management zones

4.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Namoi BOA habitat management zones was highest at Site 14 closely followed by Site 1. Native species richness was lowest at Site 3 and Site 15. Monitoring sites 9, 10, 12, 13 and 14 either met or exceeded the native species richness benchmark values for their associated vegetation types. Monitoring sites 1, 7, 3, 4, 8 and 15 however did not meet the native species richness benchmark value for their associated vegetation types (Figure 4.2).

Native overstorey percentage cover within the Namoi BOA habitat management zones was highest at Site 13. Native overstorey was absent from monitoring sites 7, 8, 9 and 10 and subsequently these sites had the lowest percentage canopy cover. Only two of the monitoring sites (Site 12 and Site 13) were within the lower and upper native overstorey percentage cover benchmarks for their associated vegetation benchmarks (Figure 4.3).

Native midstorey percentage cover within the Namoi BOA habitat management zones was highest at Site 13. Native midstorey cover was absent from monitoring sites 1, 3, 8, 9, 10 and 15 and subsequently these sites had the lowest native midstorey cover. Monitoring sites 12, 13 and 14 were within the lower and upper native midstorey percentage cover benchmarks for their associated vegetation types. The remaining monitoring site fell short of the lower benchmark value for their associated vegetation type (Figure 4.4).

Native grass percentage cover within the Namoi BOA habitat management zones was highest at Site 8 closely followed by Site 10 and Site 7 respectively. One monitoring site (Site 3) contained no native grass cover and subsequently had the lowest native grass cover (Figure 4.5) which is thought to be attributed to previous land uses (i.e. vegetation clearing and heavy agricultural grazing along the Namoi River). Nine of the monitoring sites (sites 1, 4, 7, 8, 9, 10, 12, 13 and 15) met or exceeded the native grass percentage cover benchmark values for their associated vegetation types. Site 3 and Site 14 however fell short of meeting the benchmark values for their associated vegetation types (Figure 4.5).

Native shrub percentage cover within the Namoi BOA habitat management zones was generally absent from most monitoring sites. Native shrub cover was however highest at Site 13 and Site 14 respectively. Monitoring sites where native shrub cover occurred (sites 10, 12, 13 and 14) all met or exceeded the benchmark values for their associated vegetation types. Although shrub cover was absent, monitoring sites 3, 9 and 15 also met native shrub percentage benchmark values. Monitoring sites 1, 7, 4 and 8 however fell short of the lower benchmark values for their associated vegetation types (Figure 4.6).

Native other percentage cover within the Namoi BOA habitat management zones were highest at Site 4 closely followed by Site 15. Native other cover was entirely absent from Site 3 and Site 10 (Figure 4.7). This is thought to be attributed to previous high intensity agricultural grazing. All monitoring sites except Site 3 and Site 10 all either met or exceeded the native other percentage cover benchmark values for their associated vegetation types (Figure 4.7).

The number of hollow bearing trees within the Namoi BOA habitat management zones was highest at Site 14 and closely followed by Site 13 but also present at Site 3 and Site 4 in lower numbers. Hollow bearing trees were absent from the remaining monitoring sites (1, 7, 8, 9, 10, 12 and 15) (Figure 4.8). This is thought to be attributed to previous land clearing and firewood collection practises. Monitoring sites 3, 13 and 14 met or exceeded the hollow bearing tree benchmark values for their associated vegetation types. The remaining monitoring sites (1, 4, 7, 8, 9, 10, 12 and 15) did not meet the benchmark values for their associated vegetation types (Figure 4.8).

The total length of fallen timber within the Namoi BOA habitat management zones was highest at Site 3 which was attributed to a large single fallen tree that intersects the site. In addition Site 12 and Site 13 contained the high lengths of fallen timber. Fallen timber was absent from Site 7 and Site 9 and subsequently had the lowest total length of fallen timber. Monitoring sites 3, 8, 12 and 13 met or exceeded the fallen timber benchmark values for their associated vegetation types. Monitoring sites 1, 4, 7, 9, 10, 14 and 15 however fell short of meeting the benchmark values for their associated vegetation types (Figure 4.9).

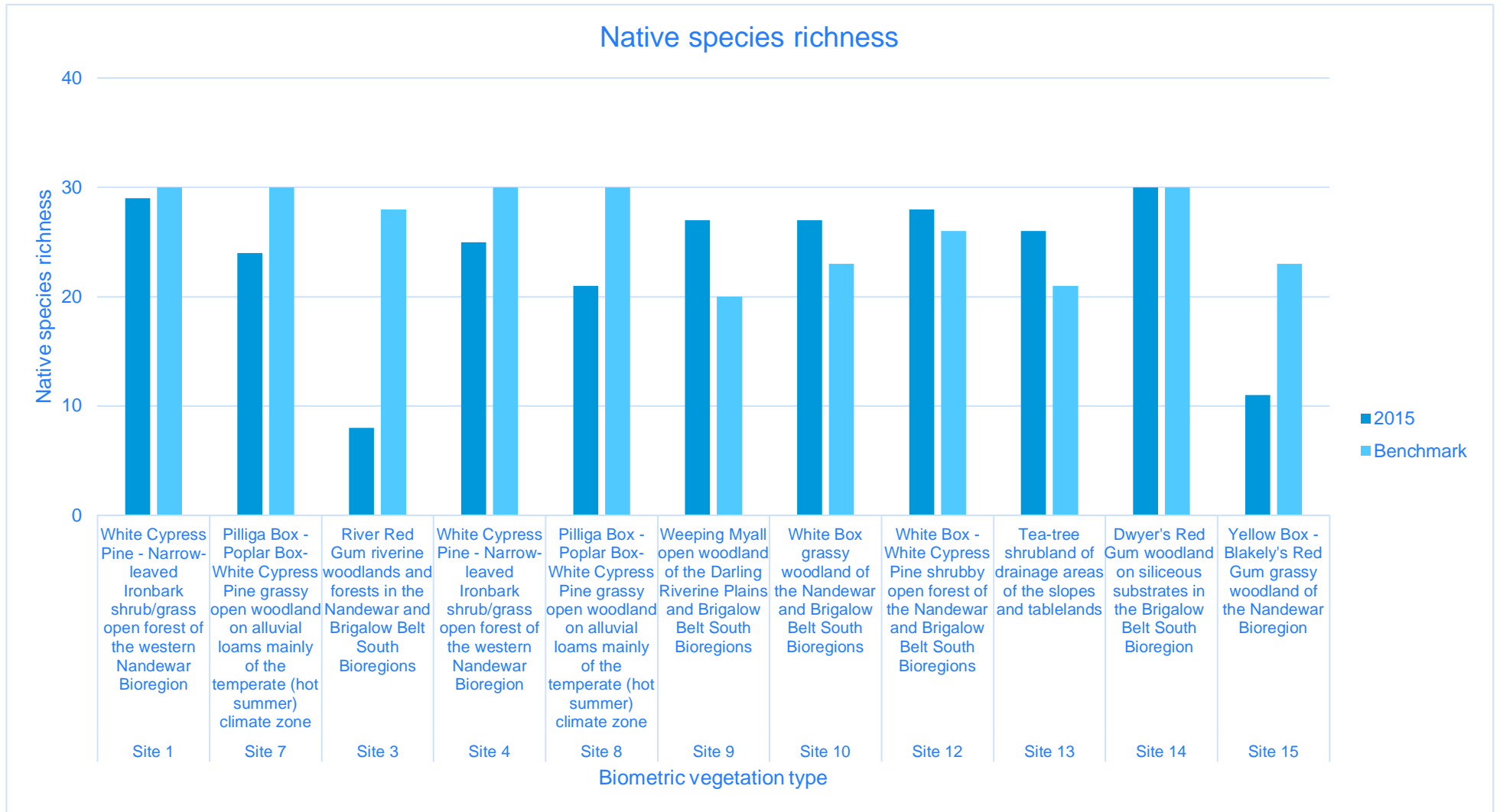


Figure 4.2 Native species richness between habitat management zone monitoring sites within the Namoi BOA

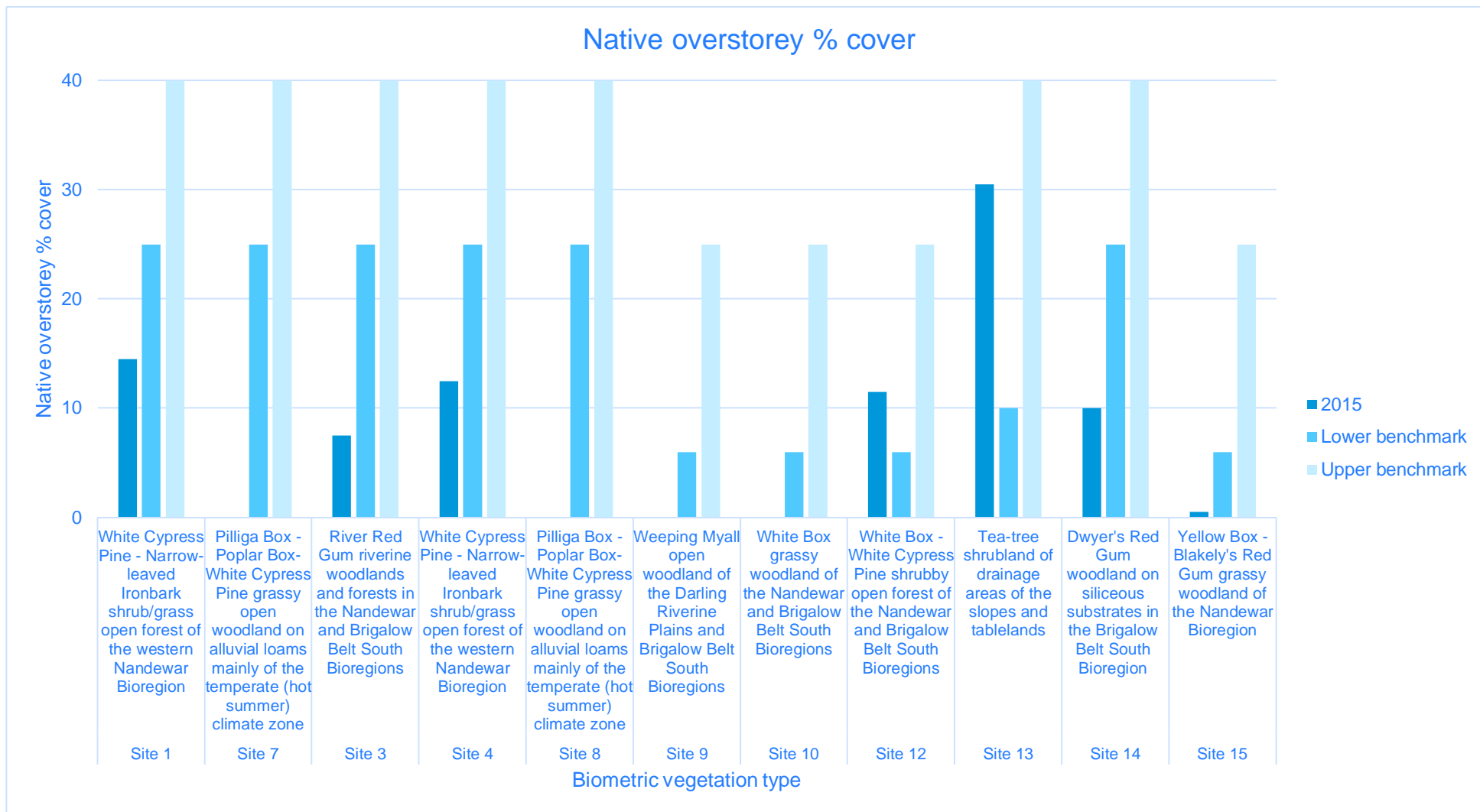


Figure 4.3 Native overstorey percentage cover between habitat management zone monitoring sites within the Namoi BOA

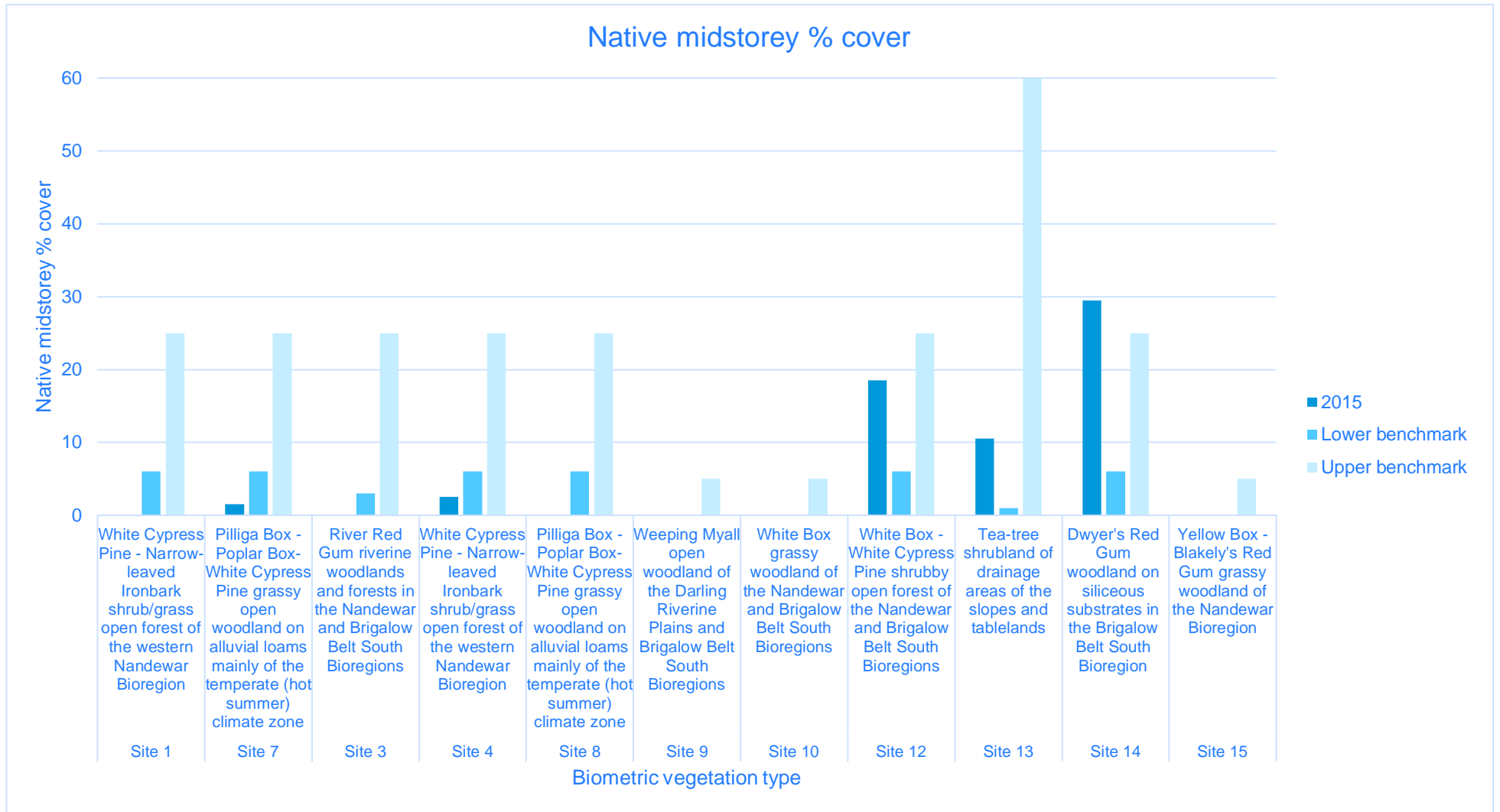


Figure 4.4 Native midstorey percentage cover between habitat management zone monitoring sites within the Namoi BOA

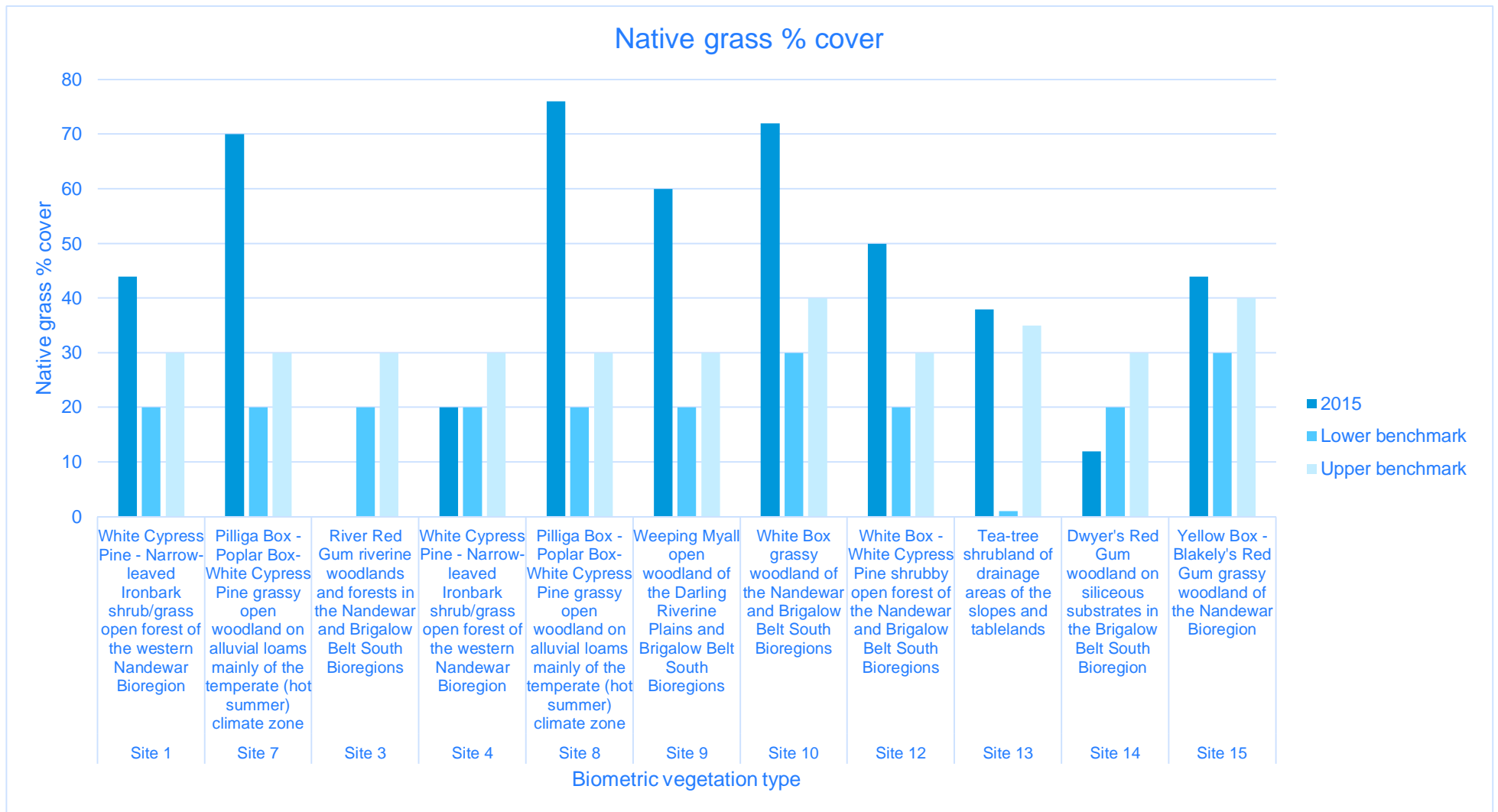


Figure 4.5 Native grass percentage cover between habitat management zone monitoring sites within the Namoi BOA

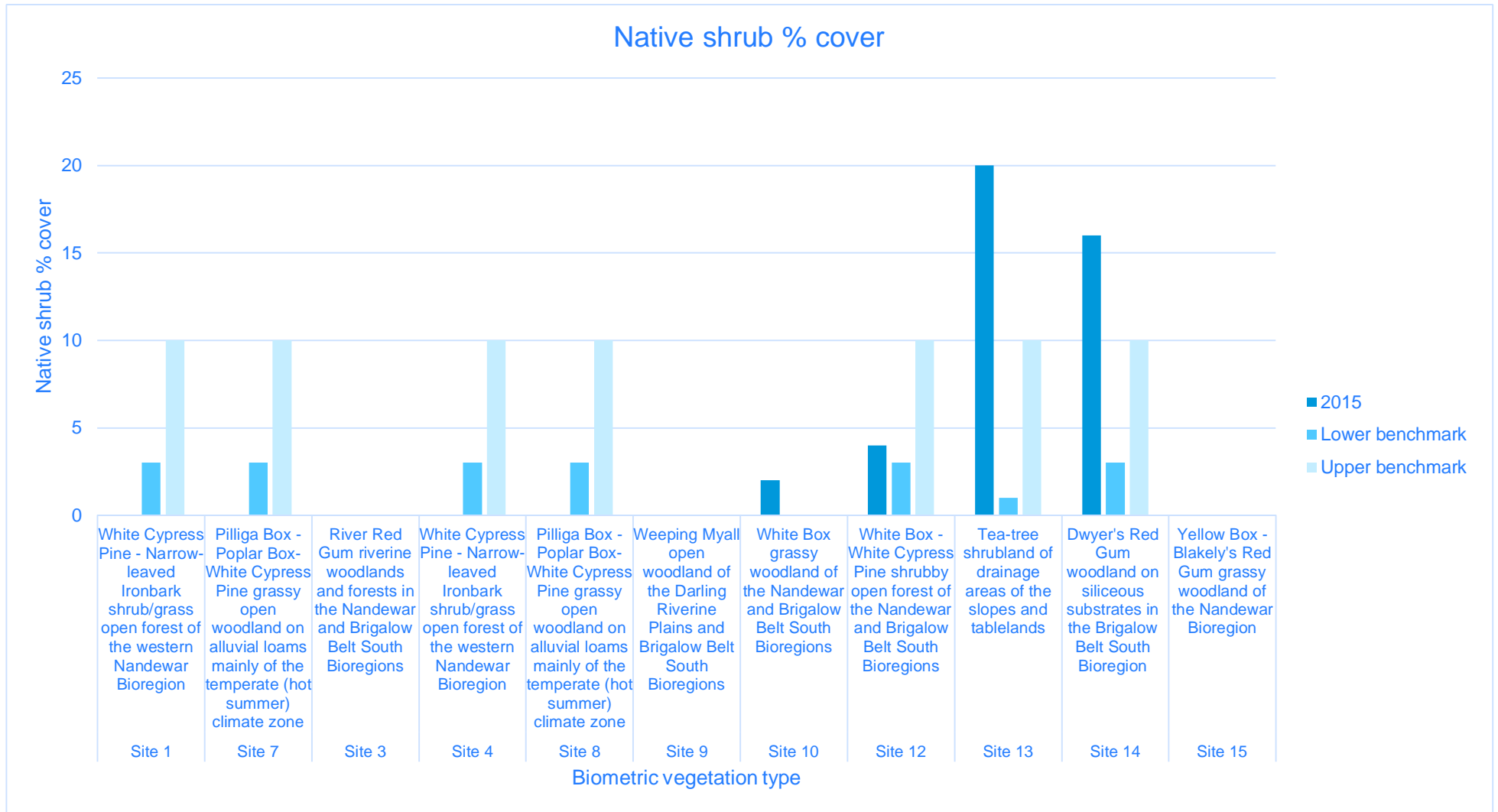


Figure 4.6 Native shrub percentage cover between habitat management zone monitoring sites within the Namoi BOA

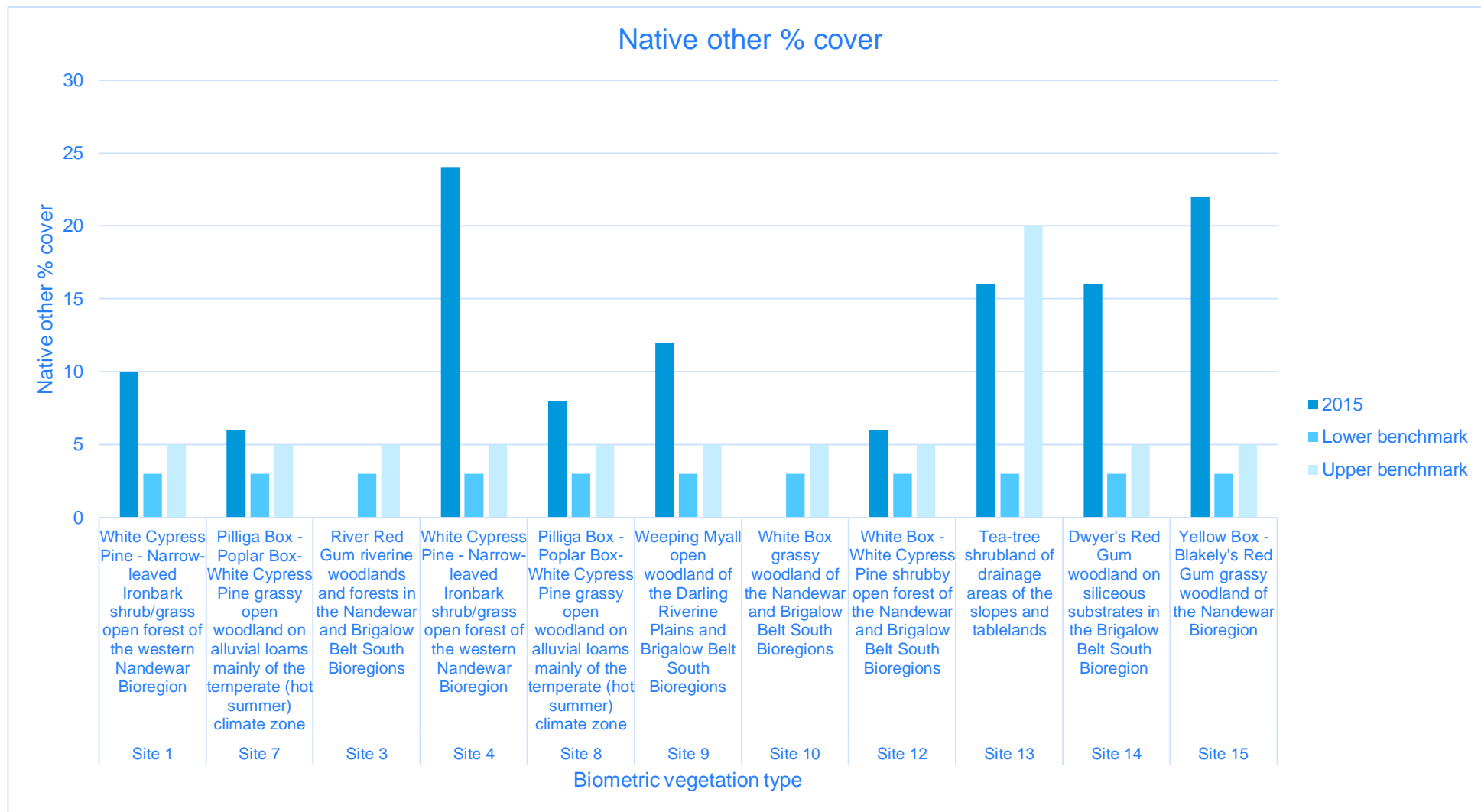


Figure 4.7 Native other percentage cover between habitat management zone monitoring sites within the Namoi BOA

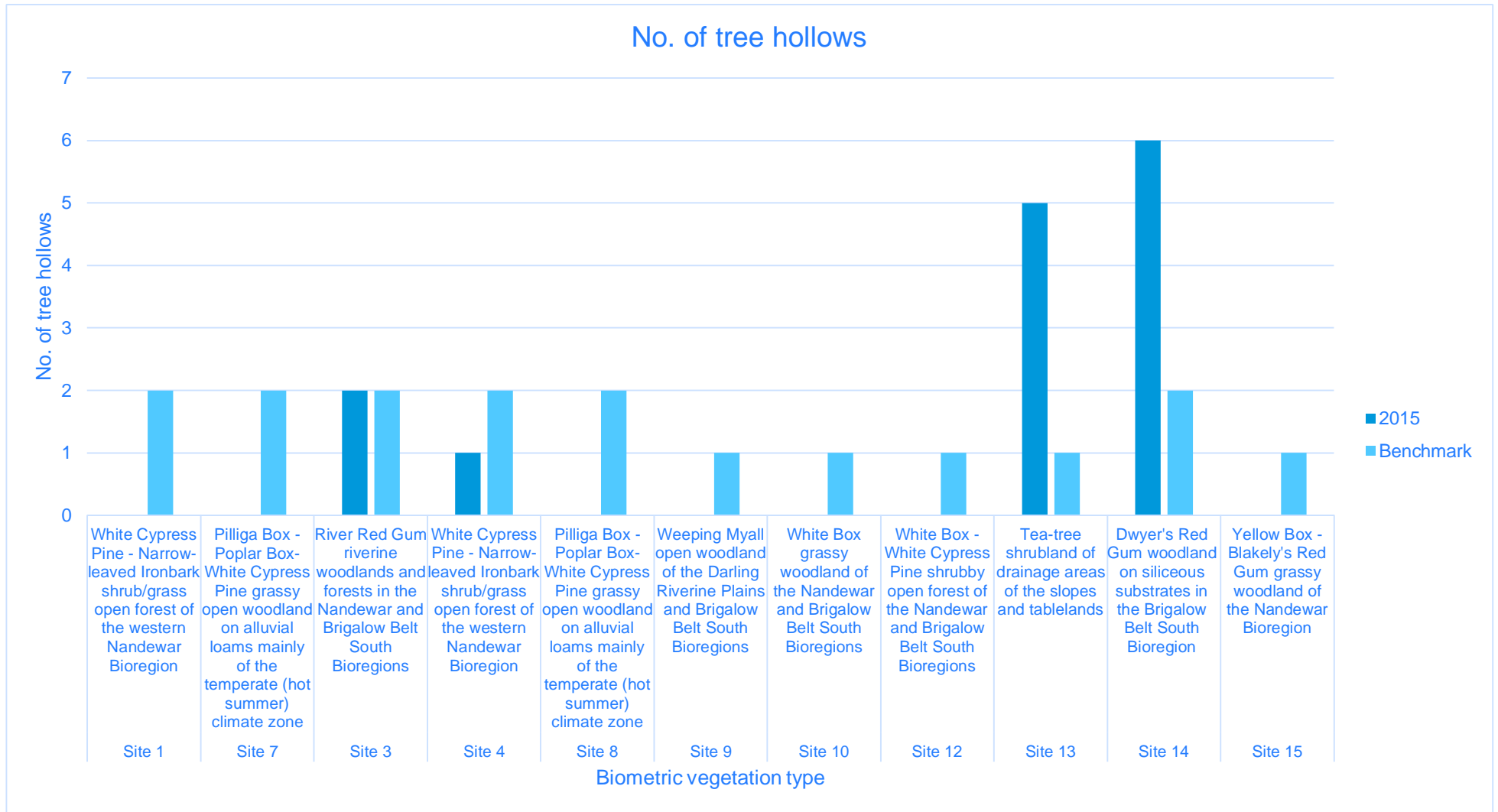


Figure 4.8 Number of hollow bearing trees between habitat management zone monitoring sites within the Namoi BOA

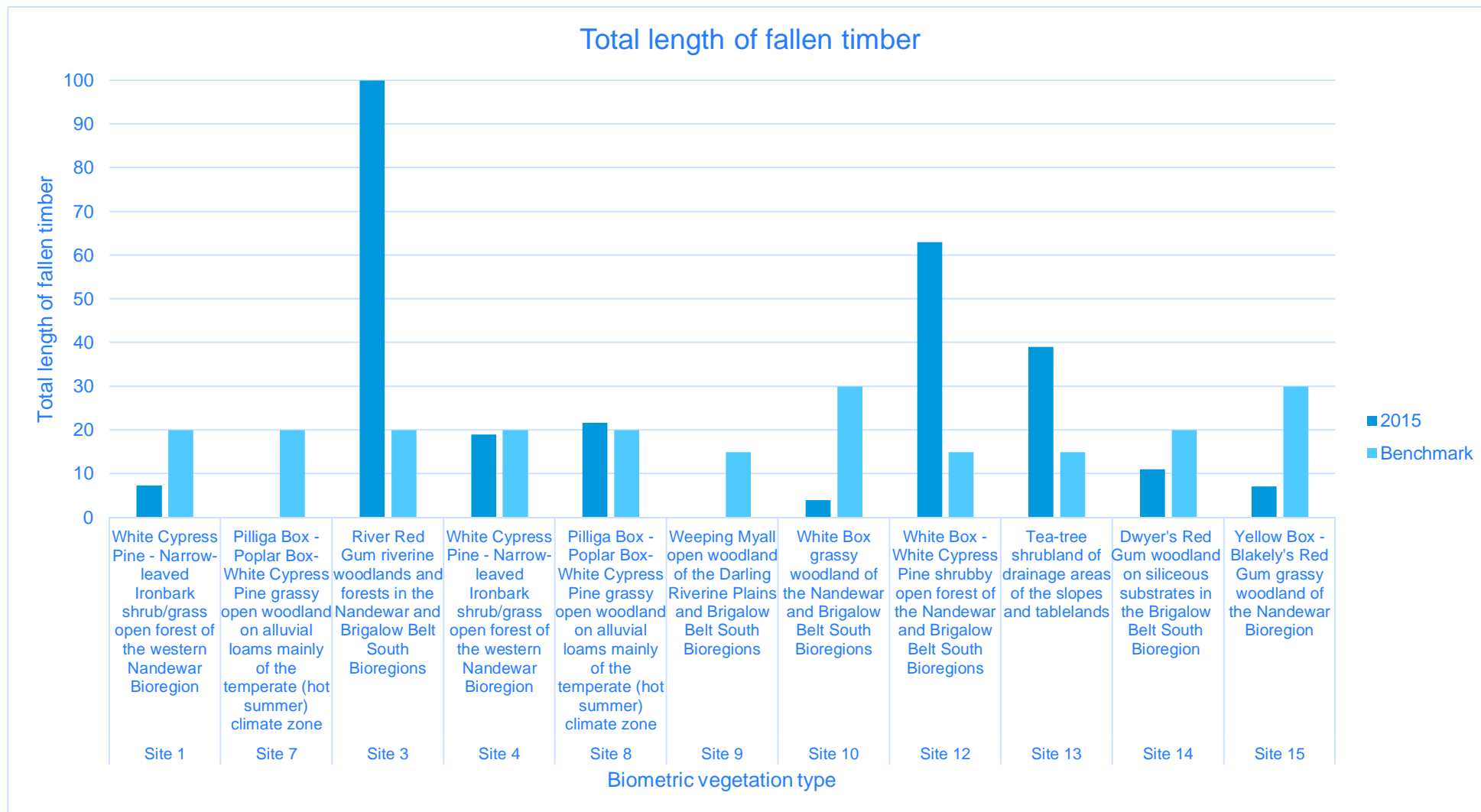


Figure 4.9 Total length of fallen timber between habitat management zone monitoring sites within the Namoi BOA

4.2.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Diurnal bird species richness was high in habitat management zones with replicate monitoring site N9 recording the highest average bird species richness at 33 birds recorded from duplicate surveys (Table 4.4). Replicate monitoring sites N7 and N12 recorded the lowest average bird species richness at 14 birds recorded from duplicate surveys. Due to the spatial extent of the Namoi BOA, encompassing a variety of habitat types with a range of condition classes, eight threatened species of bird were recorded from habitat management zones. This included, Spotted Harrier, Little Eagle, Painted Honeyeater, Varied Sittella, Speckled Warbler, Diamond Firetail, Grey-crowned Babbler and Little Lorikeet. The Grey-crowned Babbler was the most numerous threatened species of woodland bird, having been recorded at seven monitoring sites (Table D2.1 of Appendix D).

MICROCHIROPTERAN BATS

Eleven species of microbat were recorded from replicate monitoring sites associated with habitat management zones of the Namoi BOA (Table D2.1 of Appendix D). A mean microbat species richness of six was recorded from replicate monitoring site N1, N7, N10 and N12 (Table 4.4). Species commonly recorded included White-striped Freetail-bat, Inland Free-tailed Bat and Gould's Wattled Bat. Two threatened species of microbat, Eastern False Pipistrelle and Yellow-bellied Sheath-tail-bat, were recorded in habitat management zones of the Namoi BOA. The Yellow-bellied Sheath-tail-bat was recorded monitoring site N1, whilst the Eastern False Pipistrelle was recorded from monitoring site N7 and N12. No data was collected from the remaining monitoring sites associated with habitat management zones of the Namoi BOA this monitoring session.

REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at all monitoring locations associated with habitat management zones in the Namoi BOA. Native species recorded included, Eastern Grey Kangaroo, Swamp Wallaby and Common Brush-tailed Possum (Photo 4.1). Three introduced species animal, Black Rat, Pig (Photo 4.2) and Fox were also recorded from habitat management zones of the Namoi BOA.



Photo 4.1 Common Brushtail Possum captured at replicate monitoring site N4



Photo 4.2 Pigs captured at replicate monitoring site N14

NOCTURNAL BIRDS

Nocturnal call playback and spotlighting was completed at four replicate monitoring sites in habitat management zones of the Namoi BOA, including replicate monitoring site N1, N4, N9 and N13. One nocturnal bird, Southern Boobook, was recorded from monitoring site N4 and N13. No nocturnal birds were returned from monitoring site N1 and N9.

NOCTURNAL MAMMALS

Spotlighting was completed at four replicate monitoring sites in habitat management zones of the Namoi BOA, including replicate monitoring site N1, N4, N9 and N13. No nocturnal mammals were recorded therein.

Table 4.4 Namoi BOA habitat management zone – 2015 baseline fauna monitoring



4.3 Habitat restoration zones

4.3.1 Baseline vegetation attributes and benchmarks

Native species richness within the Namoi BOA habitat restoration zones was highest at Site 11 and lowest at Site 5. None of the monitoring sites met the native species richness benchmark value for their associated vegetation types (Table 4.5).

Native overstorey cover was entirely absent from all monitoring sites within the Namoi BOA habitat restoration zones. Consequently, none of the monitoring sites met the lower or upper native overstorey percentage cover benchmarks for their associated vegetation types (Table 4.5). The void of native canopy cover is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

Native midstorey cover was entirely absent from all monitoring sites within the Namoi BOA habitat restoration zones. Consequently, none of the monitoring sites met the lower or upper native midstorey percentage cover benchmarks for their associated vegetation types (Table 4.5). The void of midstorey is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

Native grass percentage cover within the Namoi BOA habitat restoration areas was highest at Site 11 and lowest at Site 5. Three monitoring sites (2, 5 and 11) met or exceeded the native grass percentage cover lower and upper benchmark values of their associated vegetation types. Site 6 however fell short of meeting the lower benchmark value for the White Bos grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 4.5).

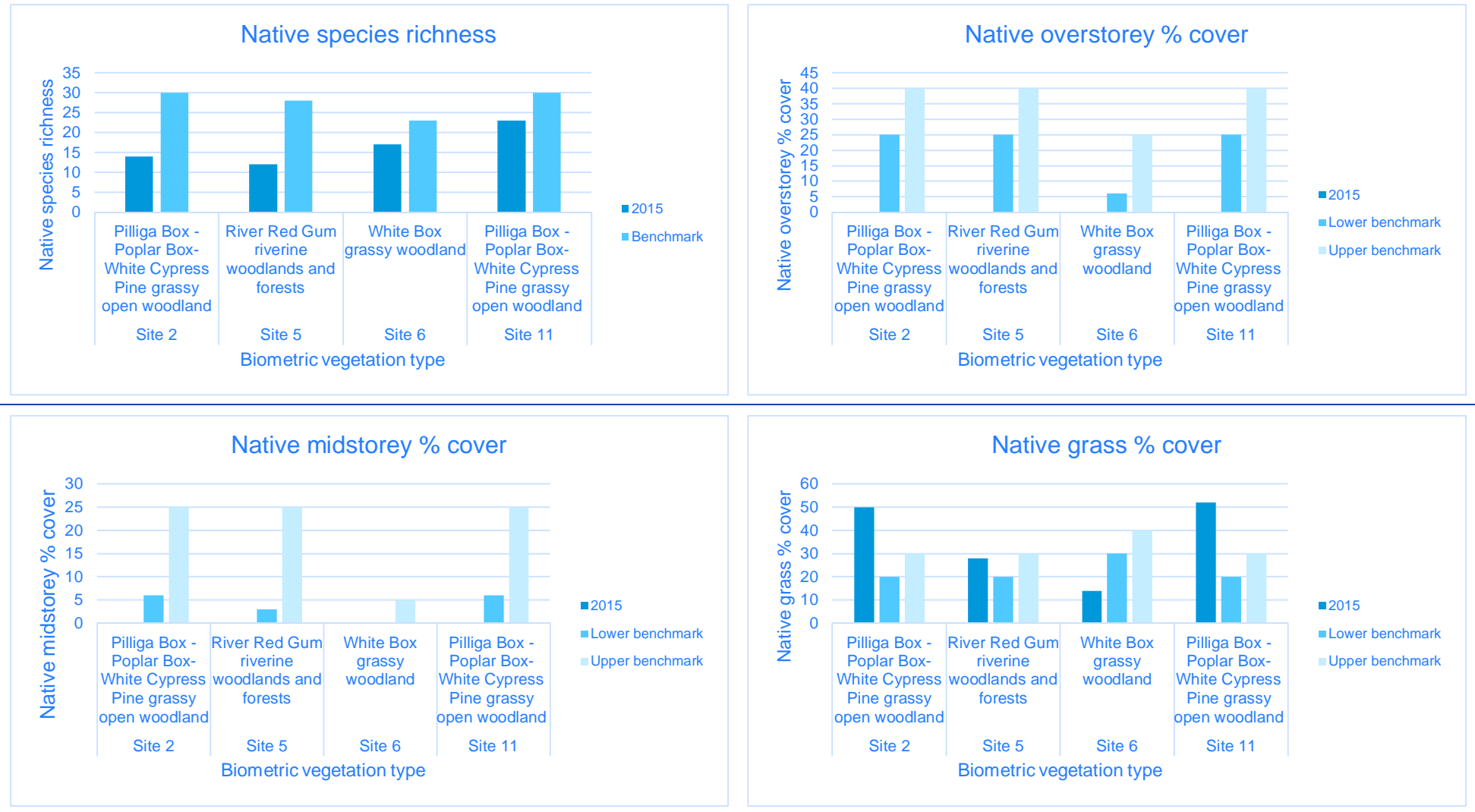
Native shrub cover was entirely absent from all monitoring sites within the Namoi BOA habitat restoration areas. Although native shrub cover was entirely absent two monitoring sites (Site 5 and Site 6) were within the lower and upper benchmark values for their associated vegetation types. Site 2 and Site 11 however fell short of the lower benchmark value for Pilliga Box – Poplar Box – white Cypress Pine grassy open woodland on alluvial loams mainly of the temperate climate zone vegetation type (Table 4.5).

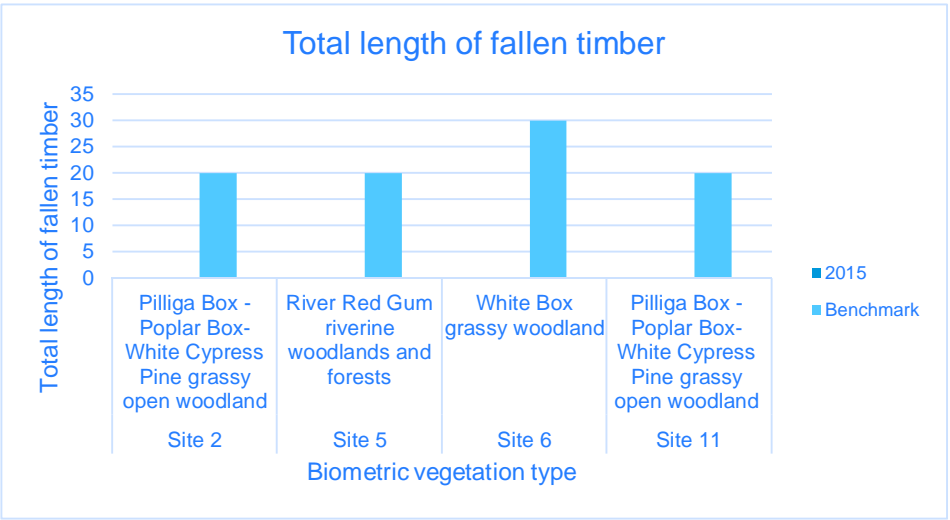
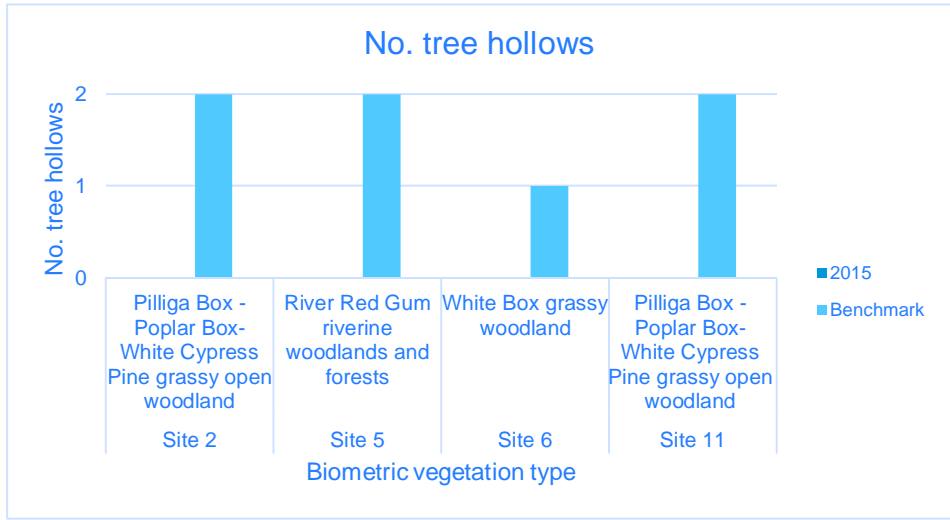
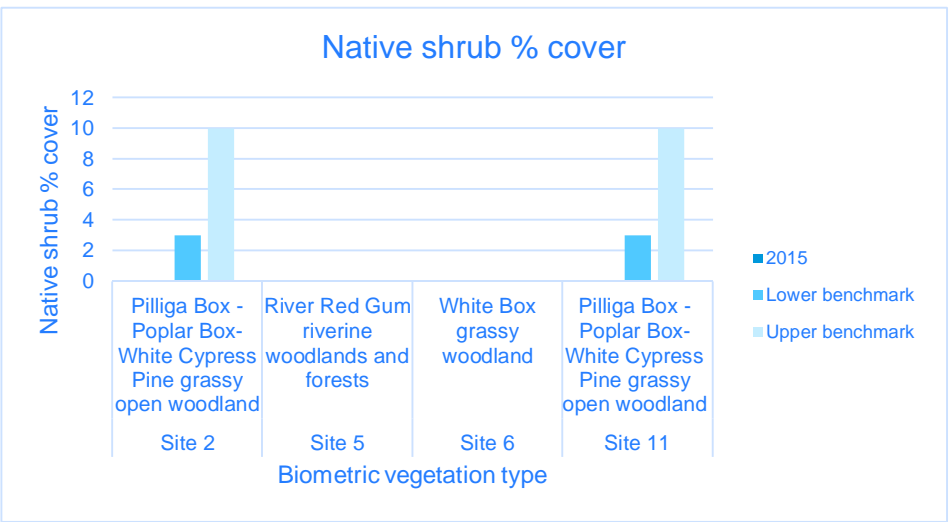
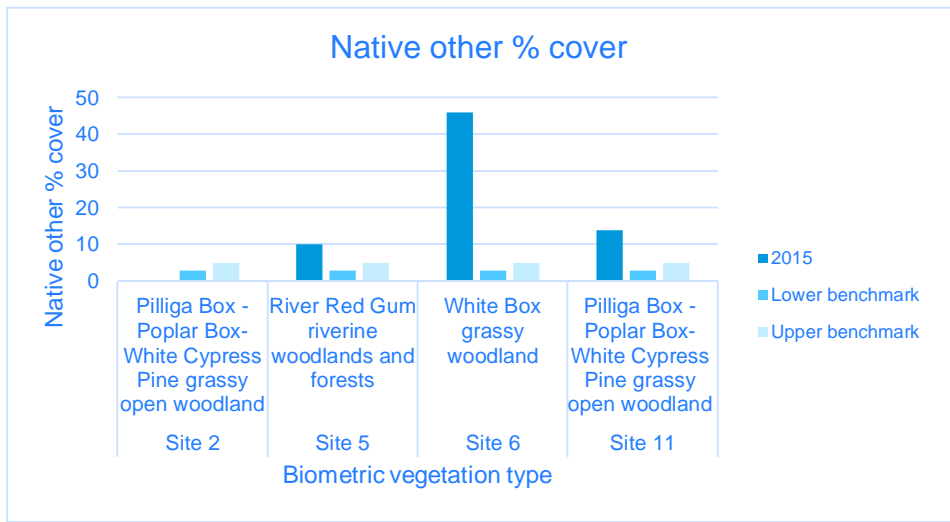
Native other cover percentage within the Namoi BOA habitat restoration zones was highest at Site 6 lowest at Site 2. Three of the habitat restoration monitoring sites (5, 6 and 11) all exceeded the upper native other percentage cover benchmark value for their associated vegetation types. Site 2 however contained no native other cover and subsequently fell short of the lower benchmark value for the Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone vegetation type (Table 4.5).

No hollow bearing trees were recorded from within any of the Namoi BOA habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the hollow bearing tree benchmark values for their associated vegetation types (Table 4.5). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland.

No fallen timber was recorded from within any of the Namoi BOA habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the total length of fallen timber benchmark values for their associated vegetation types (Table 4.5). The absence of fallen timber is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 4.5 Namoi BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





4.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

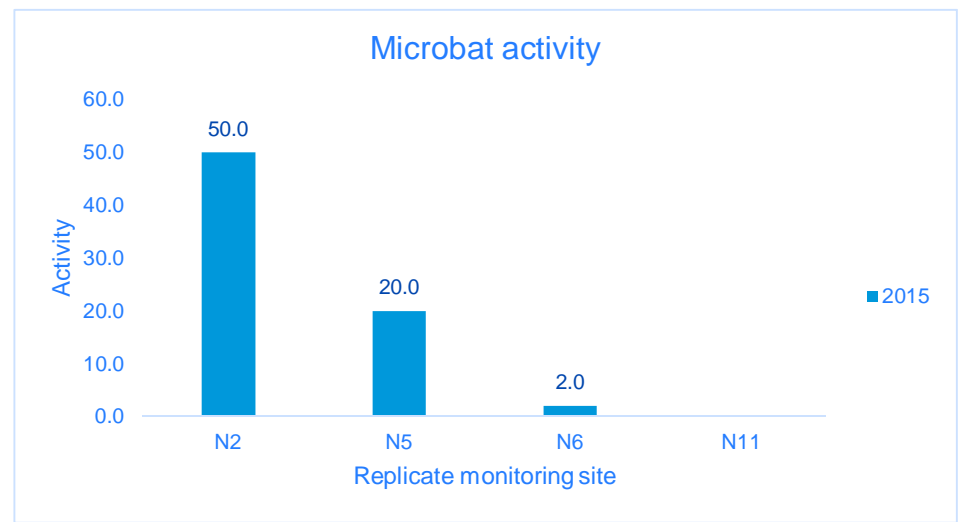
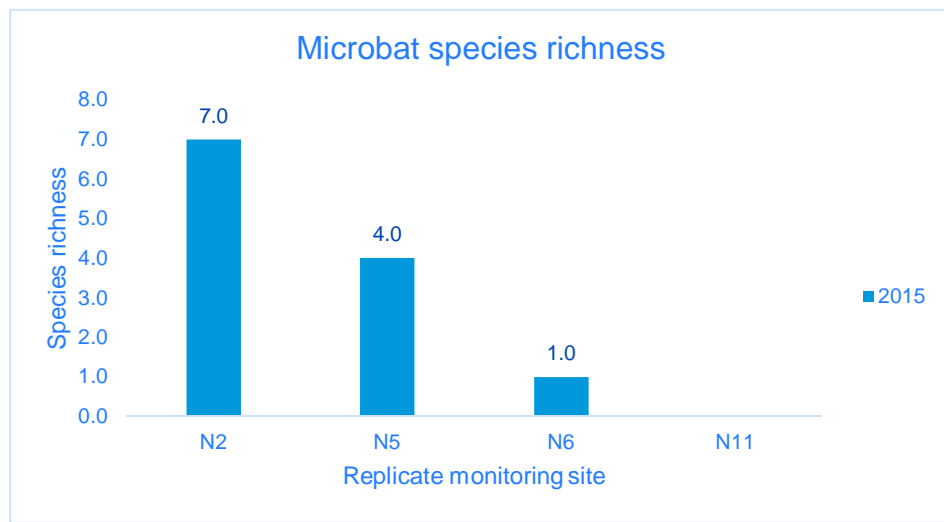
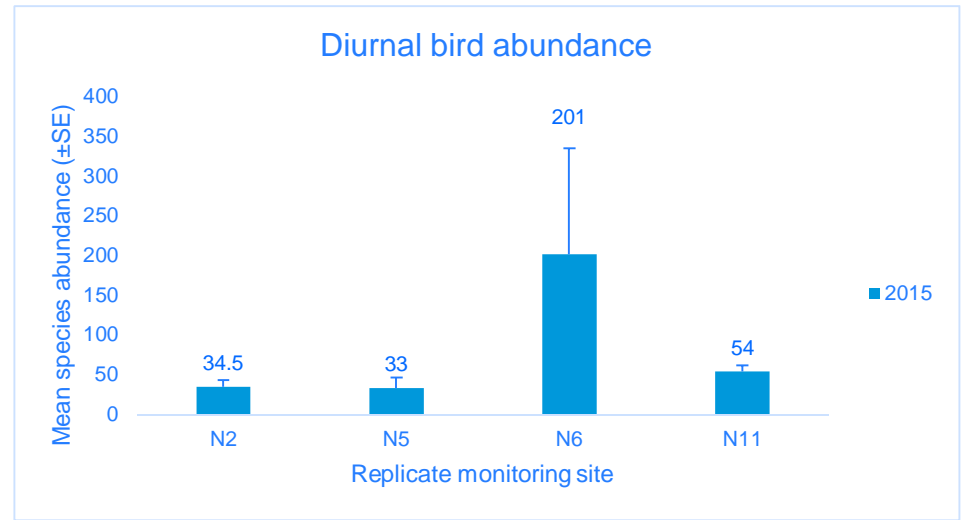
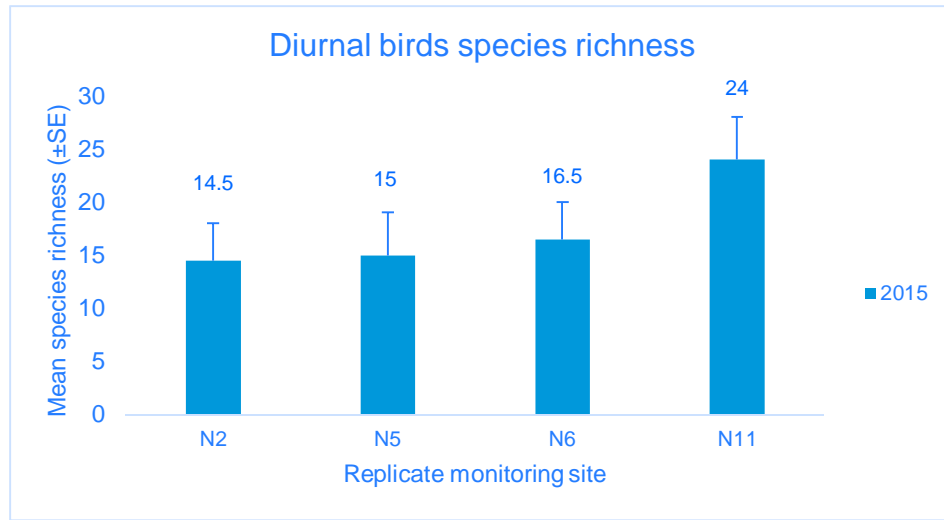
A moderate diversity of bird was observed from replicate monitoring sites associated with habitat restoration zones of the Namoi BOA. Mean diurnal bird species richness was fairly consistent between monitoring sites with N2, N5 and N6 logging about 15 birds from duplicate surveys. Monitoring site N11 recoded the highest average bird species richness with 24 birds from duplicate surveys (Table 4.6). One threatened woodland species of bird, Grey-crowned Babbler, was recorded from monitoring site N6 and N11 during this monitoring session (Table D2.1 of Appendix D).

MICROCHIROPTERAN BATS

Seven species of microbat were recorded from replicate monitoring sites associated with habitat restoration zones in the Namoi BOA (Table D2.1 of Appendix D). Mean microbat species richness ranged from an average of seven at replicate monitoring site N2 to one at monitoring site N6 (Table 4.6). The most common microbats recorded were Inland Free-tailed Bat, Gould's Wattled Bat and Little Broad-nosed Bat. One threatened species of microbat, Eastern False Pipistrelle, was recorded in habitat restoration zones of the Namoi BOA during this monitoring session (Table D2.1 of Appendix D). No data was collected from replicate monitoring site N11 during passive Anabat surveys this monitoring session.

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) was generally low, with an average of 20 and two passes recorded from replicate monitoring sites N5 and N6 respectively (Table 4.6). Replicate monitoring site N2 recorded the highest activity with 50 passes.

Table 4.6 Namoi BOA habitat restoration zone – 2015 baseline fauna monitoring



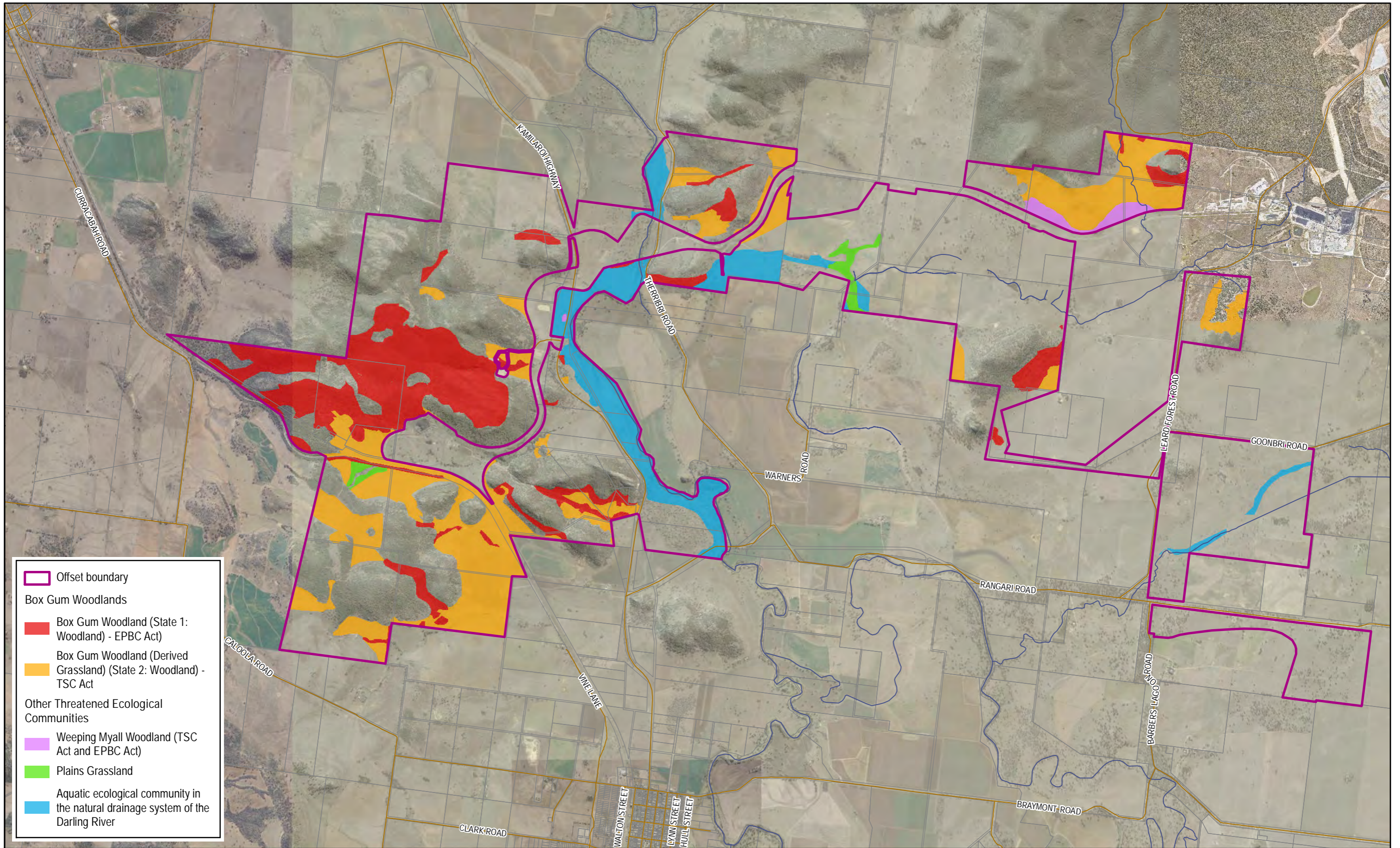
4.4 State of Box Gum Woodland

The Namoi BOA contains approximately 1204.3 ha of Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Namoi BOA on lower slopes and flatter land (Figure 4.10).

Within the Namoi BOA the Box Gum Woodland occurs in two states:

- Box Gum Woodland – State 1: Woodland – occupies approximately 535.9 ha.
- Box Gum Woodland – State 2: Native Pastures (derived native grassland) – occupies approximately 668.4 ha.

Three monitoring sites within the Namoi BOA (two within habitat management zone and one within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 4.7.



	Offset boundary
Box Gum Woodlands	
	Box Gum Woodland (State 1: Woodland) - EPBC Act
	Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act
Other Threatened Ecological Communities	
	Weeping Myall Woodland (TSC Act and EPBC Act)
	Plains Grassland
	Aquatic ecological community in the natural drainage system of the Darling River

Map: 2267029A_GIS_F010_A2	Author: mitchellem	
Date: 30/06/2016	Approved by: -	
<small>Data source: © Land and Property Information 2015 Copyright © 2014 Esri</small>		

1:50,000
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



Boggabri Coal

BIODIVERSITY OFFSET MONITORING

Figure 4.10
Box Gum Woodland within Namoi BOA

Table 4.7 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Namoi BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES					Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage		
Habitat management zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	10	X 6 below	✓			X 3 below	✓	Box Gum Woodland - State 2 (Woodland). Native over storey PFC and native other percentage groundcover below benchmark values. The remaining vegetation attributes were within or above benchmark values. Dominant canopy (no hollows but regeneration occurring), shrub and groundcover species present however exotic species are also (10). Evidence of feral herbivore grazing (rabbits) and past firewood collection was observed on site.
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	15	X 5.5 below	✓		✓		X 12 below	Box Gum Woodland - State 2 (Woodland). Native overstorey PFC and native species richness are below benchmark values. The remaining vegetation attributes were within or above benchmark values. Dominant canopy (no hollows but regeneration occurring), shrub and groundcover species present however exotic species are also (12). Evidence of feral herbivore grazing (rabbits) was observed on site.

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	6	X 6 below	✓	X 16 below	✓		X 6 below	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands)</p> <p>Native overstorey PFC, native grass percentage cover and native species richness were below benchmark values. The remaining vegetation attributes were within or above benchmark values.</p> <p>Canopy and shrub stratum absent (no hollows or regeneration occurring). Native groundcover species present however exotic species are also in high numbers (19). Evidence of past agricultural grazing pressures still evident. Evidence of feral herbivore grazing also present (rabbits) observed on site.</p>

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

5 WIRRILAH BOA – BASELINE RESULTS

5.1 Introduction

The Wirrilah property encompasses an area of 1,047.3 ha and is located approximately 3.9 km north-west of the Project. The Wirrilah property lies within the Nandewar Range and forms the north-east corner of the Regional East-West Wildlife Corridor. Much of the woodland within the Wirrilah BOA is in relatively good condition. Regeneration is present on many parts of the main ridge, particularly on the lower slopes.

The vegetation and the management zones within the Wirrilah BOA are illustrated in Figure 5.1.

5.1.1 Flora

93 plant species were recorded within the Wirrilah BOA during the 2015 monitoring session. Of these, 69 (74%) were native and 24 (26%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 21 species followed by Asteraceae with 16 species. No threatened plant species were recorded.

Of the 24 exotic species that were recorded in the Wirrilah BOA, *Opuntia stricta* (Prickly Pear) was the only species of plant listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area (Table 5.1). No exotic species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2015). Other highly invasive species that occurred abundantly within the Wirrilah BOA included *Vulpia myuros** (Rats Tail Fescue), *Carthamus lanatus** (Saffron Thistle), *Lolium perenne** (Perennial Ryegrass) and several *Trifolium* species (Clover)*.

Table 5.1 Noxious weeds recorded within the Wirrilah BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Prickly Pear	<i>Opuntia stricta</i>	4	No

No threatened flora species were recorded within the Wirrilah BOA.

5.1.2 Fauna

Baseline monitoring recorded 74 species of animal within the Wirrilah BOA, including 72 native species and two introduced species (Table 5.2 and Table D3.1 of Appendix D).

Table 5.2 Summary of terrestrial animal species identified in the Wirrilah BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	64	2
Microbats	8	-
Total	72	2

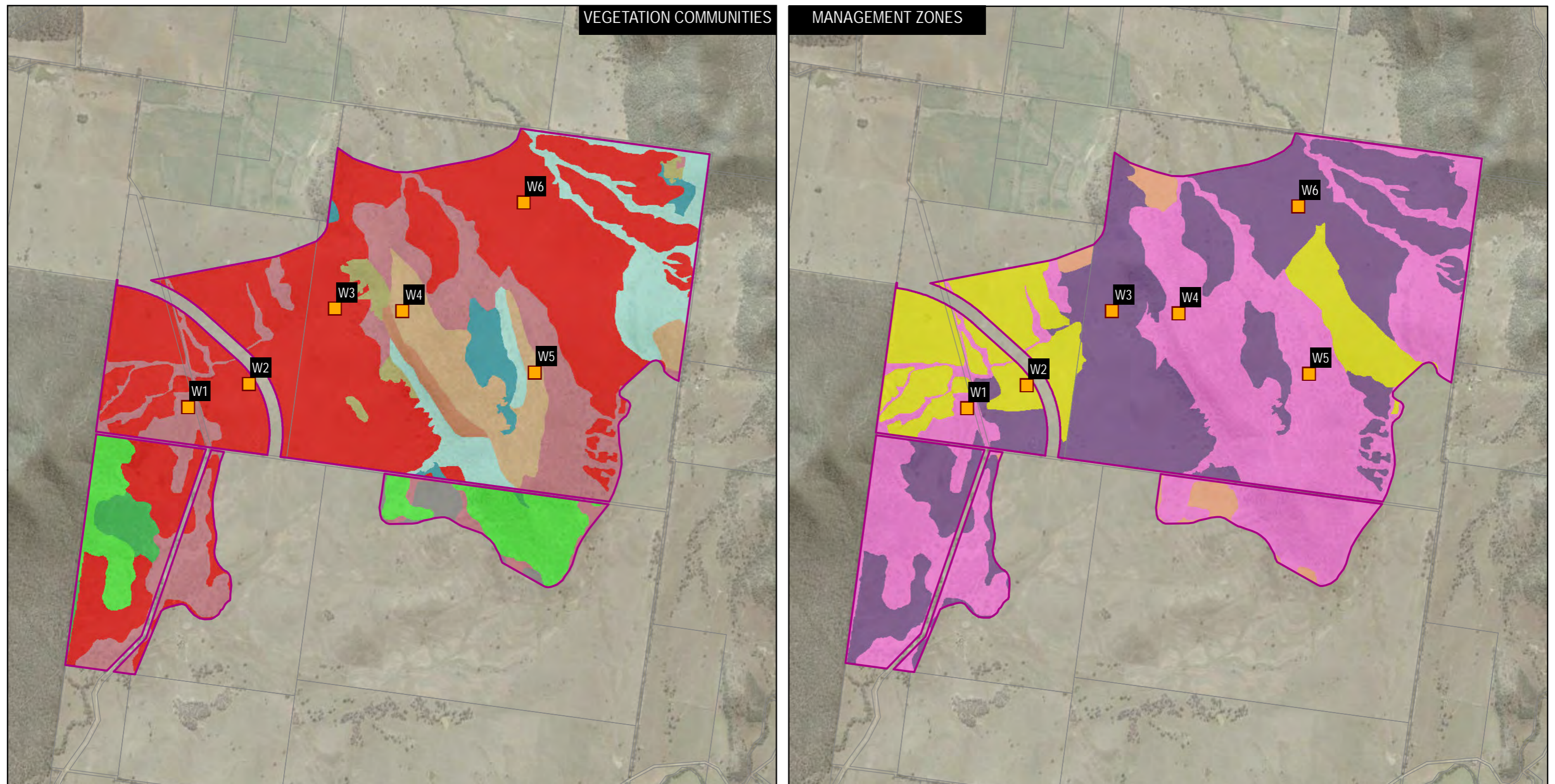
A total of four threatened species were recorded in the Wirrilah BOA during the 2015 baseline monitoring session (Table 5.3, Table D3.1 of Appendix D).

Table 5.3 Threatened species recorded in the Wirrilah BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Varied Sittella	<i>Daphoenositta chrysoptera</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	-	V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Vegetation community	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Low condition)	Management zones
Offset boundary	Emergent Rough-barked Apple low closed forest	White Box - White Cypress Pine grassy woodland	Corridor enhancement zone
	Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	White Box - White Cypress Pine grassy woodland (Low condition)	Habitat management zone
	Regrowth - White Cypress Pine (Low condition)	White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west	Habitat restoration zone
	Silver-leaved Ironbark heathy woodland	Not specified	Other land for agriculture zone
	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest		

Map: 2267029A_GIS_F004_A1	Author: SuansriR		
Date: 6/06/2016	Approved by: -		
Data source: © Land and Property Information 2015 Copyright © 2014 Esri		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	



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Figure 5.1
Vegetation communities and management zones
- Wirrilah BOA

5.2 Habitat management zones

5.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Wirrilah BOA habitat management zones was highest at Site 4 and lowest at Site 1 (Table 5.4). It is thought that the lower native species richness in Site 1 is attributed to it representing a different vegetation community (i.e. White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions) which has a lower native species richness benchmark value. All habitat management zone monitoring site within the Wirrilah BOA exceeded the native species richness benchmarks for their associated vegetation types (Table 5.4).

Native overstorey percentage cover within the Wirrilah BOA habitat management zones was highest at Site 1 followed by Site 4. Site 5 had the lowest native overstorey cover (Table 5.4) which is thought to be attributed to previously clearing and firewood collection. Site 1 was within the lower and upper native overstorey cover benchmark for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Site 4 and Site 5 however fell short of the benchmark values for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion vegetation type (Table 5.4).

Native midstorey percentage cover within the Wirrilah BOA habitat management zones was highest at Site 5 followed by Site 4. Native midstorey cover was absent from Site 1. All habitat management zones within the Wirrilah BOA were within the lower and upper native midstorey percentage cover benchmark values for their associated vegetation types (Table 5.4).

Native grass percentage cover within the Wirrilah BOA habitat management zones was highest at Site followed by Site 5. Native grass cover was lowest at Site 4. All habitat management zones within the Wirrilah BOA exceeded the upper native grass percentage cover benchmarks for their associated vegetation types (Table 5.4).

Native shrub percentage cover within the Wirrilah BOA habitat management zones was highest at Site 5. Shrub cover was absent from Site 1 and Site 4. Site 1 was within the lower and upper native shrub cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South vegetation type. Site 4 and Site 5 however both fell short of the lower native shrub cover benchmark for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion vegetation type (Table 5.4). This is thought to be attributed to past vegetation clearing.

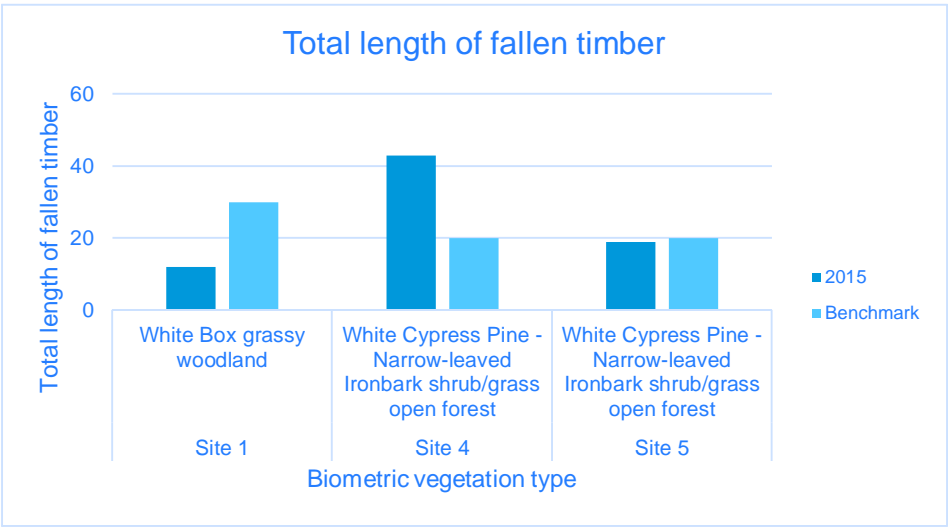
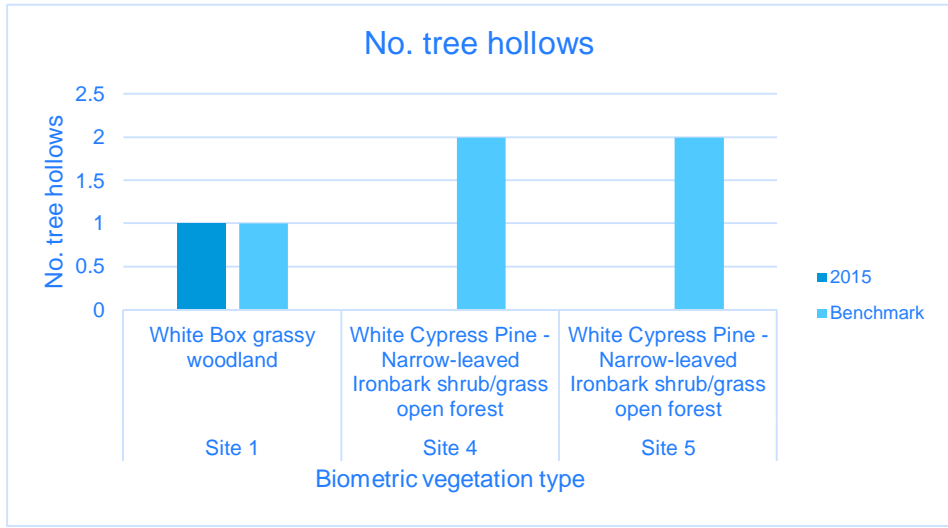
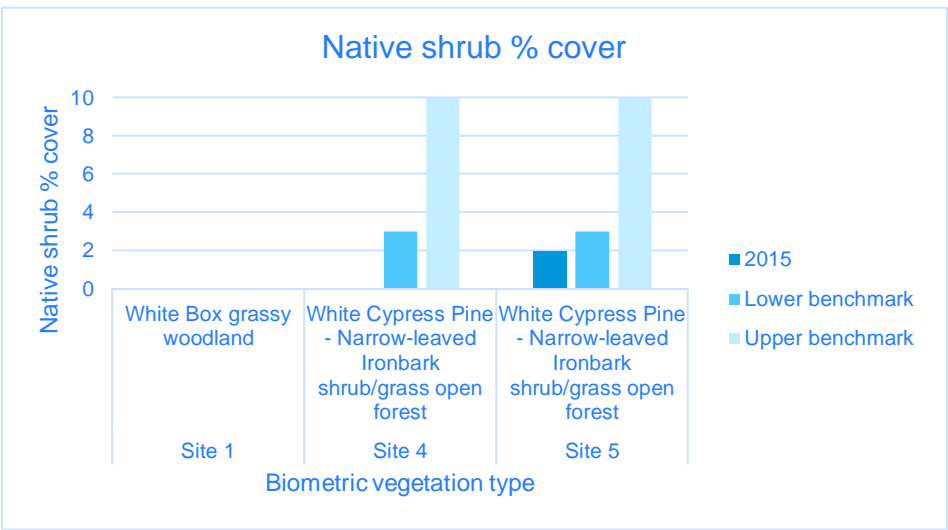
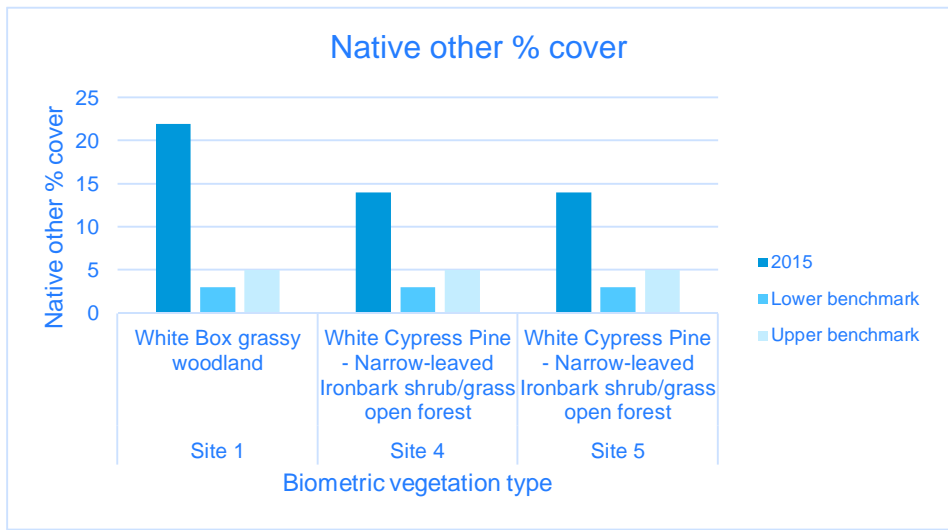
Native other percentage cover within the Wirrilah BOA habitat management zones was highest at Site 1. Both Site 4 and Site 5 had the lowest native other percentage cover. All habitat management sites within the Wirrilah BOA exceeded the upper native other percentage cover benchmark for their associated vegetation types (Table 5.4).

The number of hollow bearing trees within the Wirrilah BOA habitat management zones was highest at Site 1. Hollow bearing trees were absent from both Site 4 and Site 5 (Table 5.4) which is thought to be attributed to previous vegetation clearing and firewood collection. Site 1 was within the hollow bearing tree benchmark for the White Box grass woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Site 4 and 5 however fell short of the benchmark value for White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion vegetation type (Table 5.4).

The total length of fallen timber within the Wirrilah BOA habitat management zones was highest at Site 4 and lowest at Site 1. Site 4 exceed the length of fallen timber benchmark for White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion vegetation type. Site 1 and Site 5 however fell short of the benchmark vales for their associated vegetation types (Table 5.4). This is thought to be attributed to past firewood collection.

Table 5.4 Wirrilah BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





5.2.2 Baseline fauna assemblage benchmark

DIURNAL BIRDS

The 2015 monitoring surveys of the Wirrilah BOA identified 52 diurnal species of bird from replicate monitoring sites associated with habitat management zones (Table D3.1 of Appendix D). Three species listed as Vulnerable under the TSC Act, Varied Sittella, Speckled Warbler and Grey-crowned Babbler, were recorded from habitat management zones of the Wirrilah BOA. The Varied Sittella and Speckled Warbler were recorded from quality grassy/ shrubby White Cypress Pine – Narrow-leaved Ironbark open forest at monitoring site W4, whilst the Grey-crowned Babbler was recorded from similar habitat at monitoring site W5. Diurnal bird species richness was highest at replicate monitoring site W4 with an average of 21 birds recorded from duplicate surveys (Table 5.5). Diurnal bird species richness was lowest at replicate monitoring site W1, with an average of 12 birds recorded duplicate surveys. Monitoring site W1 is associated with White Box grassy woodland, however its location adjacent to areas long dedicated to the grazing of cattle and its general lack of native shrub and mid-storey cover may reduce its appeal to certain cover dependent species of bird.

The Striped Honeyeater, Spiny-cheeked Honeyeater, Mistletoebird, Rufous Whistler, Grey Butcherbird and Australian Raven were the most widespread diurnal species of bird within habitat management zones of the Wirrilah BOA (Table D3.1 of Appendix D).

MICROCHIROPTERAN BATS

The 2015 monitoring surveys of the Wirrilah BOA identified seven species of microbat from monitoring sites associated with habitat restoration zones (Table D3.1 of Appendix D). One species listed as Vulnerable under the TSC Act, Yellow-bellied Sheath-tail-bat, was recorded from monitoring site W4. Mean microbat species richness and activity was moderate to low, with monitoring site W4 being the most species rich with an average of four microbats recorded from duplicate surveys (Table 5.5).

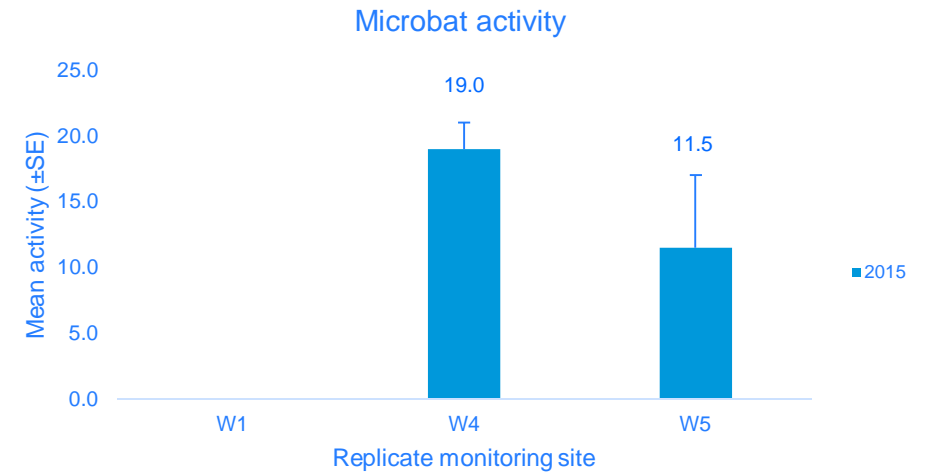
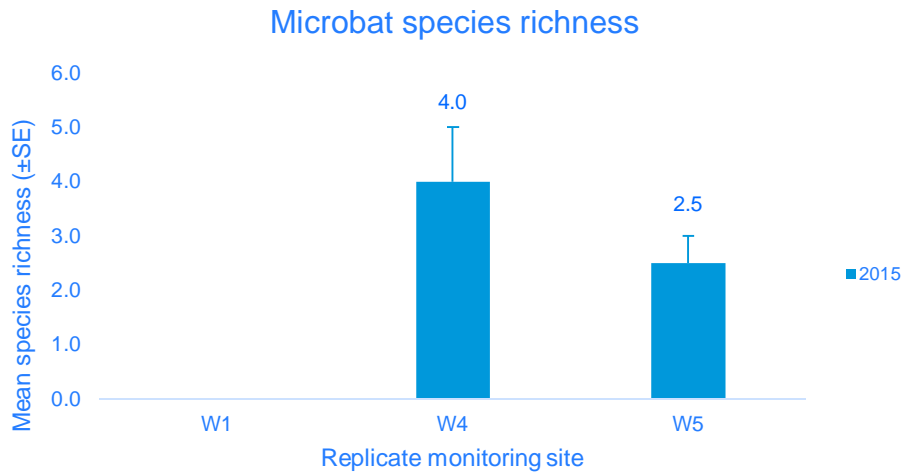
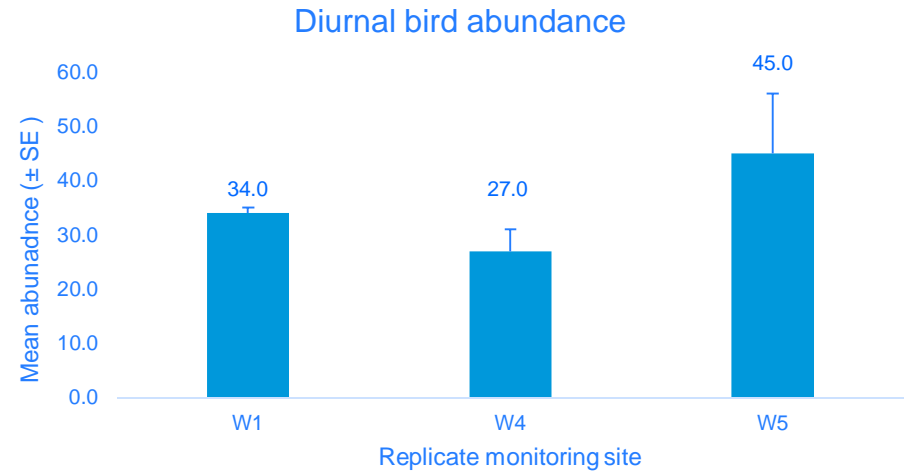
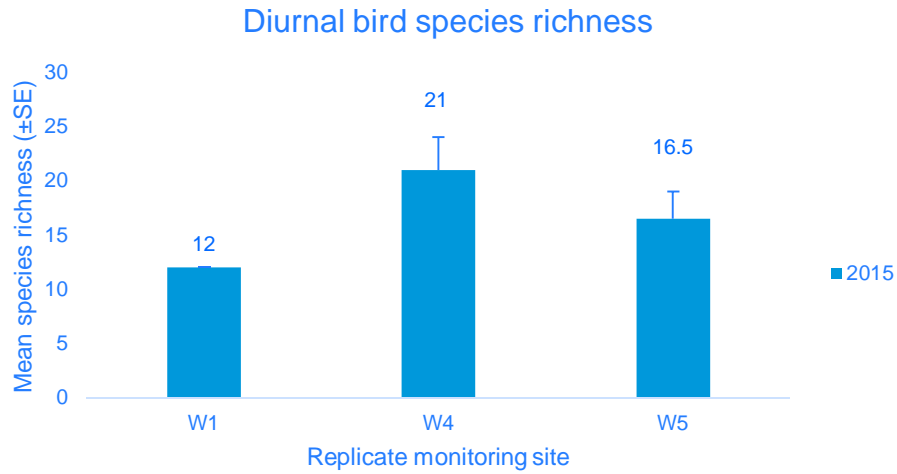
NOCTURNAL BIRDS

Nocturnal call playback and spotlighting was completed at replicate monitoring site W4. No nocturnal birds were recorded.

NOCTURNAL MAMMALS

Spotlighting was completed at replicate monitoring site W4. No nocturnal mammals were recorded therein.

Table 5.5 Wirrilah BOA habitat management zone – 2015 baseline fauna monitoring



5.3 Habitat restoration zones

5.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Wirrilah BOA habitat restoration zones were highest at Site 3 and lowest at Site 6 (Table 5.6). The differences in native species richness between these two monitoring sites is thought to be attributed to regeneration of White Cypress Pine at Site 3 and its proximity to habitat management zones. Site 3 exceeded the native species richness benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions. Site 6 however fell short of the benchmark (Table 5.6).

Native overstorey cover was generally absent from the Wirrilah habitat restoration zones. Consequently, none of the monitoring sites met the lower or upper native overstorey percentage cover benchmarks for their associated vegetation types (Table 5.6). The void of native canopy cover is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland.

Native midstorey percentage cover within the Wirrilah BOA habitat restoration zones was highest at Site 3 and absent from Site 6. Site 3 exceeded the native midstorey cover upper benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion which is thought to be attributed to the high density of White Cypress Pine regenerating at the site. Site 6 however was within the lower and upper native midstorey cover benchmark values (Table 5.6).

Native grass percentage cover within the Wirrilah BOA habitat restoration zones was highest at Site 6 and lowest at Site 3. Both monitoring sites exceeded the lower and upper native grass cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.6).

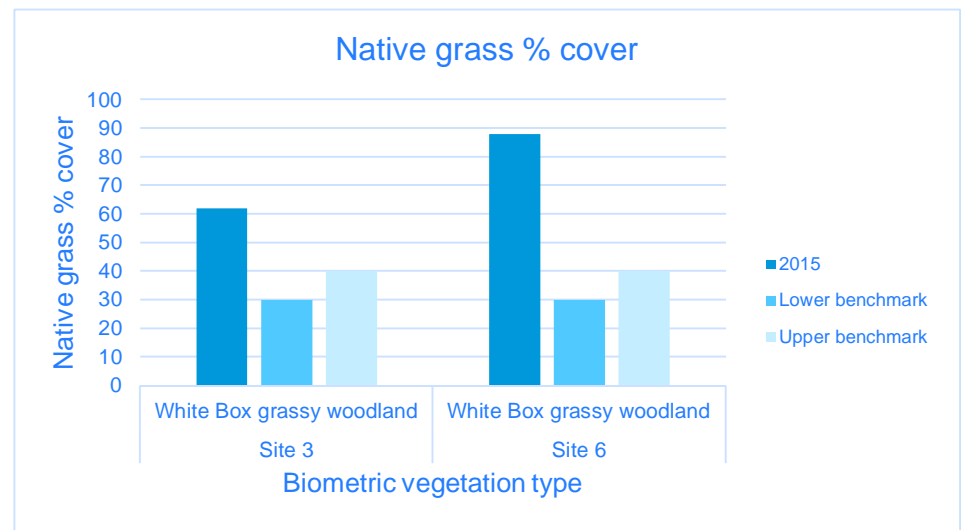
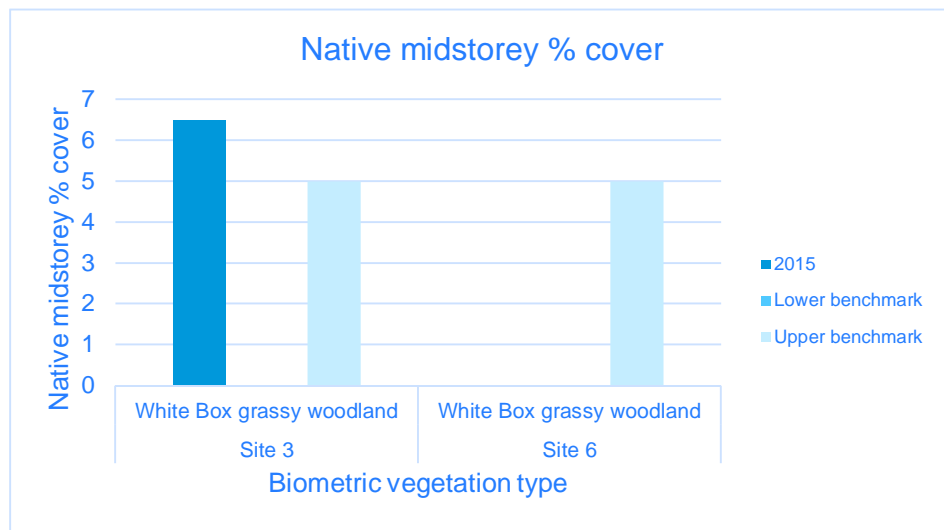
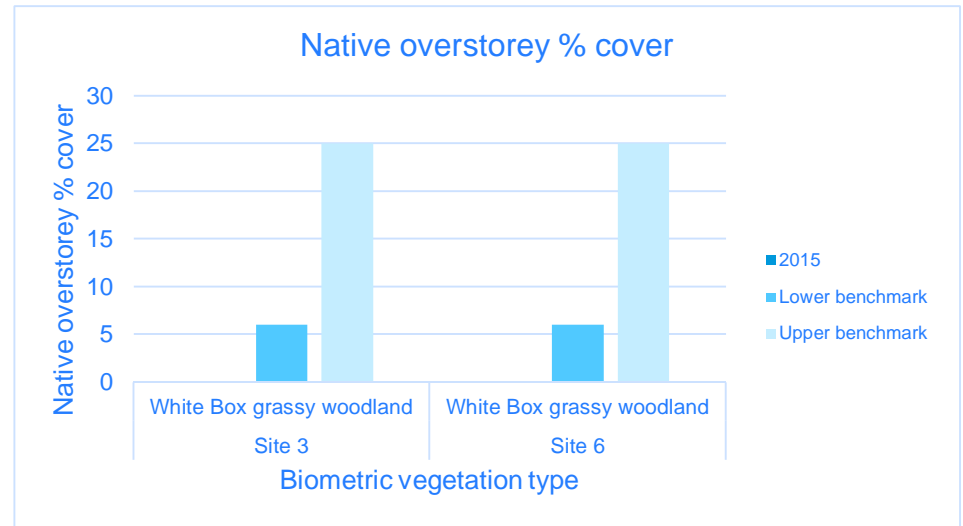
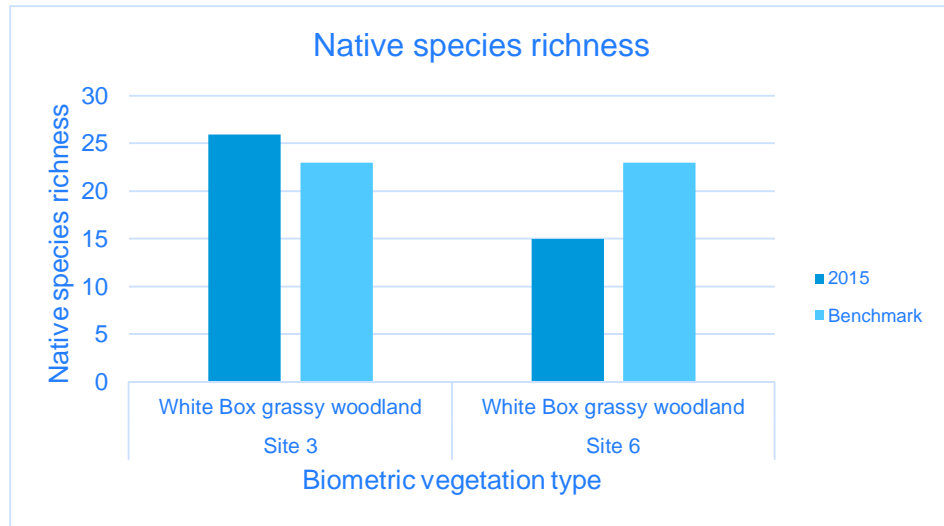
Native shrub cover within the Wirrilah BOA habitat restoration zones was highest at Site 3 and absent from Site 6 (Table 5.6). Site 3 exceeded the native midstorey cover upper benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion which is thought to be attributed to the high density of White Cypress Pine regenerating at the site. Site 6 however was within the lower and upper native grass percentage cover benchmark values (Table 5.6).

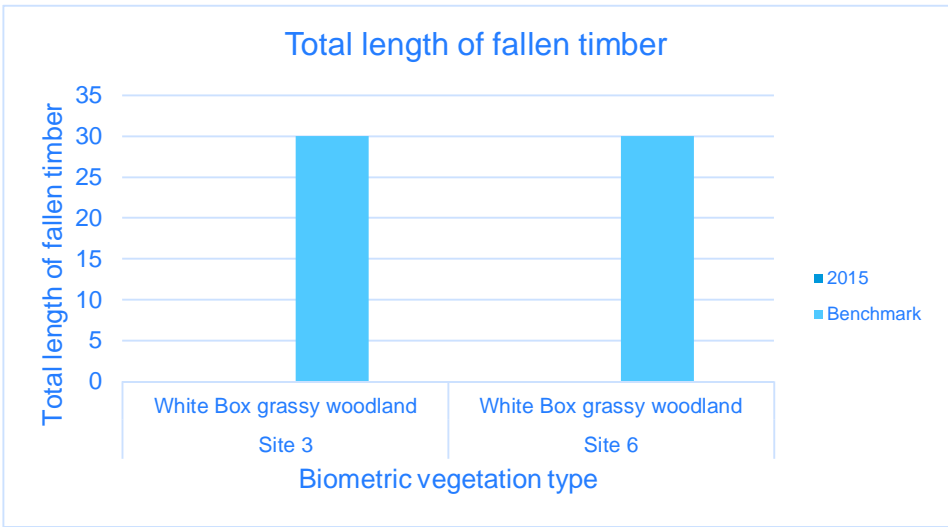
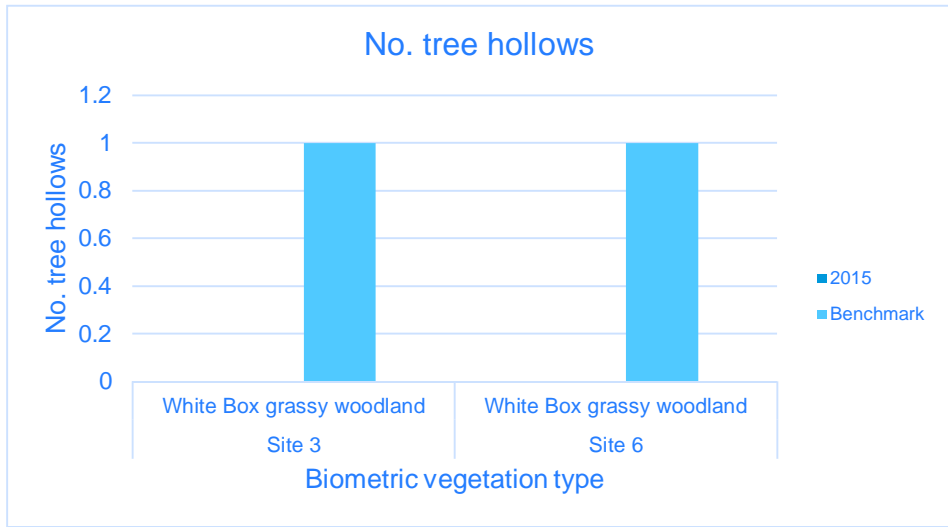
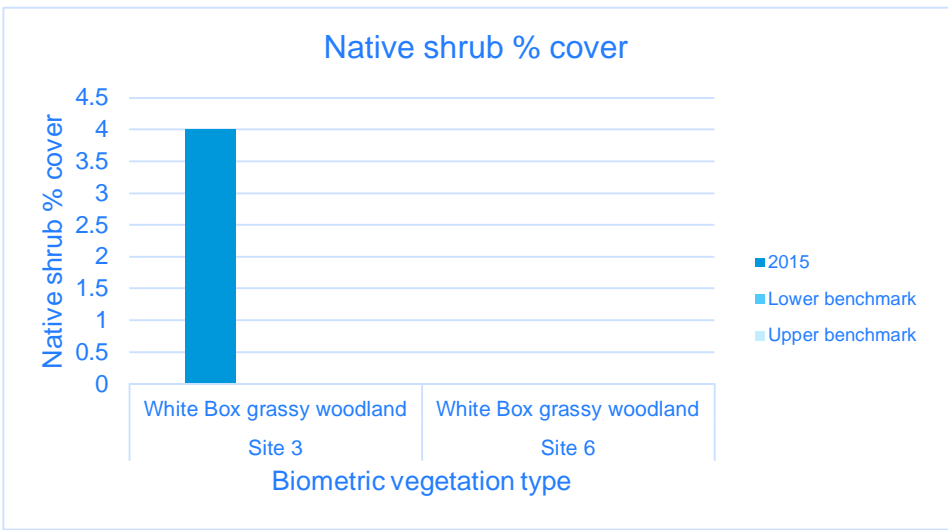
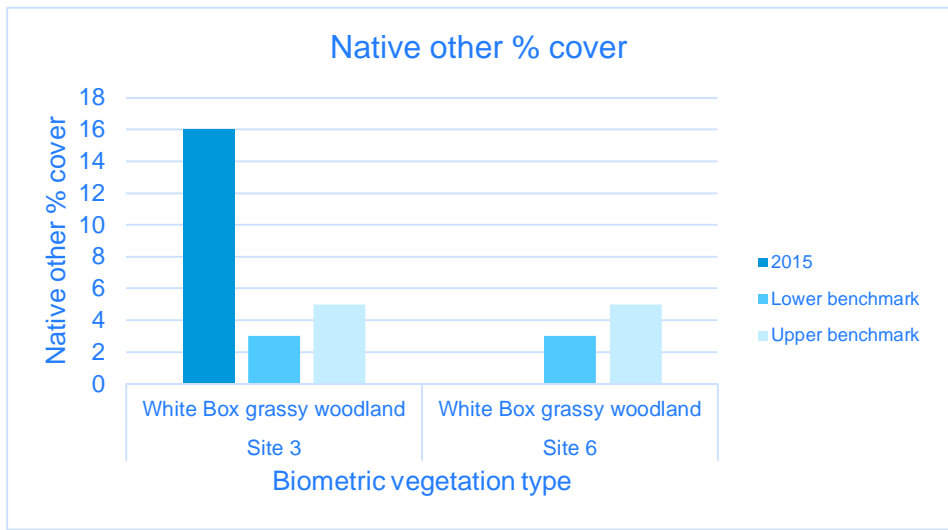
Native other percentage cover within the Wirrilah BOA habitat restoration zones was highest at Site 3 and absent from Site 6. Site 3 exceeded the lower and upper native other cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 6 however fell short of the lower benchmark value (Table 5.6).

No hollow bearing trees were recorded from within any of the Wirrilah BOA habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the hollow bearing tree benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.6). The absence of hollow bearing trees is thought to be attributed to past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland with areas showing regeneration of White Cypress Pine.

No fallen timber was recorded from within any of the Wirrilah BOA habitat restoration zone monitoring sites. Subsequently, none of the monitoring sites met the total length of fallen timber benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.6). The absence of fallen timber is thought to be attributed to past vegetation clearing and land uses which have resulted in all sites occurring as derived native grassland with areas showing regeneration of White Cypress Pine.

Table 5.6 Wirrilah BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





5.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

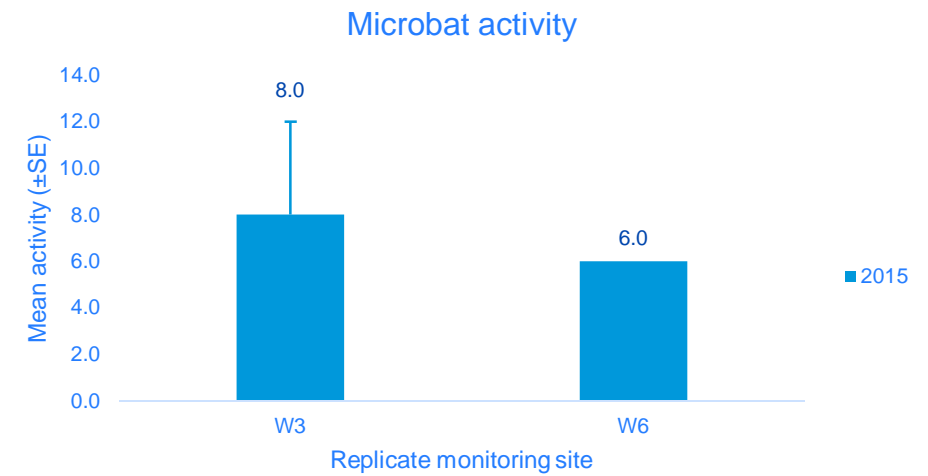
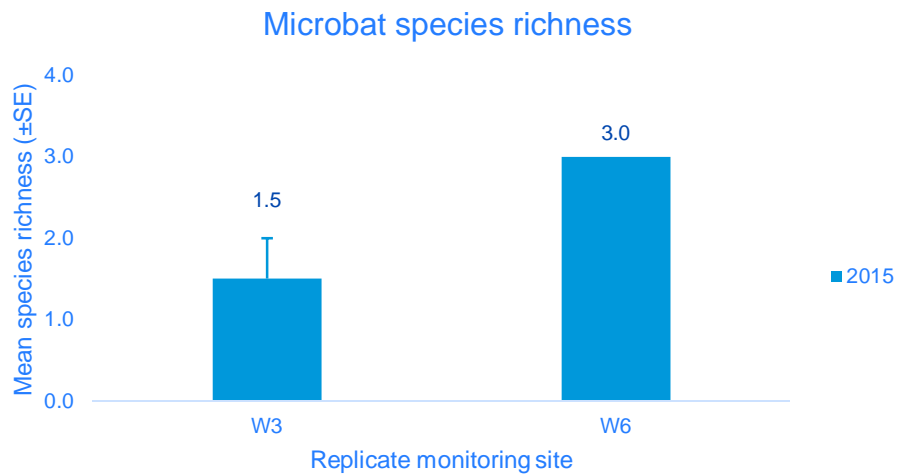
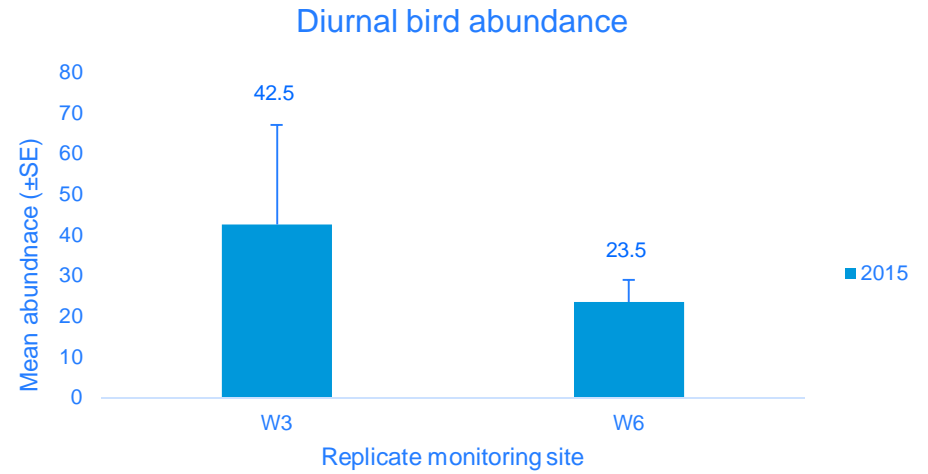
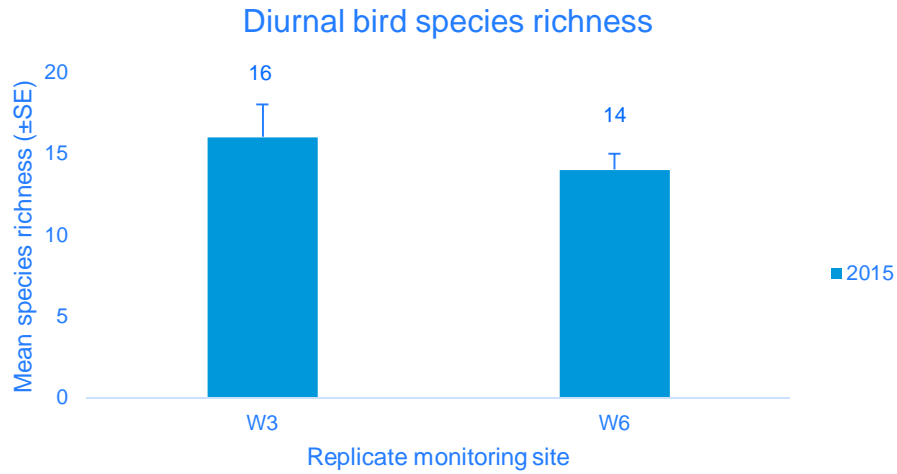
The 2015 monitoring surveys of the Wirrilah BOA identified 37 diurnal species of bird from replicate monitoring sites associated with habitat restoration zones, all of which were native species (Table D3.1 of Appendix D). One species listed as Vulnerable under the TSC Act, Grey-crowned Babbler, was recorded from White Box grassy woodland at monitoring site W3. Replicate monitoring site W3 was the most species rich site with an average of 16 species of bird recorded from duplicate surveys (Table 5.7).

The Australian Magpie, Grey Butcherbird, Galah and Australian Raven were the most widespread diurnal species of bird within habitat restoration zones of the Wirrilah BOA (Table D3.1 of Appendix D).

MICROCHIROPTERAN BATS

The 2015 monitoring surveys of the Wirrilah BOA identified five species of microbat from monitoring sites associated with habitat restoration zones (Table D3.1 of Appendix D). One species listed as Vulnerable under the TSC Act, Yellow-bellied Sheath-tail-bat, was recorded from White Box grassy woodland at monitoring site W3. Mean microbat species richness and abundance was low in habitat restoration zones, with replicate monitoring site W3 being the most species rich with an average of three species recorded from duplicate surveys (Table 5.7).

Table 5.7 Wirrilah BOA habitat restoration zone – 2015 baseline fauna monitoring



5.4 Corridor enhancement zone

5.4.1 Baseline vegetation benchmarks

Total native species richness within the Wirrilah BOA corridor enhancement zone was below the benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.8).

Native overstorey cover was absent from within the Wirrilah BOA corridor enhancement zone and therefore fell short of the lower and upper native overstorey percentage cover benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 5.8). This is attributed to the monitoring site occurring as a derived native grassland where canopy species are generally void.

Native midstorey cover was absent from within the Wirrilah BOA corridor enhancement zone and therefore fell short of the lower and upper native midstorey percentage cover benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 5.8). This is attributed to the monitoring site occurring as a derived native grassland where canopy and midstorey species are generally void.

Native grass cover within the Wirrilah BOA corridor enhancement zone exceeded the lower and upper native grassland percentage cover benchmark for the White Box grassy woodland in the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.8).

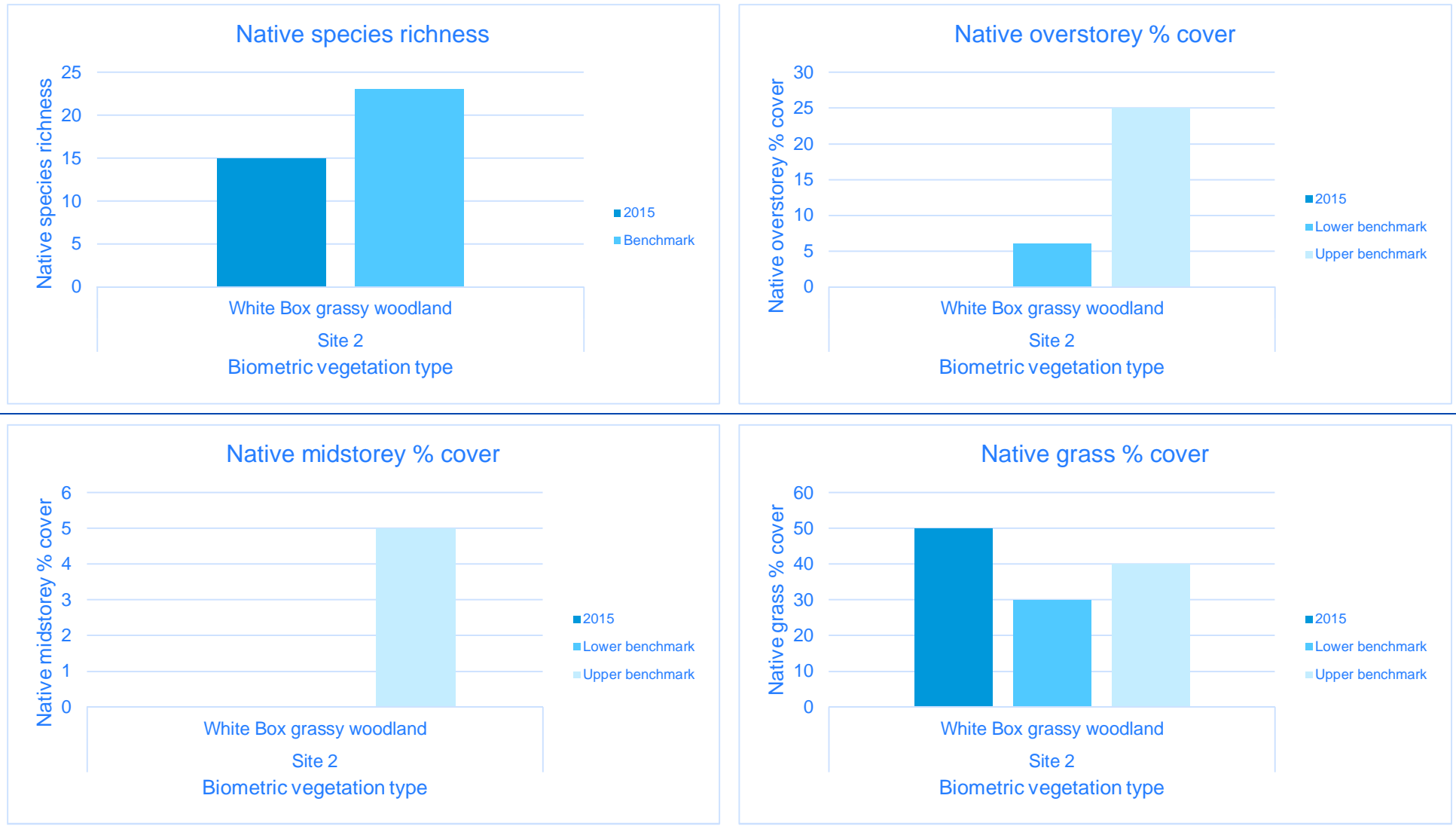
Native shrub cover was absent from within the Wirrilah BOA corridor enhancement zone. Although shrub cover was absent within the corridor enhancement zone Site 2 was within the lower and upper native shrub percentage cover benchmark values for the White Box grassy woodland in the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 5.8).

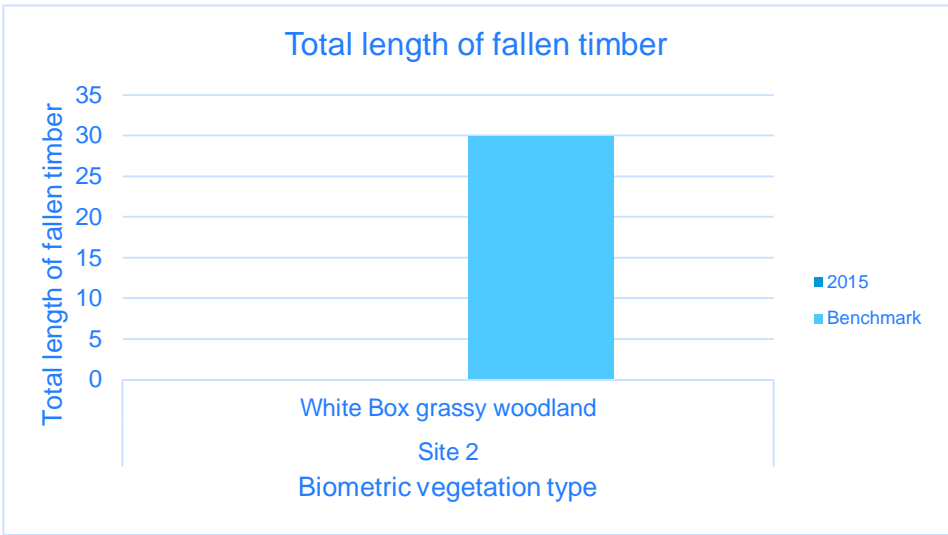
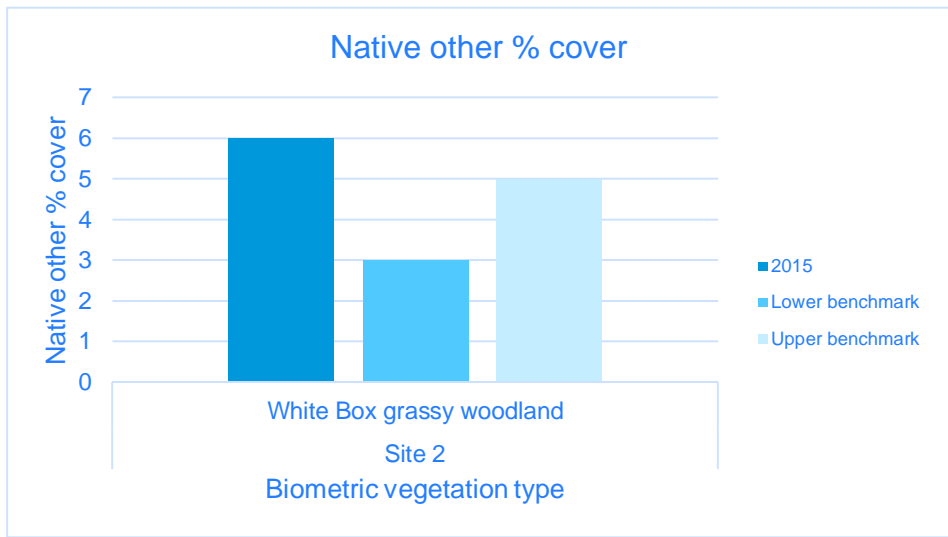
Native other cover within the Wirrilah BOA corridor enhancement zone exceeded the lower and upper native other percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.8).

No hollow bearing trees were recorded from within any of the Wirrilah BOA corridor enhancement zone (Table 5.8). Subsequently the corridor enhancement zone did not meet the hollow bearing tree benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.8). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland.

No fallen timber was recorded from within any of the Wirrilah BOA corridor enhancement zone. Subsequently the corridor enhancement zone did not meet the total length of fallen timber benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 5.8). The absence of fallen timber is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 5.8 Wirrilah BOA corridor enhancement zone – 2015 baseline vegetation attributes and benchmark data





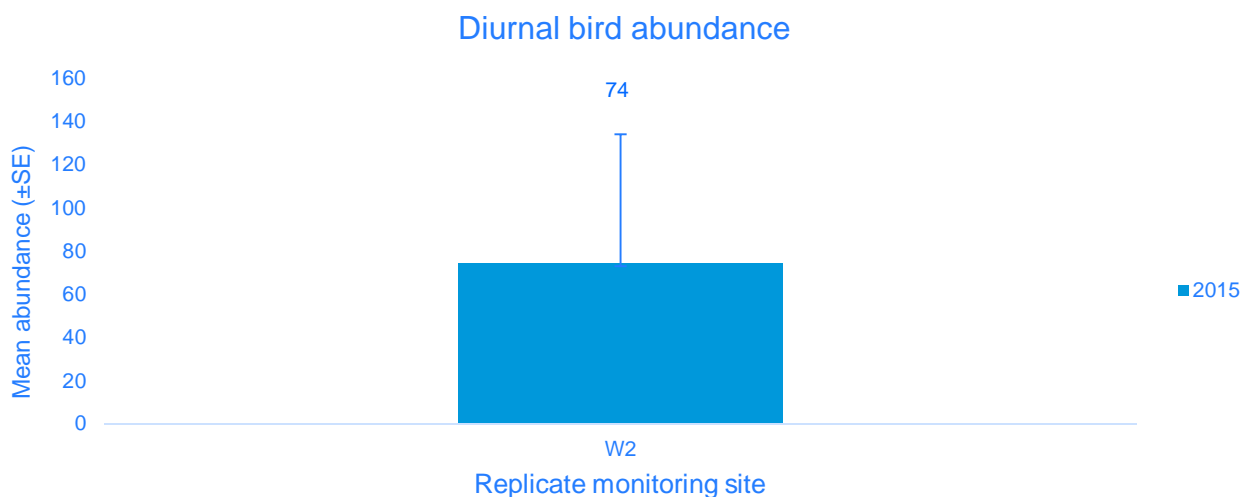
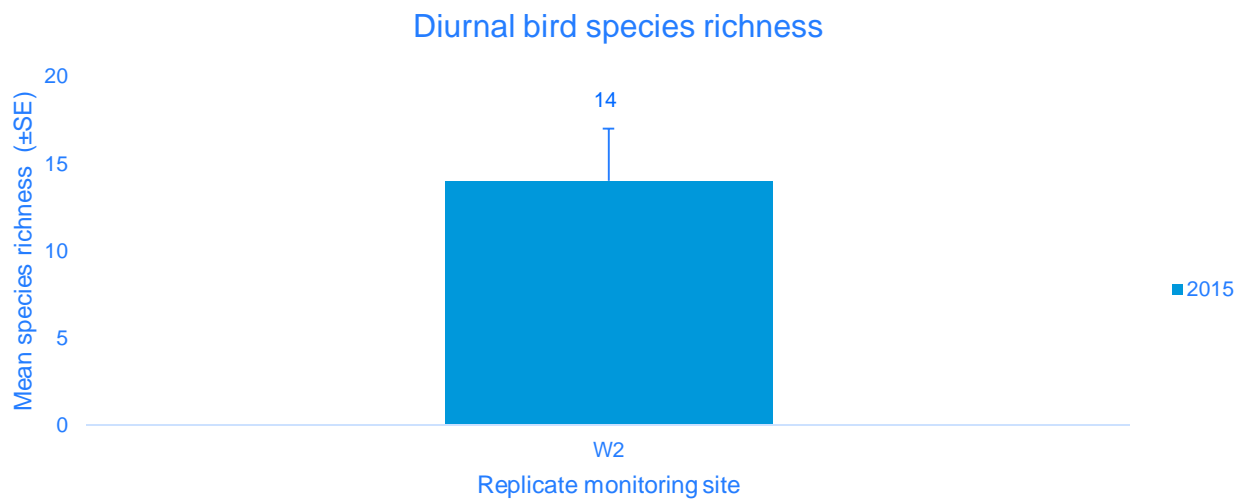
5.4.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

In the corridor enhancement zone of the Wirrilah BOA, a total 19 species of bird were recorded from replicate monitoring site W2 (Table D3.1 of Appendix D), of which two were introduced species (Common Myna and Common Starling). No threatened species of bird were recorded from the corridor enhancement zone during the 2015 monitoring session. An average diurnal bird species richness of 14 was recorded from duplicate surveys (Table 5.9).

Birds recorded from monitoring site W2 were typically open country species and species common to grassland environments, including Australian Pipit, White-winged Fairy-wren, Galah, Singing Bushlark and Magpie-lark (Table D3.1 of Appendix D).

Table 5.9 Wirrilah BOA corridor enhancement zone – 2015 baseline fauna monitoring



MICROCHIROPTERAN BATS

No data was collected from the corridor enhancement zone within the Wirrilah BOA during the 2015 baseline monitoring survey.

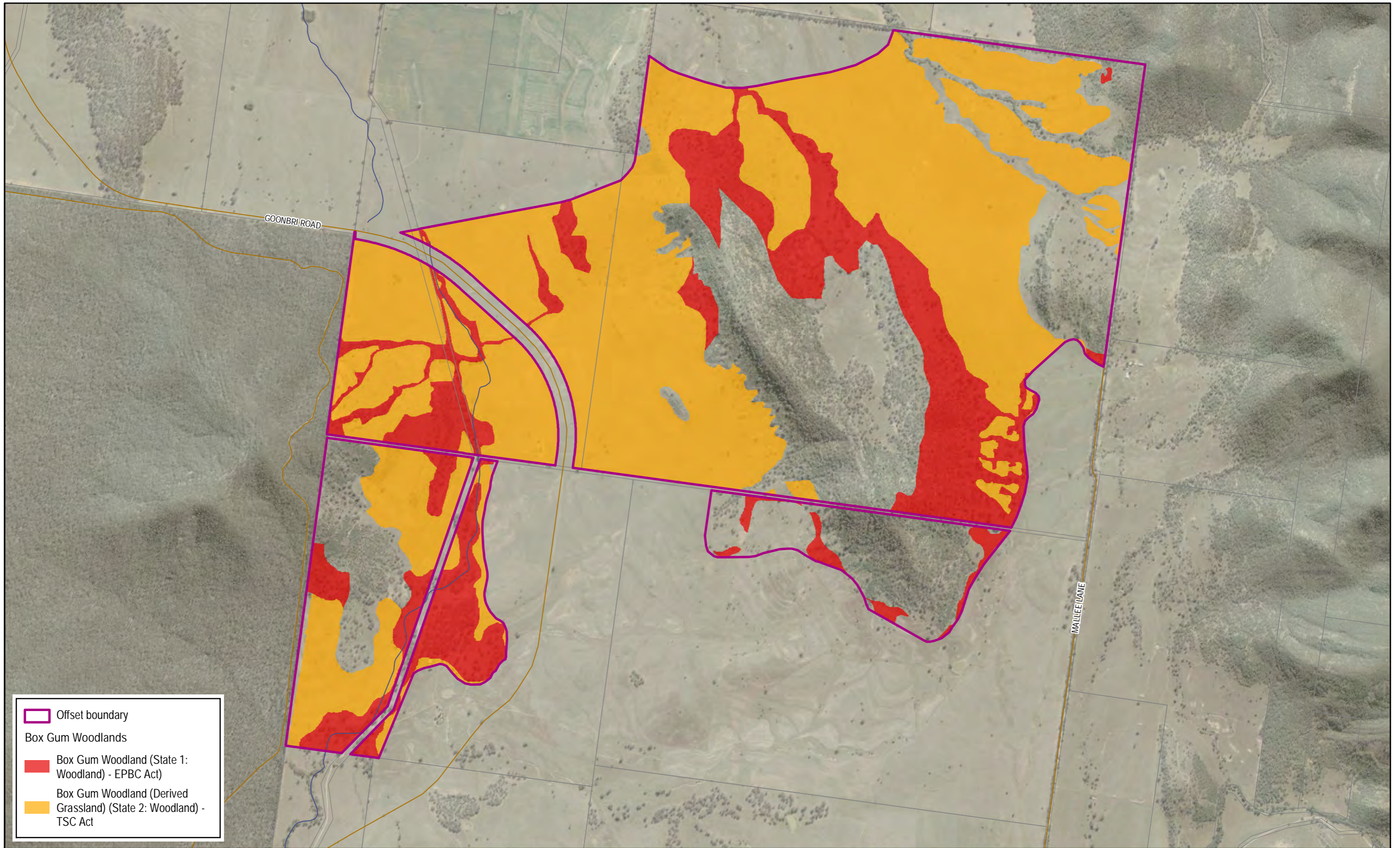
5.5 State of Box Gum Woodland




The Wirrilah BOA contains approximately 652.5 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Wirrilah BOA on lower slopes and flatter land (Figure 5.2).

Within the Wirrilah BOA the Box Gum Woodland occurs in two states:


- Box Gum Woodland – State 1: Woodland – occupies approximately 145.8 ha.
- Box Gum Woodland – State 2: Native pastures (derived native grassland) – occupies approximately 506.7 ha.


Four monitoring sites within the Wirrilah BOA (one within habitat management zone, two within habitat restoration zone and one corridor enhancement zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 5.10.



 Offset boundary
Box Gum Woodlands
 Box Gum Woodland (State 1: Woodland) - EPBC Act
 Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -





 1:20,000

Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

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Figure 5.2
Box Gum Woodland within Wirrilah BOA

Table 5.10 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Wirrilah BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage			
Habitat management zones									
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1	✓	✓		✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributes were within or above benchmark values. Dominant canopy (including hollows but no regeneration), shrub and groundcover species present however exotic species are also (5). Evidence of past firewood collection was observed on site.	
Habitat restoration zones									
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	3	X 6 below					✓	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native overstorey PFC below benchmark value. The remaining vegetation attributes are within or above benchmark values. Canopy and shrub stratum generally absent aside from regenerating White Cypress Pi (no hollows or regeneration. Native groundcover species present however exotic species are also (8). Evidence of past agricultural grazing pressures still evident. Evidence of feral herbivore grazing (pigs and goats) observed at the site.	

VEGETATION ATTRIBUTES								
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
	6	X 6 below	✓		✓	X 3 below	X 8 below	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands).</p> <p>Native overstorey PFC, native other groundcover percentage and native species richness are below benchmark values. The remaining vegetation attributes are within or above benchmark values.</p> <p>Canopy and shrub stratum absent. Native groundcover species present however exotic species are also in high numbers (14). Evidence of past agricultural grazing pressures still evident. Evidence of feral herbivore grazing (rabbits) observed on site.</p>
Corridor enhancement zone								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	2	X 6 below	✓		✓		X 8 below	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands).</p> <p>Native overstorey PFC and native species richness are below benchmark values. The remaining vegetation attributes are within or above benchmark values.</p> <p>Canopy and shrub stratum absent (no hollows or regeneration). Native groundcover species present however exotic species are also in high numbers (16). Evidence of past agricultural grazing pressures still evident. Evidence of feral herbivore grazing also present (rabbits) observed on site.</p>

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

6 MYALL PLAINS BOA – BASELINE RESULTS

6.1 Introduction

The Myall Plains property encompasses an area of 480.5 ha and is located approximately 8 km north-west of the Project. The Myall Plains property lies within the Nandewar Range and forms the north-east corner of the Regional East-West Wildlife Corridor. The property supports woodland habitats in relatively good condition.

The vegetation and management zones within the Myall Plains BOA are illustrated in Figure 6.1.

6.1.1 Flora

100 plant species were recorded within the Myall Plains BOA during the 2015 monitoring session. Of these, 80 (80%) were native and 20 (20%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 15 species followed by Asteraceae with 21 species. No threatened plant species were recorded.

Of the 20 exotic species that were recorded in the Myall Plains BOA, *Opuntia stricta* (Prickly Pear) was the only species of plant listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area (Table 6.1). No exotic species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2015). Other highly invasive species that occurred abundantly within the Myall Plains BOA included *Medicago polymorpha** (Burr Medic), *Centaurea melitensis** (Cockspur Thistle), *Centaurea calcitrapa** (Star Thistle) and *Hypochaeris radicata** (Catsear).

Table 6.1 Noxious weeds recorded within the Myall Plains BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Prickly Pear	<i>Opuntia stricta</i>	4	No

No threatened flora species were recorded within the Myall Plains BOA.

6.1.2 Fauna

Baseline monitoring recorded 77 species of animal within the Myall Plains BOA, including 74 native species and three introduced species (Table 6.2 and Table D4.1 of Appendix D).

Table 6.2 Summary of terrestrial animal species identified in the Myall Plains BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	63	-
Microbats	9	-
Mammals (other)	2	3
Total	74	3

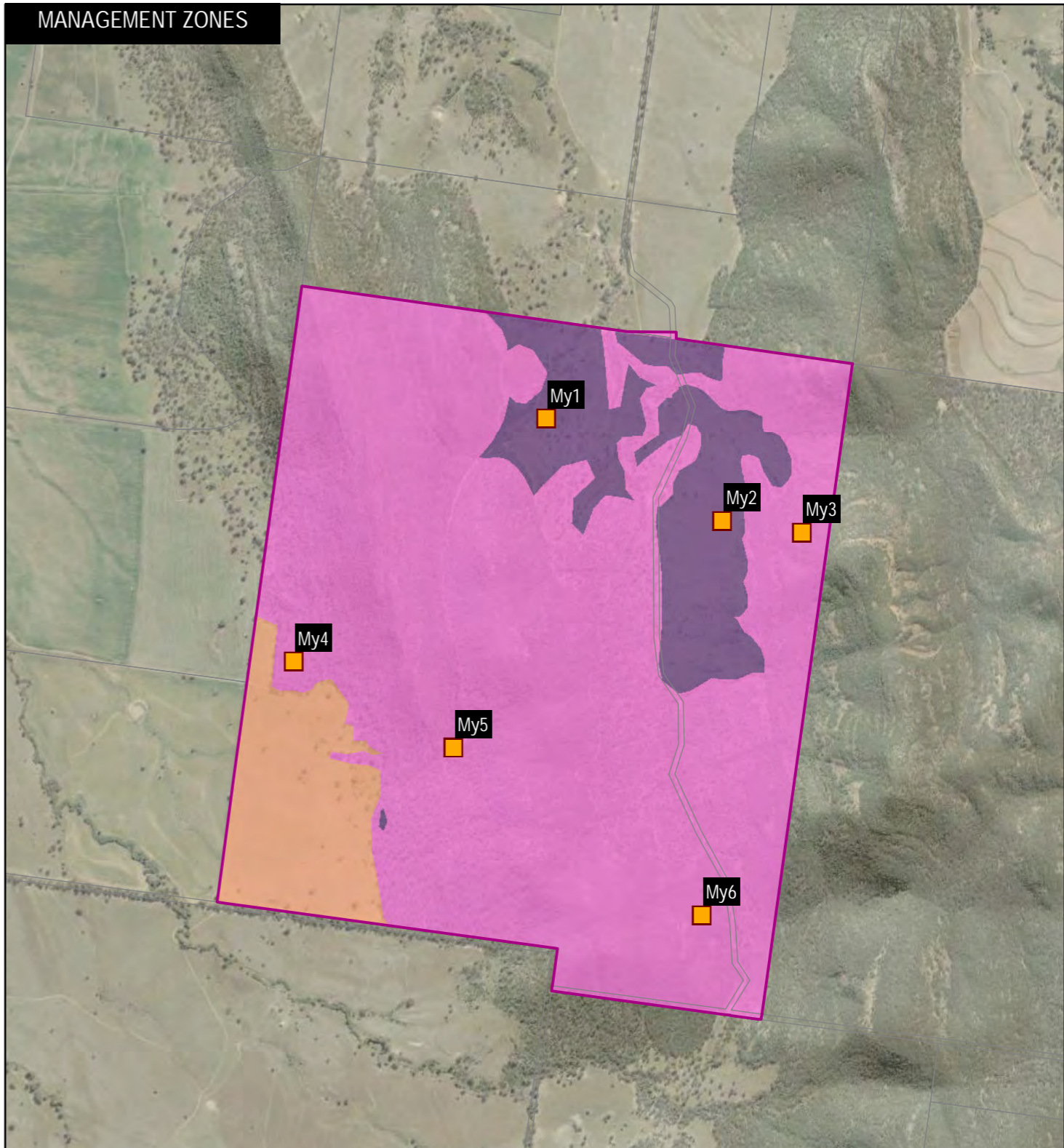
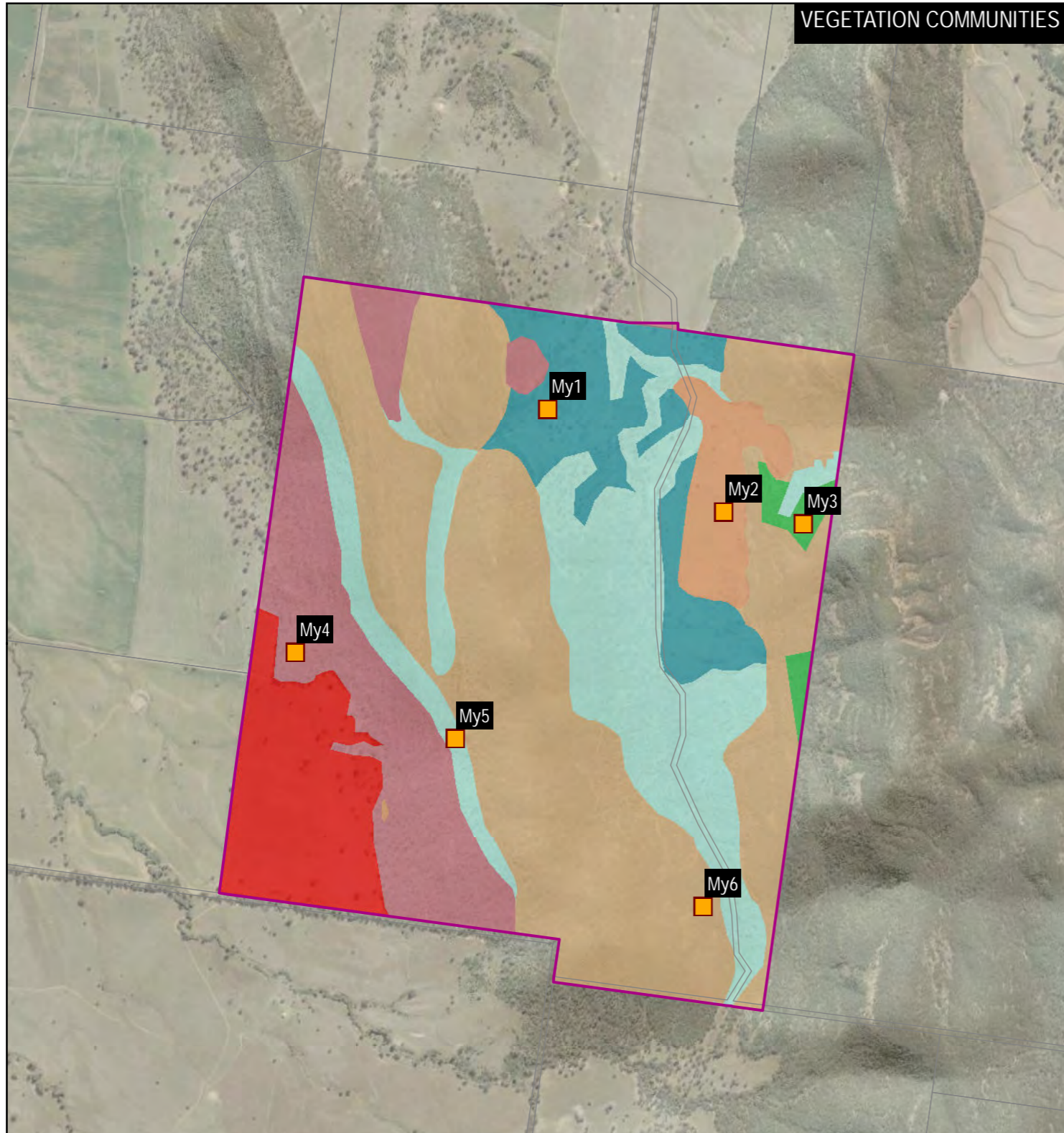
A total of six threatened species were recorded in the Myall Plains BOA during the 2015 baseline monitoring session (Table 6.3, Table D4.1 of Appendix D).

Table 6.3 Threatened species recorded in the Myall Plains BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	-	V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Turquoise Parrot	<i>Neophema pulchella</i>	-	V
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Silver-leaved Ironbark heathy woodland	White Box - White Cypress Pine grassy woodland	Habitat management zone
Offset boundary	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	White Box - White Cypress Pine grassy woodland (Low condition)	Habitat restoration zone
	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Low condition)	White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west	Other land for agriculture zone
		White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west (Low condition)	

Map: 2267029A_GIS_F005_A1	Author: SuansriR		
Date: 6/06/2016	Approved by: -		
Data source: © Land and Property Information 2015 Copyright © 2014 Esri		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	

BIODIVERSITY OFFSET MONITORING

Figure 6.1
Vegetation communities and management zones
- Myall Plains BOA

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6.2 Habitat management zones

6.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Myall Plain BOA habitat management zones was highest at Site 4 and lowest at Site 3. All monitoring sites within the Myall Plains BOA habitat management zones exceeded the native species richness benchmark values for their associated vegetation types (Table 6.4).

Native overstorey cover within the Myall Plains BOA habitat management zones was highest at Site 5 and lowest at Site 3. Monitoring sites 4, 5 and 6 either exceeded or were within the lower and upper native overstorey percentage cover benchmark values for their associated vegetation types. Site 3 however fell short of the lower benchmark values for White Cypress Pine – Silver-leaved Ironbark – Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 6.4).

Native midstorey percentage cover within the Myall Plains BOA habitat management zones was highest at Site 5 and lowest at Site 3. All monitoring sites within the Myall Plains BOA habitat management zones were either within or exceeded the lower and upper native midstorey percentage cover benchmark values for their associated vegetation types (Table 6.4).

Native grass percentage cover within the Myall Plains BOA habitat management zones was highest at Site 6 and lowest at Site 3. All monitoring sites within the Myall Plains BOA habitat management zones were either within or exceeded the lower and upper native grass percentage cover benchmark values for their associated vegetation types (Table 6.4).

Native shrub cover was absent from all monitoring sites within the Myall Plains BOA habitat management zones. Although native cover was absent Site 4 met the lower and upper native shrub percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. The remaining three monitoring site (sites 3, 5 and 6) however fell short of the lower benchmark values for their associated vegetation types (Table 6.4).

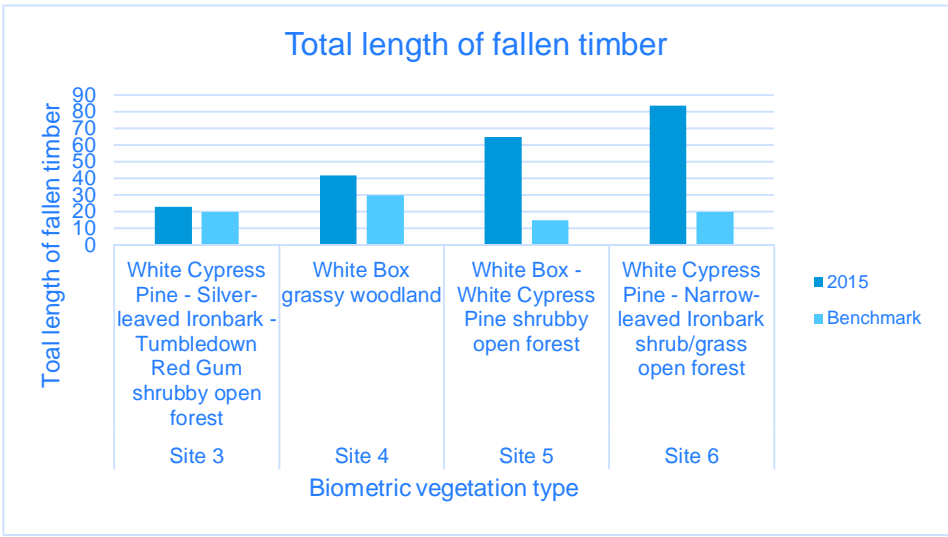
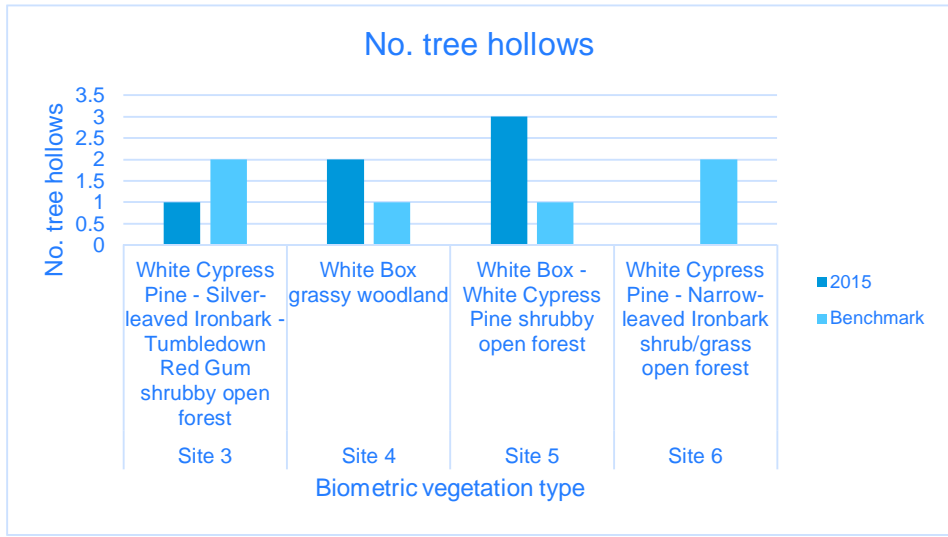
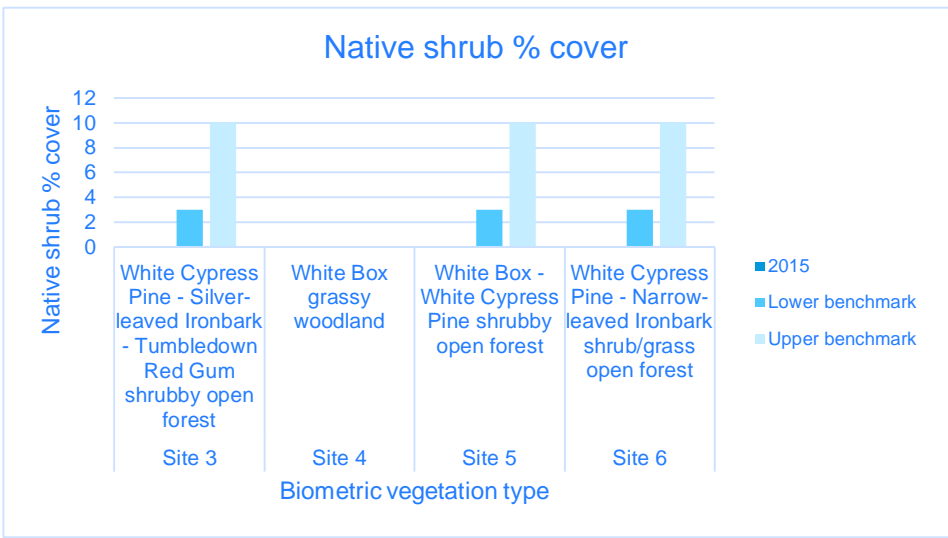
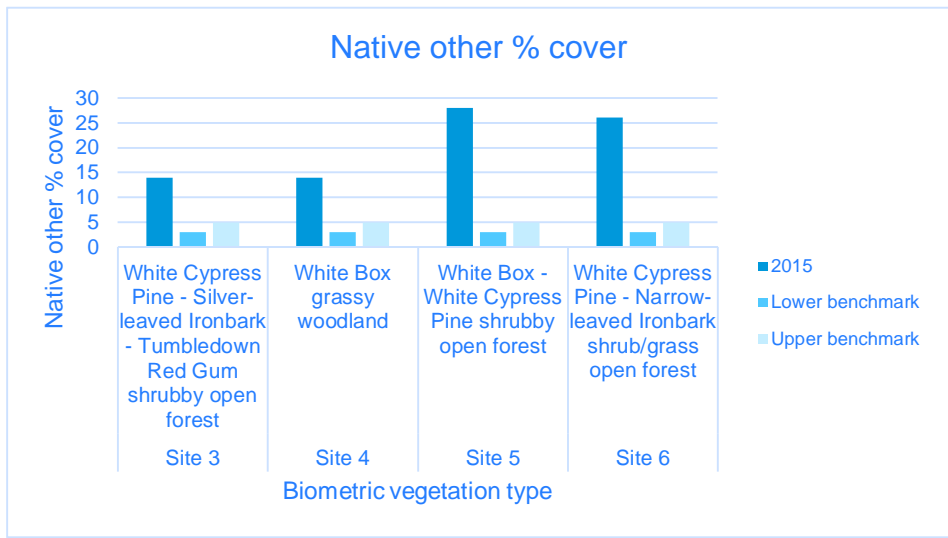
Native other percentage cover within the Myall Plains BOA habitat management zones was highest at Site 5 and lowest at Site 3 and Site 4. All monitoring sites within the Myall Plains BOA habitat management zones exceeded the native other percentage cover upper benchmark values for their associated vegetation types (Table 6.4).

The number of hollow bearing trees within the Myall Plains BOA habitat management zones were highest at Site 5 and lowest at Site 6 where no hollow bearing trees were recorded. Site 4 and Site 5 exceeded the hollow bearing tree benchmark value for their associated vegetation types. Site 3 and Site 6 however did not meet the benchmark values for their associated vegetation types (Table 6.4).

The total length of fallen timber within the Myall Plains BOA habitat management zones was highest at Site 6 and lowest at Site 3. All monitoring sites within the Myall Plains habitat management zones exceeded the length of fallen timber benchmark values for their associated vegetation types (Table 6.4).

Table 6.4 Myall Plains BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





6.2.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

During the 2015 monitoring survey a total of 44 birds were identified during standardised duplicate surveys at monitoring sites associated with habitat management zones of the Myall Plains BOA (Table D4.1 of Appendix D). Three species listed as Vulnerable under the TSC Act, Brown Treecreeper, Speckled Warbler and Turquoise Parrot, were recorded from habitat management zones of the Myall Plains BOA. Replicate monitoring site My4, which is associated with high quality White Box grassy woodland on fertile soils retained the highest usage by threatened species, with Brown Treecreeper, Speckled Warbler and Turquoise Parrot all recorded therein. Furthermore, diurnal bird species richness was highest at monitoring site My4 with an average of 18.5 birds recorded from duplicate surveys (Table 6.5). Diurnal bird species richness was lowest at monitoring site My3, with an average of 9.5 birds returned from duplicate surveys. Monitoring site My3 is positioned in White Cypress Pine – Silver-leaved Ironbark shrubby open forest that occurs on skeletal soils on mid to lower slope; attributes that generally do not associate with a rich avifauna.

Eastern Yellow Robin, Rufous Whistler, White-throated Treecreeper and Mistletoebird were the most widespread species of bird within habitat management zones of the Myall Plains BOA (Table D4.1 of Appendix D).

MICROCHIROPTERAN BATS

A total of nine species of microbat were identified from monitoring sites associated with habitat management zones (Table D4.1 of Appendix D). Two species, listed as Vulnerable under the TSC Act, Yellow-bellied Sheath-tail-bat and Eastern False Pipistrelle, were recorded from habitat management zones. The Yellow-bellied Sheath-tail-bat was the most prominent, being recorded at each of the four monitoring site sampling habitat management zones (Table D4.1 of Appendix D). Mean microbat species richness was similar between monitoring sites and ranged from 5.5 at My3 to 7.0 at My4 and My5 (Table 6.5).

REMOTE CAMERA TRAPS

Remote motion sensing infra-red camera traps were positioned at each replicate monitoring site in the habitat management zone of the Myall Plains BOA. Two native species of animal were recorded from remote camera traps, including Australian Magpie (monitoring site My3) and Lace Monitor (monitoring site My5). One introduced species of animal, Pig, was recorded from monitoring site My3.

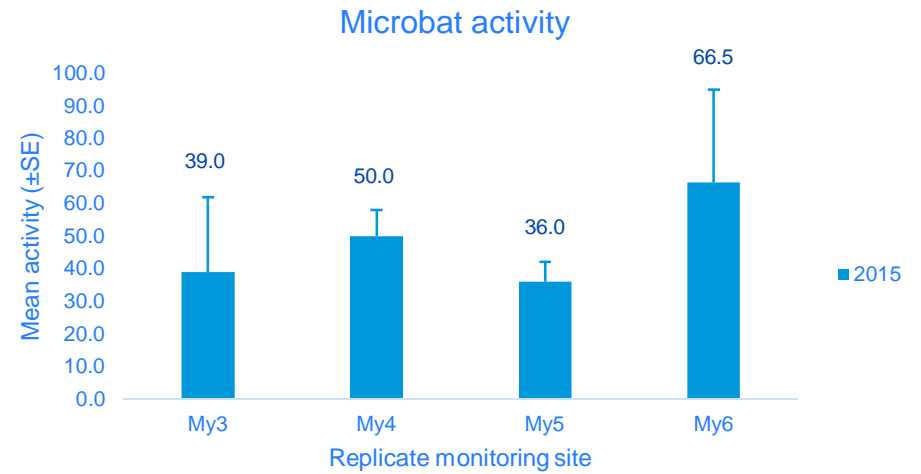
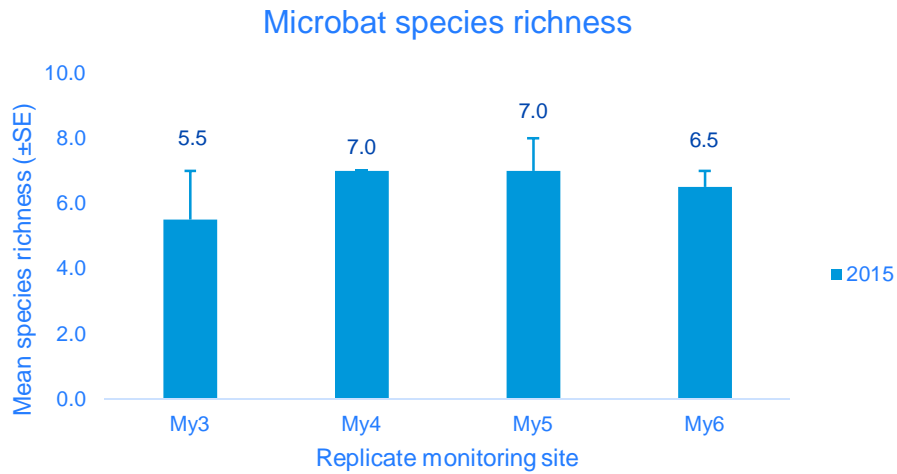
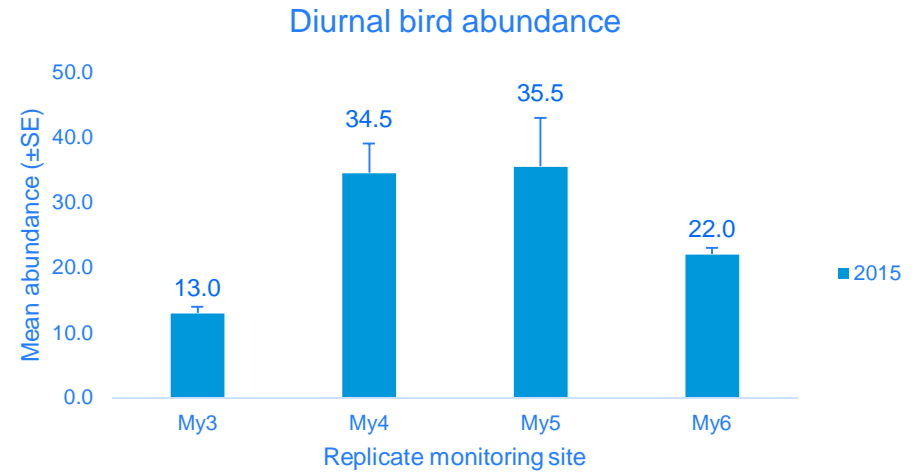
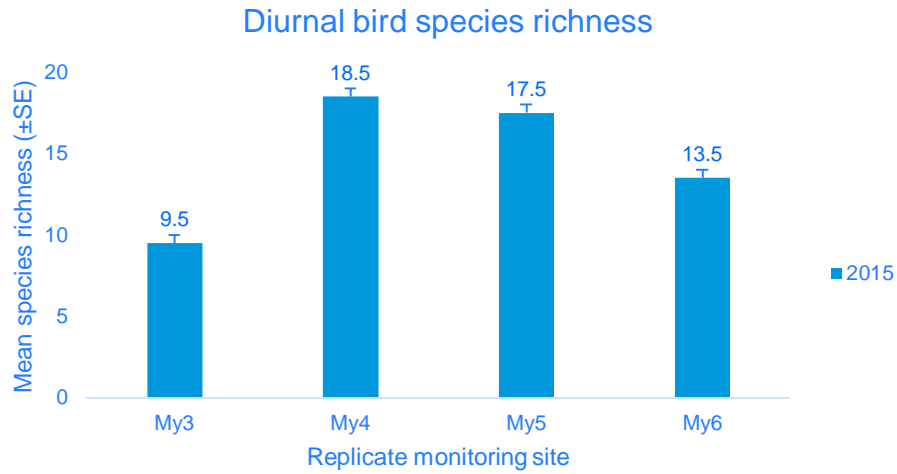
NOCTURNAL BIRDS

Nocturnal call playback and spotlighting was completed at replicate monitoring site My4 and My6. Tawny Frogmouth was recorded from monitoring site My6, whilst Australian Owlet Nightjar was recorded from both My4 and My6.

NOCTURNAL MAMMALS

Spotlighting was completed at replicate monitoring site My4 and My6. One arboreal mammal, Common Brushtail Possum, was recorded at monitoring site My6.

Table 6.5 Myall Plains BOA habitat management zone – 2015 baseline fauna monitoring



6.3 Habitat restoration zones

6.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Myall Plains BOA habitat restoration zone was highest at Site 1 and lowest at Site 2. Site 1 exceeded the native species richness benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 2 however fell short of meeting the benchmark value for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type (Table 6.6).

Native overstorey percentage cover within the Myall Plains BOA habitat restoration zone was highest at Site 1 and lowest at Site 2. Site 1 was meet the lower native overstorey percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 2 however fell short of meeting the lower benchmark value for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type (Table 6.6).

Native midstorey percentage cover within the Myall Plains BOA habitat restoration zone was highest at Site 1 and lowest at Site 2. Site 1 exceeded the upper native midstorey percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 6.6). This is thought to be attributed to the regeneration of canopy, midstorey and shub species occurring at the site. Alternatively Site 2 did not met the lower benchmark value for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type (Table 6.6) which is thought to be attributed to the absence of regeneration occurring at the site.

Native grass percentage cover within the Myall Plains BOA habitat restoration zone was highest at Site 2 and lowest at Site 1. Site 2 exceeded the lower and upper native grass percentage cover benchmark values for White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type whils Site 1 fell short of the lower benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 6.6). This is thought to be attributed to the lack of regeneration at Site 1 allowing for a higher percentage of native grass cover to occur.

Native shrub cover was absent from within the Myall Plains BOA habitat restoration zone. Although shrub cover was absent within the corridor enhancement zone Site 1 was within the lower and upper native shrub percentage cover benchmark values for the White Box grassy woodland in the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 2 however fell short of the lower benchmark value for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type (Table 6.6).

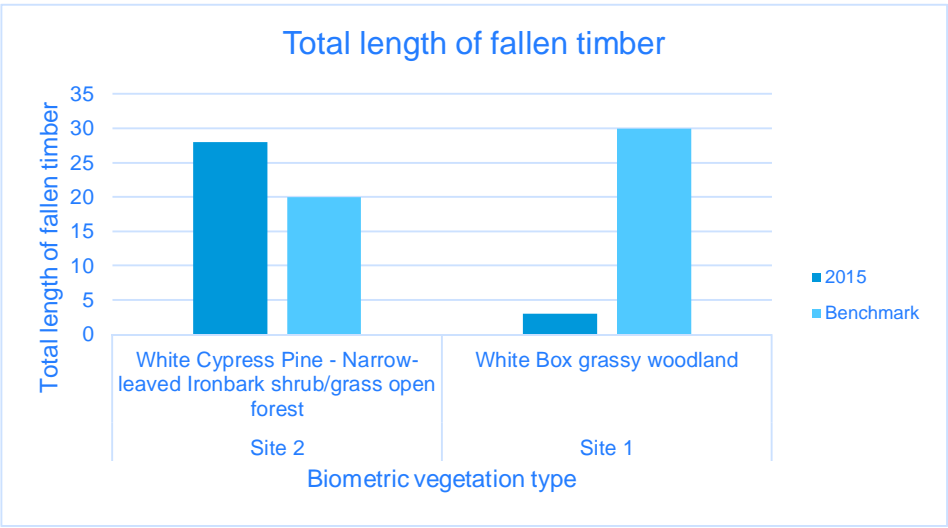
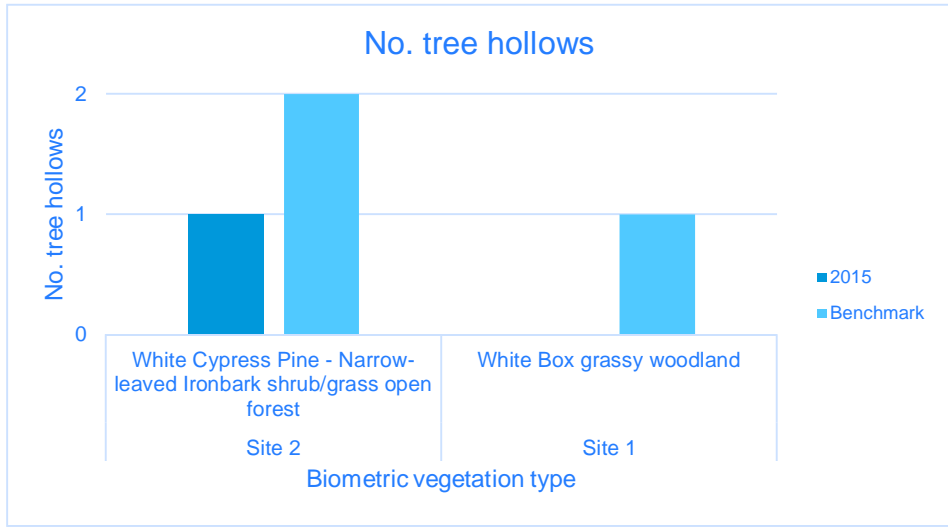
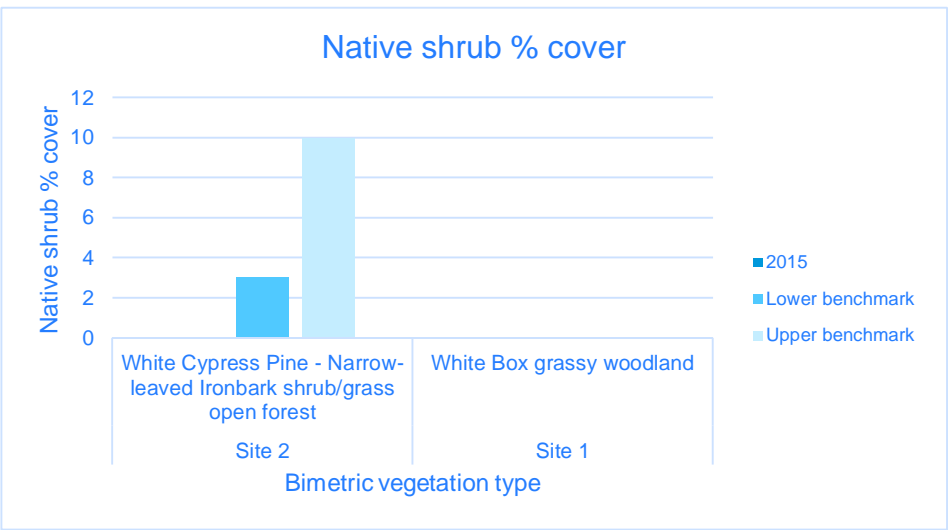
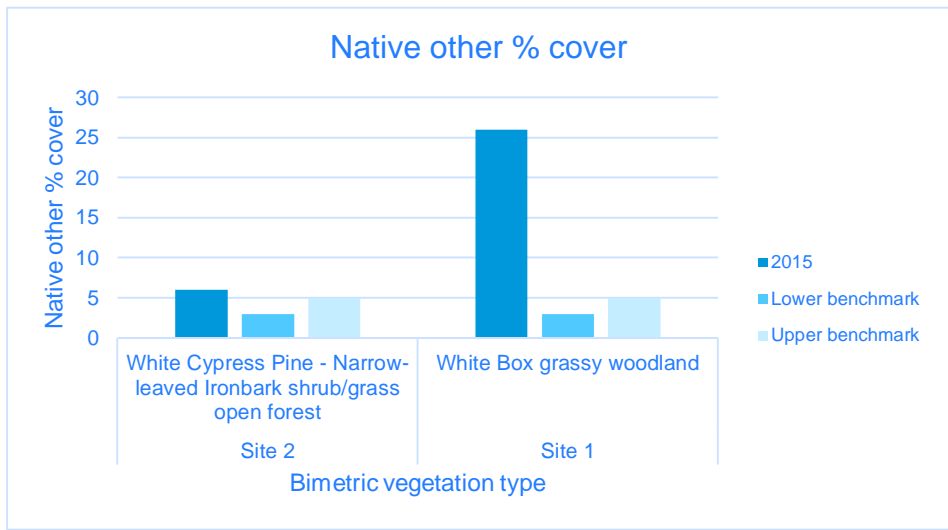
Native other percentage cover within the Myall Plains BOA habitat restoration zone was highest at Site 1 and lowest at Site 2. Both monitoring sites within the Myall Plains BOA habitat restoration zone exceeded the lower and upper native other percentage cover benchmark values for their associated vegetation types (Table 6.6).

The number of hollow bearing trees within the Myall Plains BOA habitat restoration zone was highest at Site 2 and lowest at Site 1 were no hollow bearing trees were recorded. Both monitoring sites within the Myall Plains BOA habitat restoration zones fell short of the hollow bearing tree benchmark values for their associated vegetation types (Table 6.6).

The total length of fallen timber within the Myall Plains BOA habitat management zones was highest at Site 2 and lowest as Site 1. Site 2 exceeded the total length of fallen timber benchmark values for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass forest of the western Nandewar Bioregion vegetation type. Site 1 however fell short of the benchmark value for the White Box grassy woodland in the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 6.6).

Table 6.6 Myall Plains BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





6.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

During the 2015 monitoring session of the Myall Plains BOA, a total of 34 native species of bird were identified from replicate monitoring sites associated with habitat restoration zones (Table D4.1 of Appendix D). No threatened species of bird were recorded during standardised surveys in habitat restoration zones. Replicate monitoring site My1 was the most species rich site with an average of 20.5 birds recorded during duplicate surveys (Table 6.7). This may be accounted for by a number of attributes, including a higher native plant species richness and larger percentage of native canopy and mid-storey cover (Table 6.6). Monitoring site My2 recorded a mean bird species richness of nine, however this location largely occurred as derived native grassland, with little canopy, mid-storey or shrub cover (Table 6.6).

Species commonly recorded at monitoring sites in habitat restoration zones included, Spiny-cheeked Honeyeater, Striated Pardalote, Weebill and Yellow-rumped Thornbill (Table D4.1 of Appendix D).

MICROCHIROPTERAN BATS

A total of nine species of microbat were identified from monitoring sites associated with habitat restoration zones (Table D4.1 of Appendix D). Two species, listed as Vulnerable under the TSC Act, Yellow-bellied Sheathtail-bat and Eastern False Pipistrelle, were recorded from habitat management zones. The most species rich site was My1 with a mean species richness of eight microbats recorded from duplicate surveys (Table 6.7).

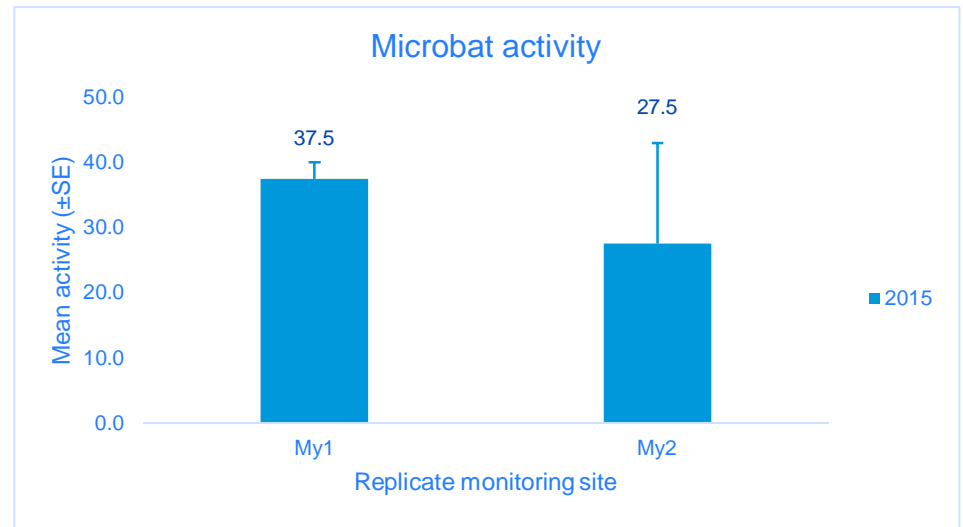
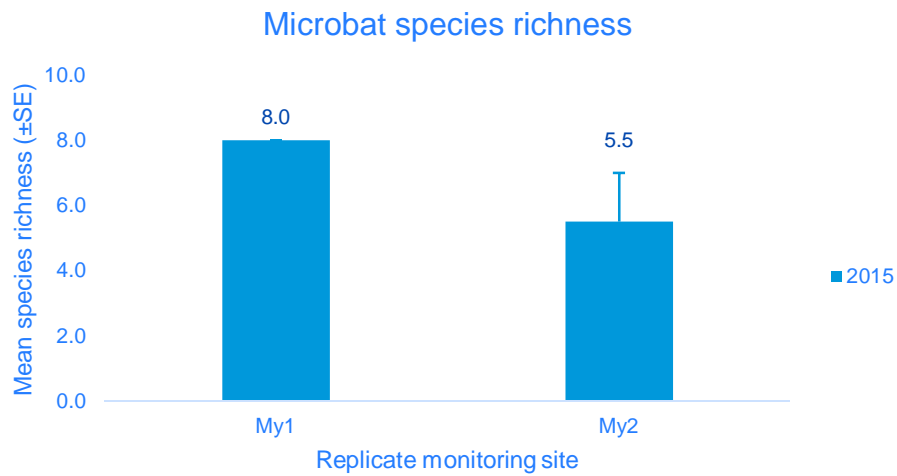
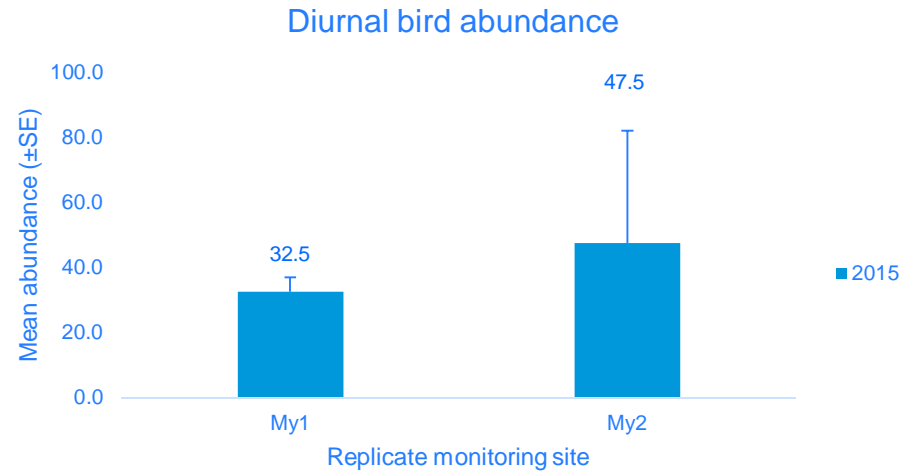
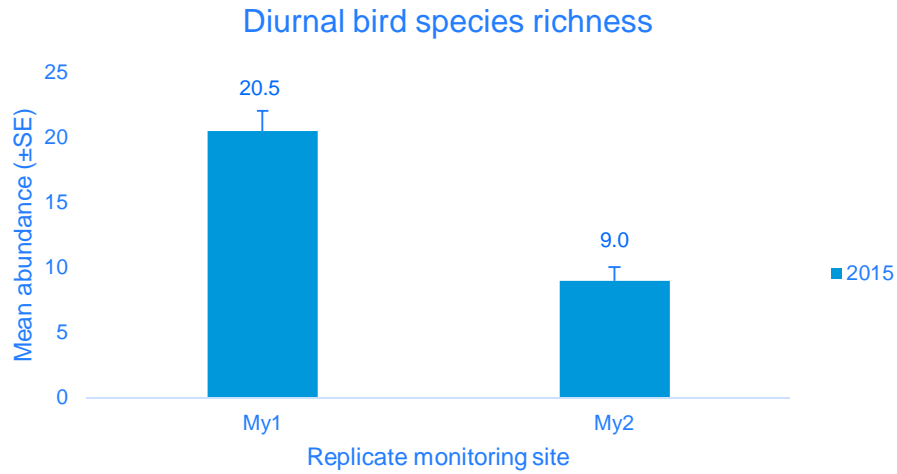
REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at each replicate monitoring site within habitat restoration zones of the Myall Plains BOA. In total, three species of animal were recorded via remote camera, including one native species (Swamp Wallaby, monitoring site My1) and one domestic species (Cow, monitoring site My2, Photo 6.1).



Photo 6.1 Cow recorded at replicate monitoring site My2

Table 6.7 Myall Plains BOA habitat restoration zone – 2015 baseline fauna monitoring



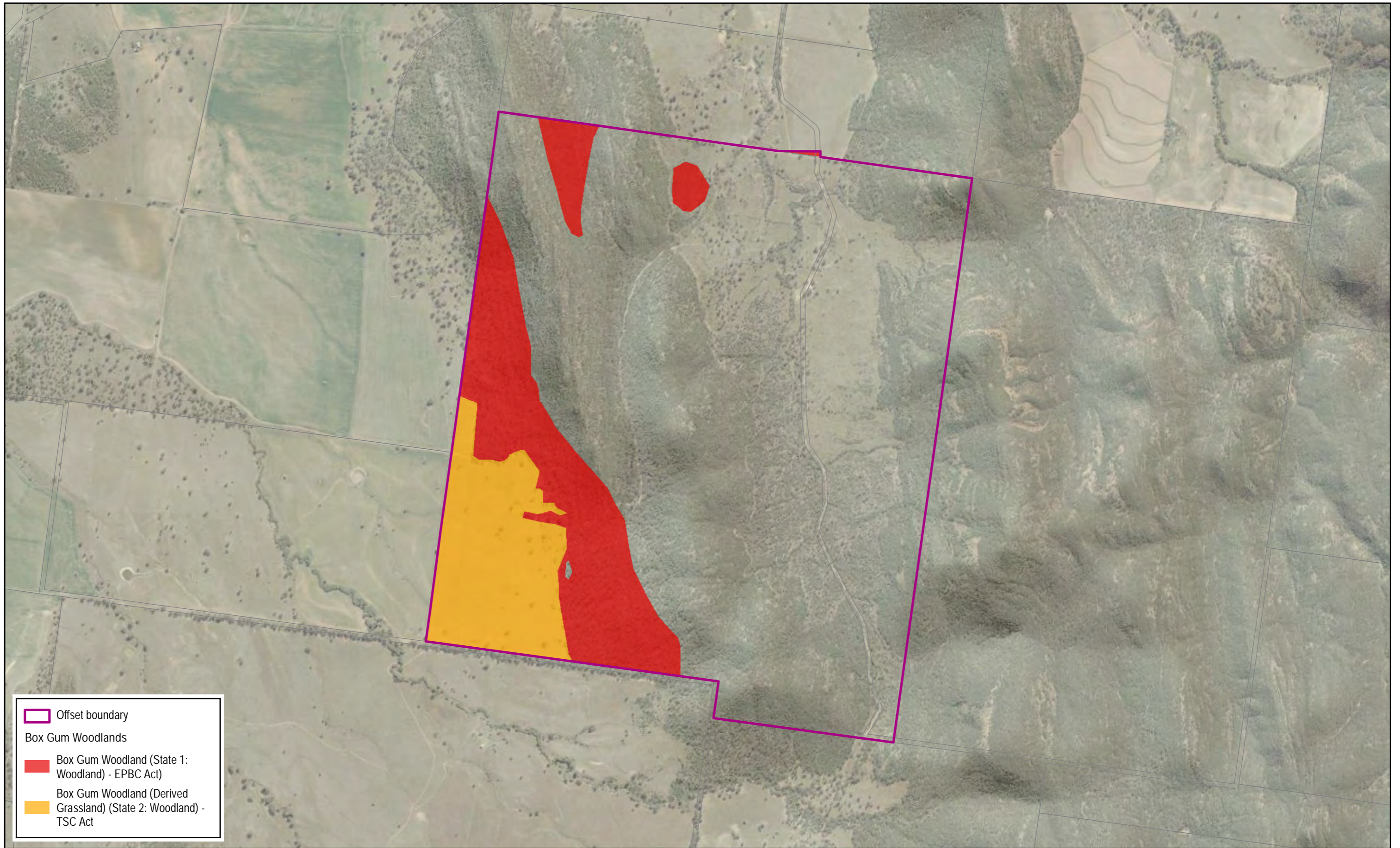
6.4 State of Box Gum Woodland




The Myall Plains BOA contains approximately 110.7 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Myall Plains BOA on lower slopes and flatter land (Figure 6.2).

Within the Myall Plains BOA the Box Gum Woodland occurs in two states:

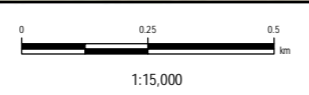
- Box Gum Woodland – State 1: Woodland – occupies 66.7 ha.
- Box Gum Woodland – State 2: Native Pastures (derived native grassland) – occupies approximately 43.9 ha.

Two monitoring sites within the Myall Plains BOA (one within habitat management zone and one within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 6.8.



	Offset boundary
Box Gum Woodlands	
	Box Gum Woodland (State 1: Woodland) - EPBC Act
	Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -



Data source: © Land and Property Information 2015
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Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 6.2
 Box Gum Woodland within Myall Plains BOA

Table 6.8 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Myall Plains BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTE						BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat management zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	4			✓	✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributes are within or exceed the benchmark values. Dominant canopy (no hollows but regeneration occurring), shrub and groundcover species present. Low number of exotic species present (2). Minor agricultural and feral herbivore grazing pressures observed on site.
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1	✓		X 2 below	✓		✓	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native groundcover grass percentage cover below benchmark value. All remaining vegetation attributes are within or above the benchmark values. Dominant canopy and shrub species showing evidence of regeneration (hollows also present). Groundcover species present however exotic species are also (10). Agricultural and feral herbivore grazing pressures observed on site.

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

7 MALLEE BOA – BASELINE RESULTS

7.1 Introduction

The Mallee property encompasses an area of 2,066.2 ha and is located approximately 8.4 km north-west of the Project. The Mallee property lies within the Nandewar Range and forms the north-east corner of the Regional East-West Wildlife Corridor. The property supports woodland habitats of good quality with very few edge effects.

The vegetation and management zones within the Mallee BOA are illustrated in Figure 7.1.

7.1.1 Flora

108 plant species were recorded within the Mallee BOA during the 2015 monitoring session. Of these, 84 (78%) were native and 24 (22%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 22 species followed by Asteraceae with 18 species. No threatened plant species were recorded.

Of the 24 exotic species that were recorded in the Mallee BOA, no species are listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area or listed as Weeds of National Significance. The Mallee BOA did however contain other highly invasive species that occurred abundantly within the Mallee BOA included *Carthamus lanatus** (Saffron Thistle), *Vulpia bromoides** (Silver Grass), *Hypochaeris radicata** (Catsear) and several *Trifolium* species* (Clover).

No threatened flora species were recorded within the Mallee BOA.

7.1.2 Fauna

Baseline monitoring recorded 80 species of animal within the Mallee BOA, including 78 native species and two introduced species (Table 7.1, and Table D5.1 of Appendix D).

Table 7.1 Summary of terrestrial animal species identified in the Mallee BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	62	-
Microbats	9	-
Mammals (non-bats)	4	2
Reptiles	2	-
Frogs	1	-
Total	78	2

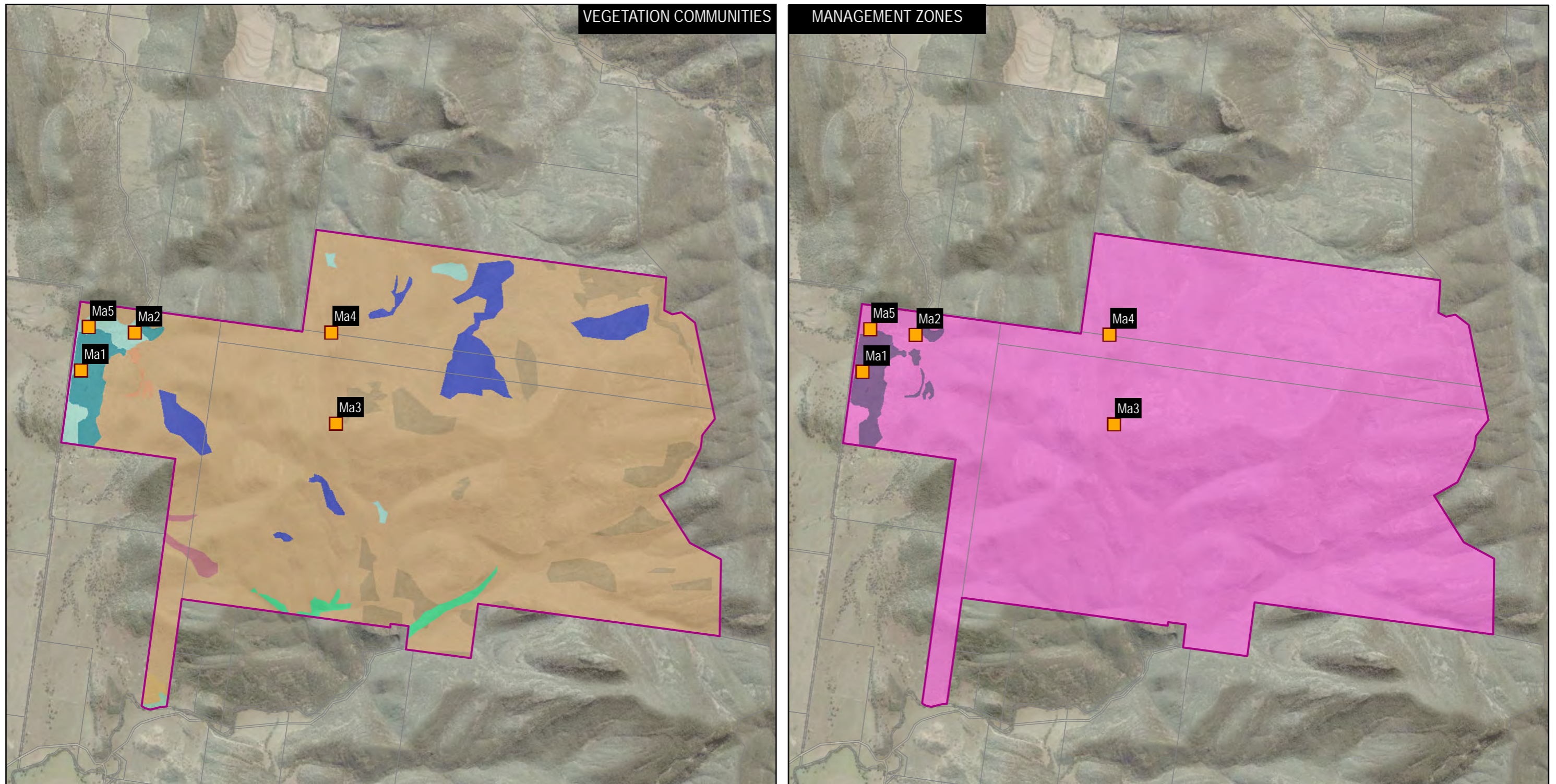
A total of six threatened species were recorded within the Mallee BOA during the 2015 baseline monitoring session (Table 7.2, Table D5.1 of Appendix D).

Table 7.2 Threatened species recorded in the Mallee BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	-	V
Varied Sittella	<i>Daphoenositta chrysoptera</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	-	V
Turquoise Parrot	<i>Neophema pulchella</i>	-	V
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

VEGETATION COMMUNITIES

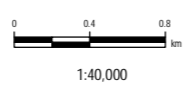
MANAGEMENT ZONES



Ecological survey locations	Vegetation community	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Low condition)	Management zones	
Offset boundary	Dwyer's Red Gum woodland	White Box - White Cypress Pine grassy woodland		Habitat management zone
	Myrtle Shrubland (+/- White Pine/Tumbledown Red Gum); Dripping Rock	White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west		Habitat restoration zone
	River Oak Riparian Open Forest; widespread	White Pine/Narrow-leaved Ironbark Shrub/Grass Open Forest; south-west (Low condition)		
	Rough-barked Apple Riparian Forb/Grass Open Forest; widespread	Yellow Box - Blakely's Red Gum grassy woodland		
	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest			

Map: 2267029A_GIS_F006_A1

Author: SuansriR



Date: 6/06/2016

Approved by: -

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Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3



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Figure 7.1
Vegetation communities and management zones
- Mallee BOA

7.2 Habitat management zones

7.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Mallee BOA habitat management zone was highest at Site 3 closely followed by Site 5 and lowest at Site 3. Site 2 and Site 5 both exceeded the native species benchmark values for their associated vegetation types. Site 3 and Site 4 however fell short of the benchmark values for their associated vegetation types (Table 7.3).

Native overstorey percentage cover within the Mallee BOA habitat management zone was highest at Site 4 and Site 5 and was lowest at Site 3. All monitoring sites within the Mallee BOA habitat management zone was within the lower and upper native overstorey percentage cover benchmark values for their associated vegetation types (Table 7.3).

Native midstorey percentage cover within the Mallee BOA habitat management zone was highest at Site 2 and lowest at the remaining three monitoring site (sites 3, 4 and 5) which all had the same native midstorey cover. All monitoring sites within the Mallee BOA habitat management zones either exceeded or were within the lower and upper native midstorey percentage cover benchmarks for their associated vegetation types (Table 7.3).

Native grass percentage cover within the Mallee BOA habitat management zones was highest at Site 2 and lowest at Site 3. All monitoring sites within the Mallee BOA habitat management zone either exceeded or were within the lower and upper native grass percentage cover benchmarks for their associated vegetation types (Table 7.3).

Native shrub cover was generally absent from the Mallee BOA habitat management zone monitoring sites except at Site 3. Site 3 and Site 3 was within the lower and upper native shrub percentage cover benchmarks for their associated vegetation types. Both Site 4 and Site 5 fell short of the lower benchmark values for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion vegetation type (Table 7.3).

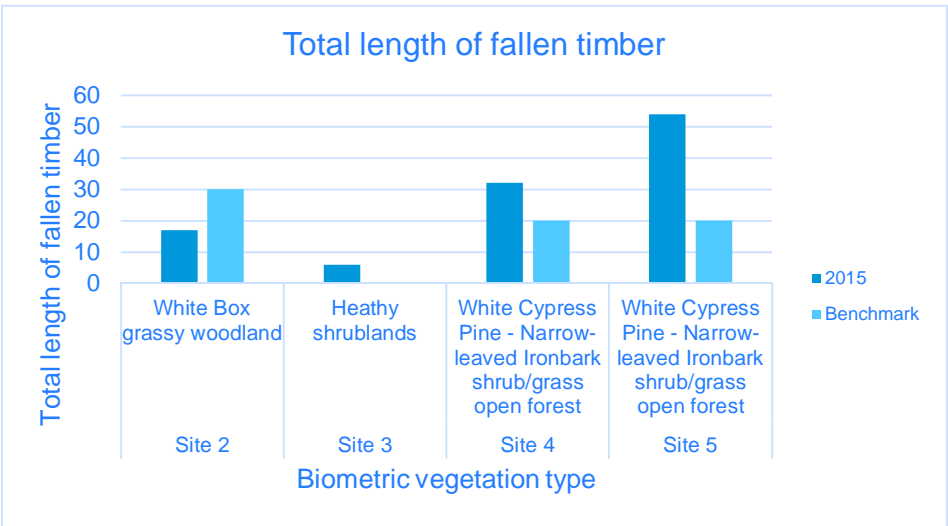
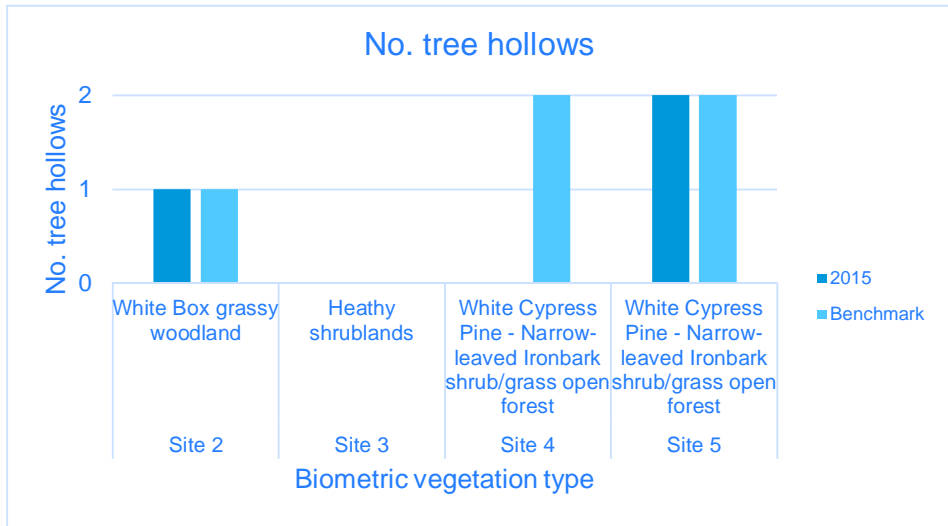
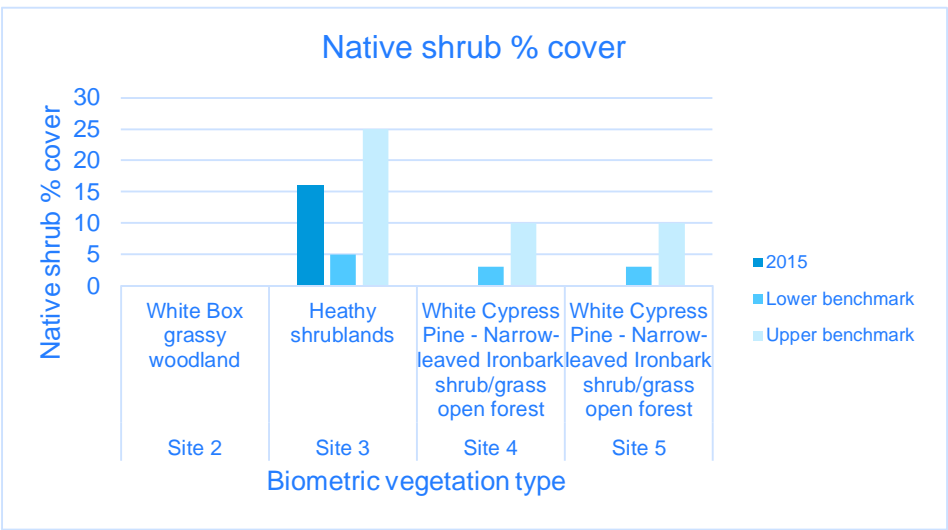
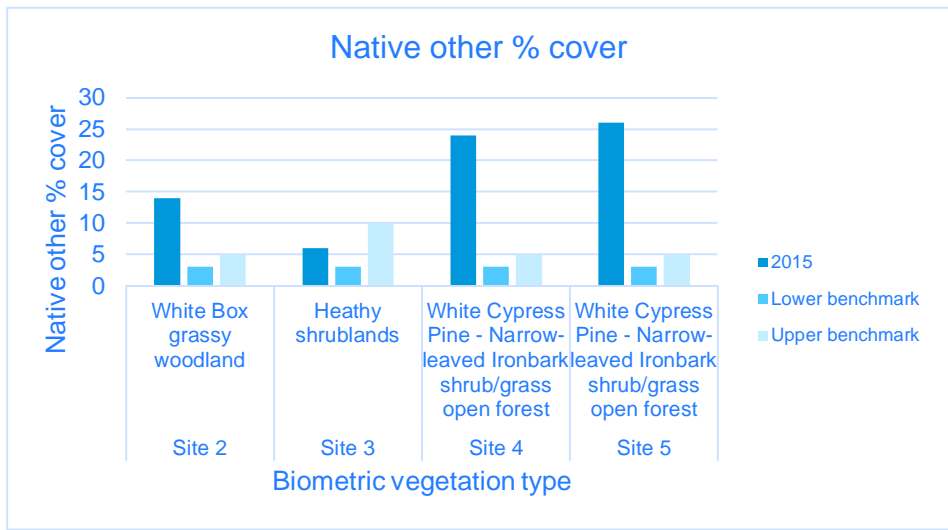
Native other percentage cover within the Mallee BOA habitat management zone was highest at Site 5 and lowest at Site 3. All monitoring sites within the Mallee BOA habitat management zones were within or exceeded the lower and upper native other percentage cover benchmark values for their associated vegetation types (Table 7.3).

The number of hollow bearing trees within the Mallee BOA habitat management zone was highest at Site 5 and lowest at Site 3 and Site 4 were no hollow bearing trees were recorded. Site 2, Site 3 and Site 5 all met the hollow bearing tree benchmark values associated with their vegetation types. Site 4 however fell short of the benchmark for the White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Table 7.3). The differences between hollow bearing trees within this vegetation type at (i.e. between Site 4 and Site 5) is thought to be attributed to previous vegetation clearing of which evidence was more prevalent at Site 4 where no hollow bearing trees were recorded.

The total length of fallen timber within the Mallee BOA habitat management zone was highest at Site 5 and lowest at Site 3. Site 3, 4 and 5 all met or exceeded the lower and upper total length of fallen timber benchmark values for their associated vegetation types. Site 2 however fell short of the lower benchmark value for White Box Grassy woodland of the Nandewar and Brigalow Belt South Bioregions (Table 7.3) which was thought to be attributed to heavier previous vegetation clearing at noted above.

Table 7.3 Mallee BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





7.2.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Diurnal bird species richness was high in habitat management zones with replicate monitoring site Ma2 recording the highest average species richness at 20.5 birds recorded from duplicate surveys (Table 7.4). Monitoring site Ma2 occurs in a mosaic of quality grassy White Box Woodland with patches of shrubby understorey with other important habitat attributes such as mistletoe prevalent. Monitoring site Ma3 occurs in heathy shrubland type habitat and returned the lowest average diurnal bird species richness at 11. Due to the presence of high quality woodland habitat associated with monitoring site Ma2 three threatened woodland birds, including Brown Treecreeper, Speckled Warbler and Turquoise Parrot were recorded therein. One other threatened species, Varied Sittella, was recorded from monitoring site Ma3.

MICROCHIROPTERAN BATS

Nine species of microbat were recorded from replicate monitoring sites associated with habitat management zones of the Mallee BOA (Table D5.1 of Appendix D). Microbats recorded largely comprised species common to the north-west slopes and plains. The most common microbats recorded, having been recorded at each monitoring site included White-striped Freetail-bat, Gould's Wattled Bat, Chocolate Wattled Bat, Little Broad-nosed Bat and Little Forest Bat (Table D6.1 of Appendix D). Mean microbat species richness was similar between replicate monitoring sites in habitat management zones and ranged from 5.5 at Ma3 to seven at Ma5 (Table 7.4). Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) ranged from an average of 130.5 passes at site Ma2 to 16 passes at site Ma3.

REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at all replicate monitoring locations within habitat management zones of the Mallee BOA. Two native species were recorded from habitat management zones including Eastern Grey Kangaroo (Photo 7.1) and Swamp Wallaby (Photo 7.2). No introduced species were recorded via remote camera traps.



Photo 7.1 Eastern Grey Kangaroo captured on remote camera at replicate monitoring location Ma2



Photo 7.2 Swamp Wallaby captured on remote camera at replicate monitoring site Ma5

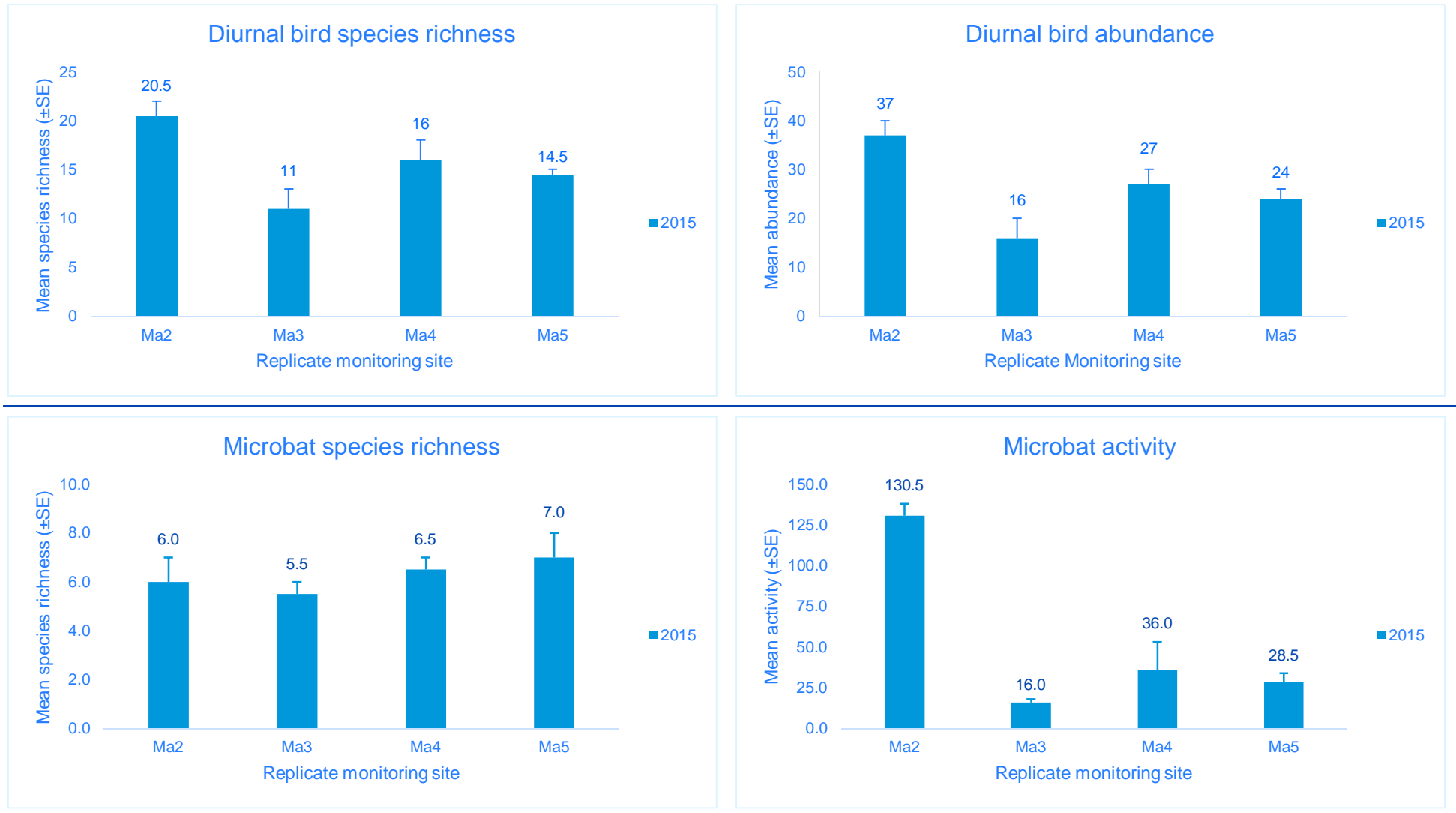
NOCTURNAL BIRDS

Nocturnal call playback and spotlighting was completed at replicate monitoring site Ma3, whereby one nocturnal bird, Australian Owlet Nightjar, was recorded therein.

NOCTURNAL MAMMALS

One spotlight event was completed at replicate monitoring site Ma3. No nocturnal mammals were recorded.

Table 7.4 Mallee BOA habitat management zone – 2015 fauna monitoring



7.3 Habitat restoration zones

7.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Mallee BOA habitat management zone fell short of the native species benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5).

Native overstorey cover within the Mallee BOA habitat restoration zone was absent and consequently fell short of the lower native overstorey percentage cover benchmark for the White Box grassy Woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5). This is attributed to the monitoring site occurring as a derived native grassland where canopy species are generally void.

Native midstorey cover within the Mallee BOA habitat restoration zone exceeded the upper native midstorey percentage cover benchmark for the White Box grassy Woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5).

Native grass cover within the Mallee BOA habitat restoration zone was within the lower and upper native grass percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5).

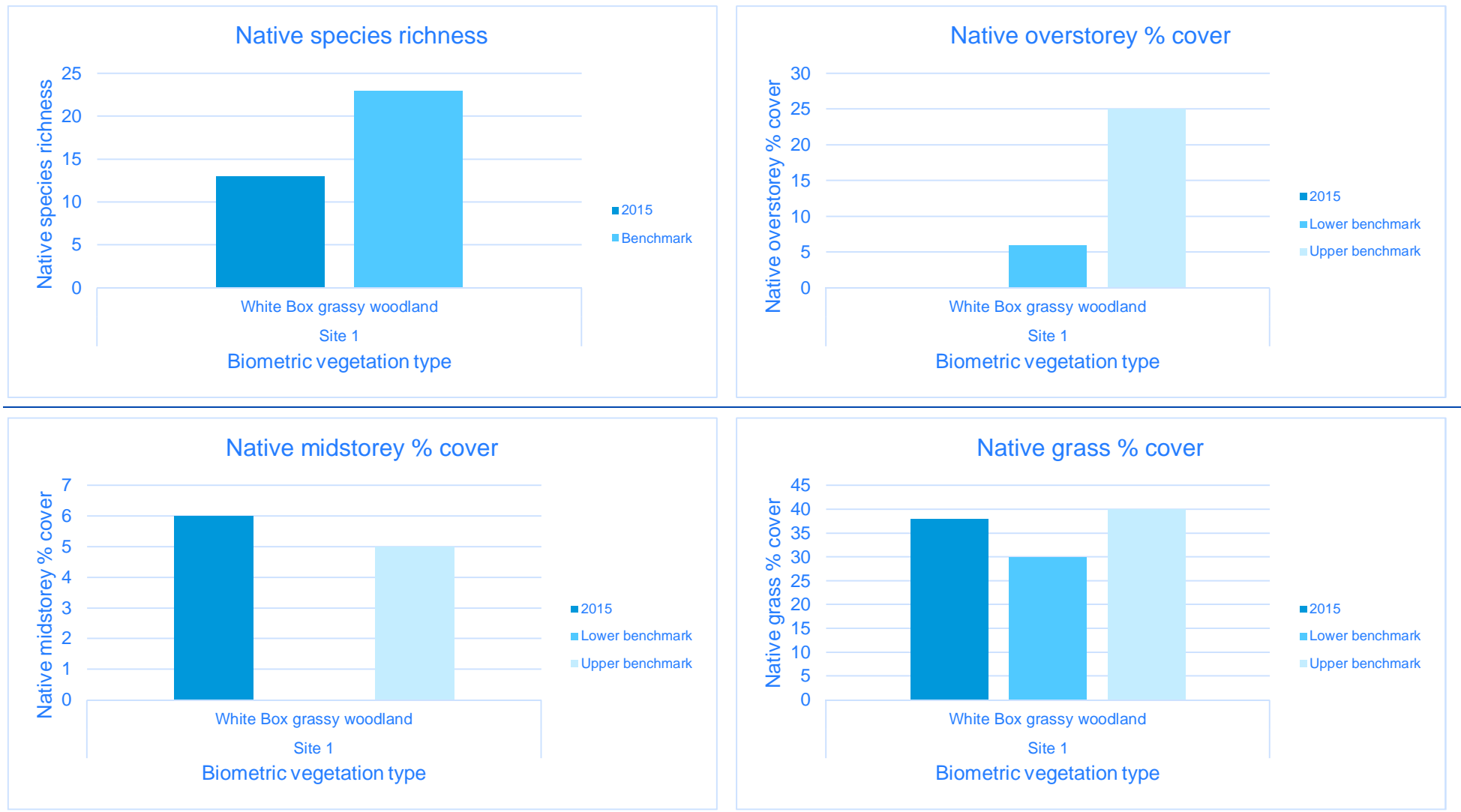
Native shrub cover was absent within the Mallee BOA habitat restoration zone. Although native shrub cover was absent Site 1 was within the lower and upper native shrub percentage cover benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5).

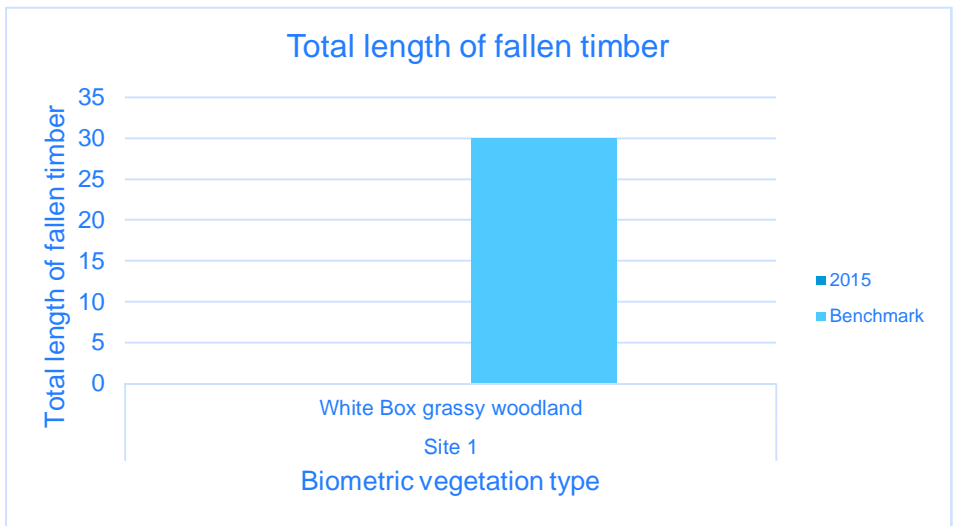
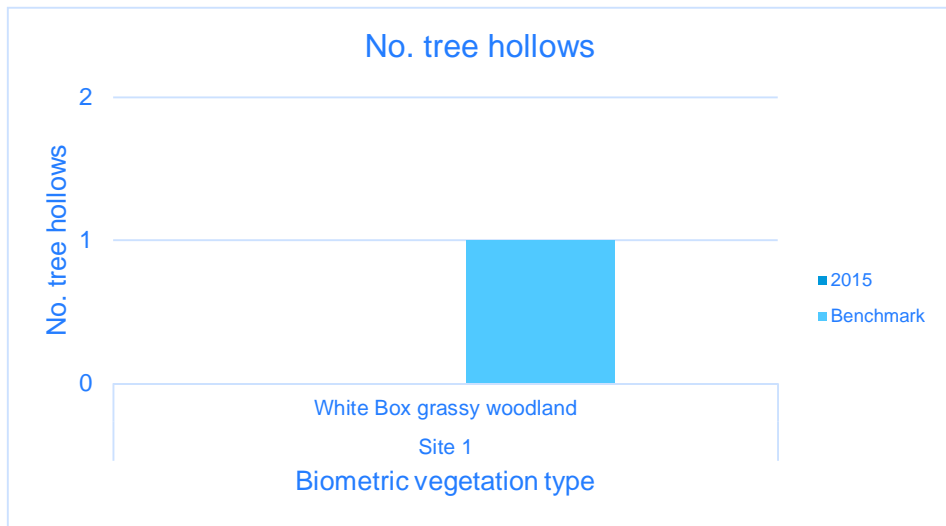
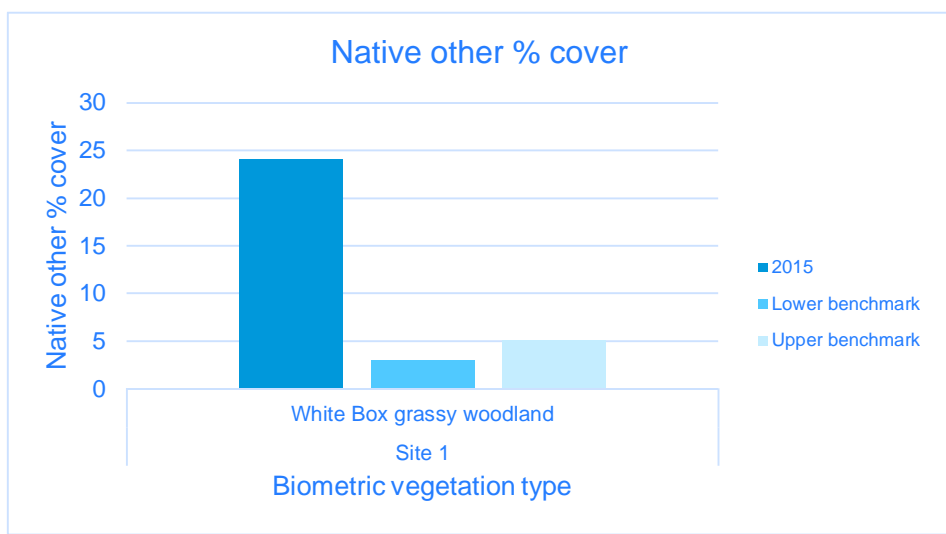
Native other cover within the Mallee BOA habitat restoration zone exceeded the upper native other percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5).

No hollow bearing trees were recorded from within the Mallee BOA habitat restoration zone. Consequently, Site 1 fell short of the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland.

Fallen timber was not recorded from within the Mallee BOA habitat restoration zone. Consequently, Site 1 fell short of the total length of fallen timber benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 7.5). The absence of fallen timber recorded is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 7.5 Mallee BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





7.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

The Mallee BOA contains areas, typically on the lower slopes and flats that have long been dedicated to grazing of cattle. Such areas are devoid of plant diversity and canopy and understorey cover that may otherwise encourage the occurrence of small woodland fauna. Consequently, a low diversity of bird was observed from replicate monitoring site Ma1, which is associated with habitat restoration zone of the Mallee BOA, with an average bird species richness of one recorded during duplicate surveys (Table 7.6). Diurnal bird abundance was observed to mirror species richness. No threatened species of bird were recorded from monitoring sites associated with habitat restoration zones.

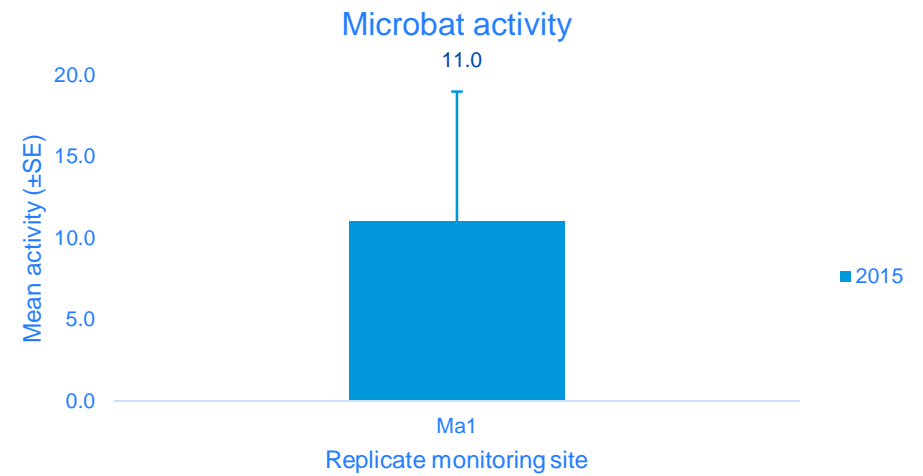
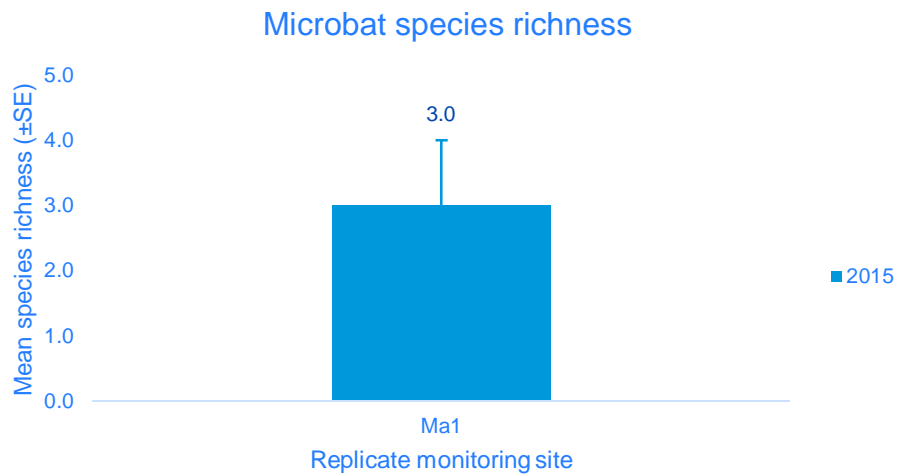
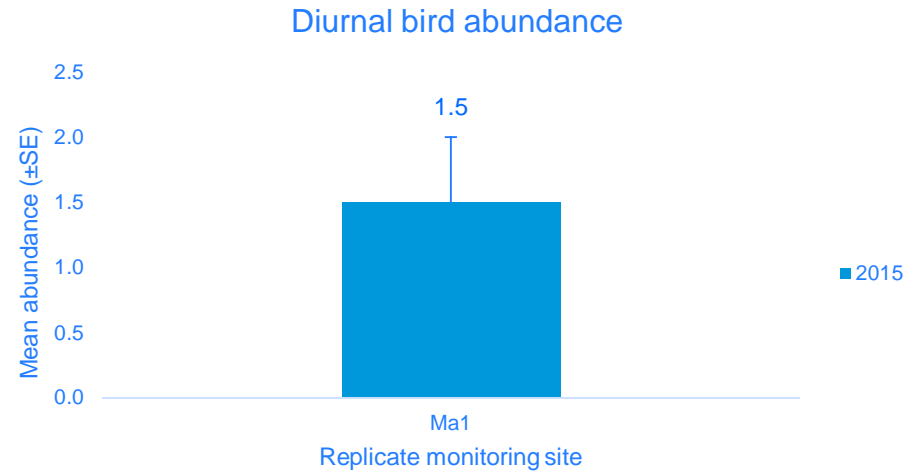
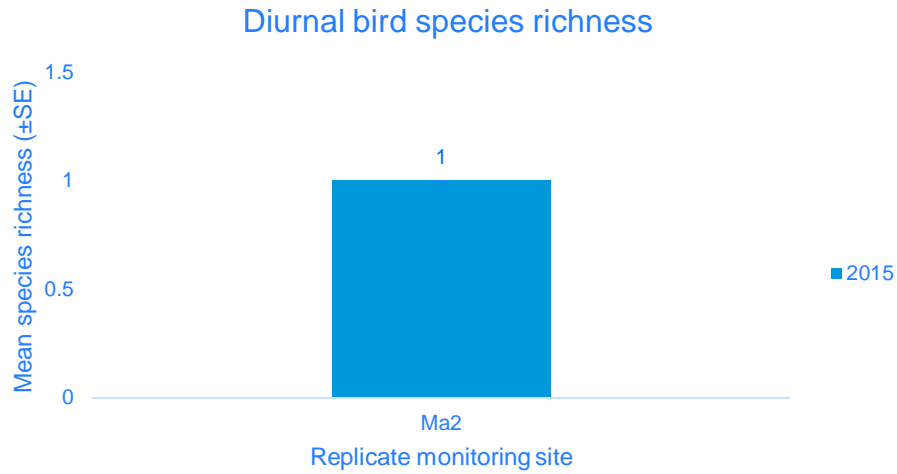
MICROCHIROPTERAN BATS

Five species of microbat were recorded from replicate monitoring site Ma1 (Table D5.1 of Appendix D) during this monitoring session, with a mean microbat species richness of three recorded from duplicate surveys (Table 7.6). Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) was low, having returned an average of 11 passes from duplicate surveys.

REMOTE CAMERA TRAPS

A remote motion sensing infra-red camera was positioned at replicate monitoring site Ma1 within that habitat restoration zone of the Mallee BOA. No native or pest species of animal were recorded.

Table 7.6 Mallee BOA habitat restoration zone – 2015 baseline fauna monitoring



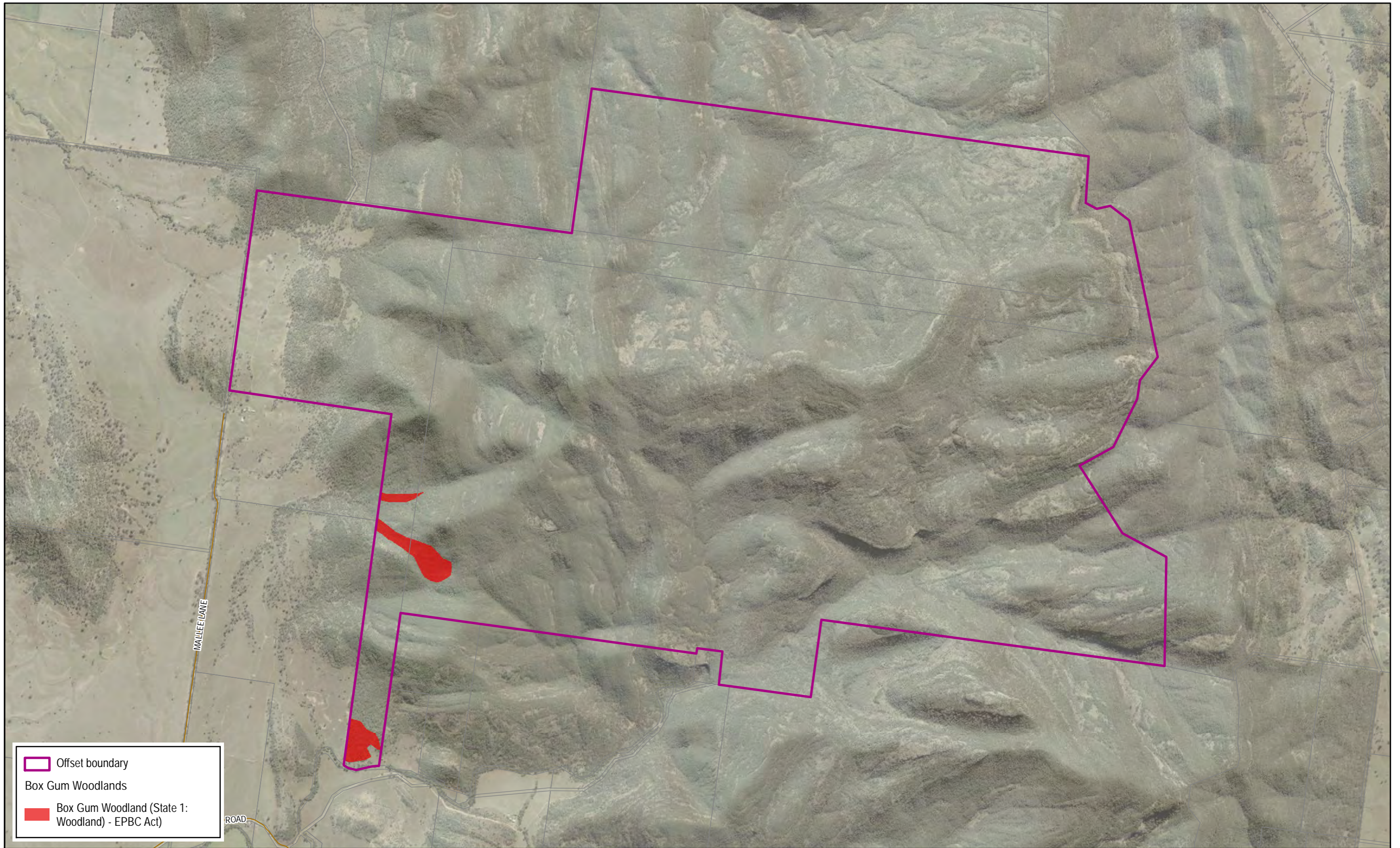
7.4 State of Box Gum Woodland



The Mallee BOA contains approximately 14.2 ha of Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Mallee BOA on lower slopes and flatter land (Figure 7.2).

Within the Mallee BOA the Box Gum Woodland occurs in one state:

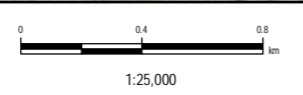
→ Box Gum Woodland – State 1: Woodland – occupies 14.2 ha.

Two monitoring sites within the Mallee BOA (one within habitat management zone and one within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 7.7.



	Offset boundary
	Box Gum Woodland (State 1: Woodland) - EPBC Act

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -



Data source: © Land and Property Information 2015
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Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



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Figure 7.2
 Box Gum Woodland within Mallee BOA

Table 7.7 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Mallee BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage			
Habitat management zones									
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	2	✓			✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributes are within or exceed the benchmark values. Dominant canopy (including hollows and regeneration), shrub and groundcover species present however exotic species were also recorded (10). Evidence of past agricultural and current feral herbivore grazing (goats) was observed on site.	
Habitat restoration zones									
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1	X 6 below		✓	✓		X 10 below	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native overstorey PFC and native species richness were below benchmark values. All remaining vegetation attributes were within or above benchmark values. Dominant canopy and shrub species absent. Native groundcover species present however exotic species also recorded (12). Evidence of past agricultural and current feral herbivore grazing (goats) was observed on site.	

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

8 NIOKA NORTH BOA – BASELINE RESULTS

8.1 Introduction

The Nioka North property encompasses an area of 867.9 ha and is located approximately 6.5 km north-west of the Project. The Nioka North property lies within the Nandewar Range and forms part of the eastern section of the Regional East-West Wildlife Corridor. The most intact areas of woodland habitat occur in the west and far east of the Nioka North BOA, although understorey vegetation exhibits the effects of grazing on the lower slopes. Large remnant intact native vegetation occurs on the ridges in the south west linking the BOA to larger areas intact native vegetation extending the north and south. Elsewhere throughout the property remnant woodland trees are largely scattered or form residual patches along drainage lines or regrowth covering on hills.

The vegetation and management zones within the Nioka North BOA are illustrated in Figure 8.1.

8.1.1 Flora

108 plant species were recorded within the Nioka North BOA during the 2015 monitoring session. Of these, 71 (66%) were native and 37 (34%) were exotic (Appendix C). The most diverse families recorded were the Asteraceae with 23 species followed by Poaceae with 18 species. No threatened plant species were recorded.

Of the 37 exotic species that were recorded in the Nioka North BOA, no species are listed under the *Noxious Weeds Act 1993* for the Narrabri Shire Council Local Control Authority Area or as Weeds of National Significance. Nioka North BOA did however contain other highly invasive species that occurred abundantly within the Nioka North BOA included *Lolium perenne** (Perennial Ryegrass), *Bromus molliformis**, *Bromus catharticus** (Prairie Grass), *Medicago polymorpha** (Burr Medic), and thistle species such as *Centaurea calcitrapa** (Saffron Thistle), *Silybum marianum** (Variegated Thistle) and *Centaurea melitensis** (Star Thistle).

No threatened flora species were recorded within the Nioka North BOA.

8.1.2 Fauna

Baseline monitoring recorded 101 species of animal within the Nioka North BOA, including 95 native species and six introduced species (Table 8.1 and Table D6.1 of Appendix D).

Table 8.1 Summary of terrestrial animal species identified in the Nioka North BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	76	2
Microbats	10	-
Mammals (non-bats)	5	4
Reptiles	3	-
Frogs	1	-
Total	95	6

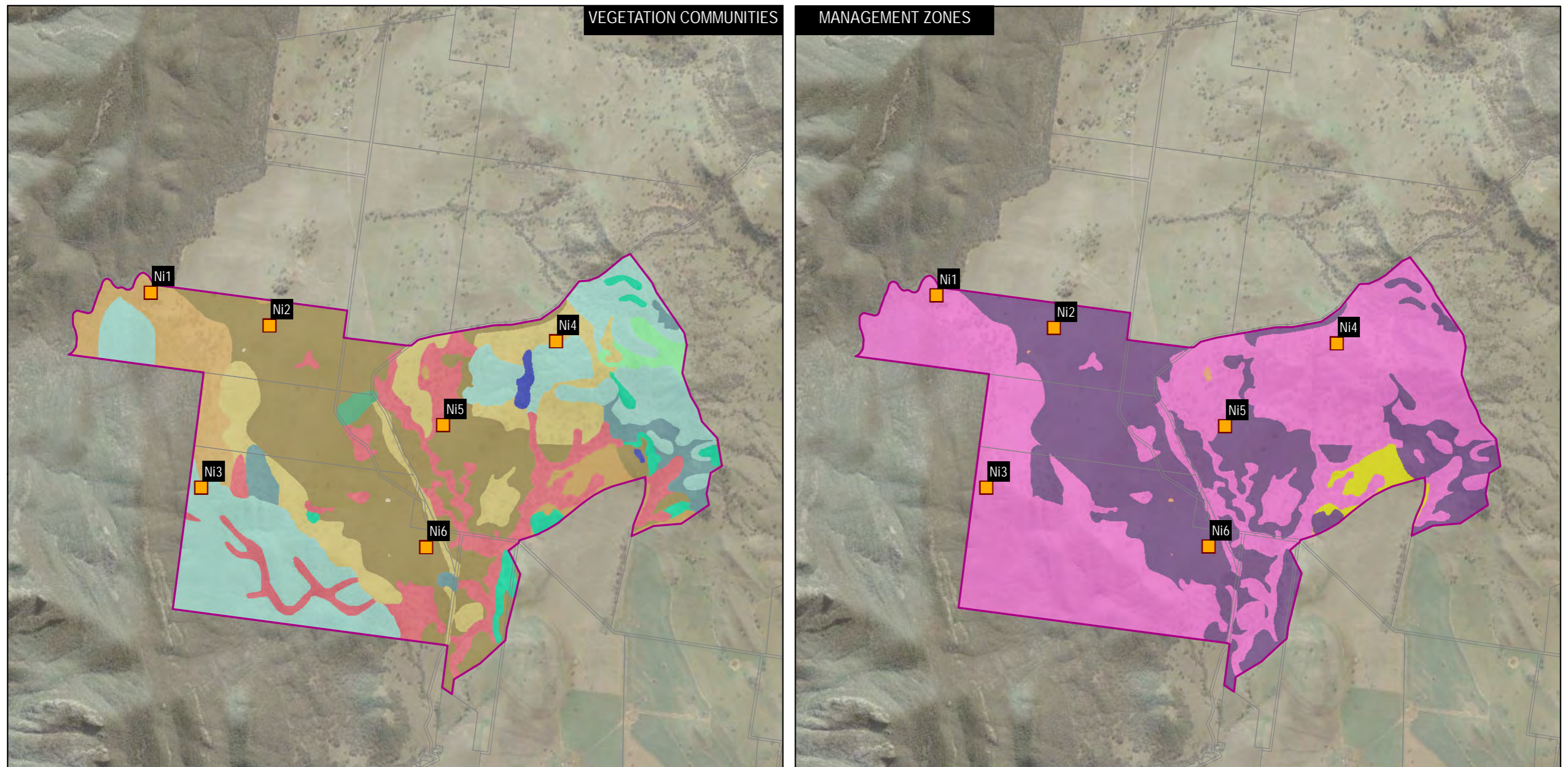
A total of seven threatened species were recorded within the Nioka North BOA during the 2015 baseline monitoring session (Table 8.2, Table D6.1 of Appendix D).

Table 8.2 Threatened species recorded in the Nioka North BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	-	V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Turquoise Parrot	<i>Neophema pulchella</i>	-	V
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V
Squirrel Glider	<i>Petaurus norfolcensis</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Vegetation community	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Shiny Bush)	Management zones
Offset boundary	Dwyer's Red Gum woodland	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	
	Farm dams	White Box Blakely's Red Gum Rough-barked Apple riparian woodland	Corridor enhancement zone
	Intensive Agriculture	White Box Grassy Woodland	Habitat management zone
	Rough-barked Apple - White Box shrubby/grassy woodland	White Box Grassy Woodland (Low condition)	Habitat restoration zone
	Silver-leaved Ironbark heathy woodland (Low condition)	Yellow Box - Blakely's Red Gum grassy woodland	Other land for agriculture zone
	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Callitris Regrowth)		

Map: 2267029A_GIS_F007_A1	Author: SuansriR		
Date: 6/06/2016	Approved by: -		
Data source: © Land and Property Information 2015 Copyright: © 2014 Esri		Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	



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Figure 8.1
Vegetation communities and management zones
- Nioka North BOA

8.2 Habitat management zones

8.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Nioka North BOA habitat management zones was highest at Site 3 and lowest at Site 1. Both Site 3 and Site 4 exceeded the native species richness benchmark value for each of their associated vegetation types. Site 1 however fell short of the benchmark value for Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion (Table 8.3).

Native overstorey cover within the Nioka North BOA habitat management zone was highest at Site 1 and lowest at Site 3. All monitoring sites within the Nioka North BOA habitat management zone were within the lower and upper native overstorey percentage cover for each of their associated vegetation types (Table 8.3).

Native midstorey cover within the Nioka North BOA habitat management zone was highest at Site 3 and lowest at Site 4. All monitoring sites within the Nioka North BOA habitat management zone met or exceeded the upper native midstorey percentage cover benchmark value for each of their associated vegetation types (Table 8.3).

Native grass cover within the Nioka North BOA habitat management zone was highest at Site 1 and lowest at Site 4. All monitoring sites within the Nioka North BOA habitat management zone were either within or exceeded the lower and upper native grass percentage cover benchmark values for each of their associated vegetation types (Table 8.3).

Native shrub cover within the Nioka North BOA habitat management zone was highest at Site 1 and lowest at Site 3 and Site 4 where shrub cover was absent. Site 1 and Site 4 were either within or exceeded the lower and upper native shrub percentage cover benchmark values for each of their associated vegetation types. Site 3 however fell short of the lower benchmark value for the White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.3).

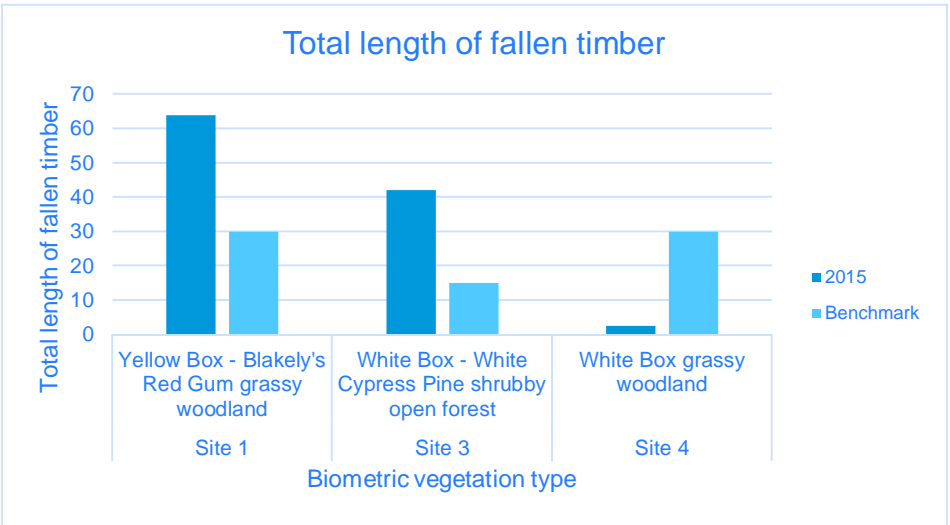
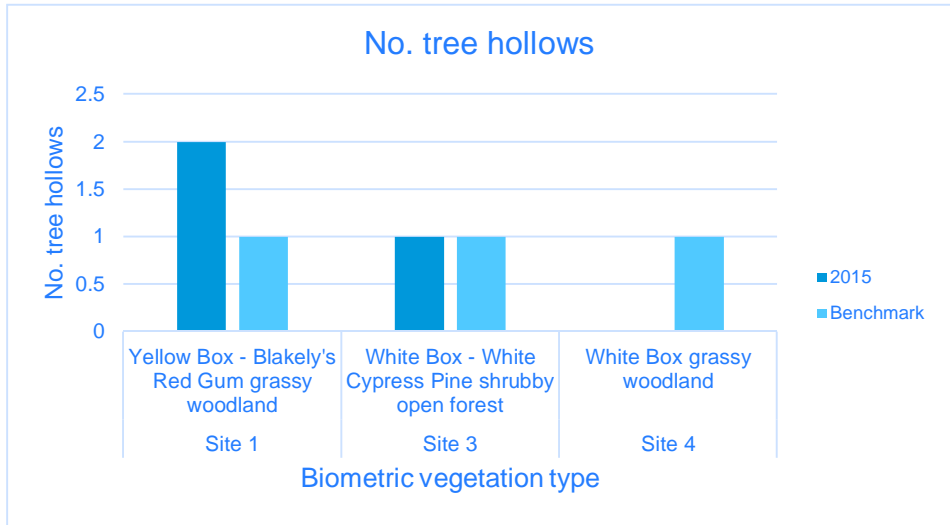
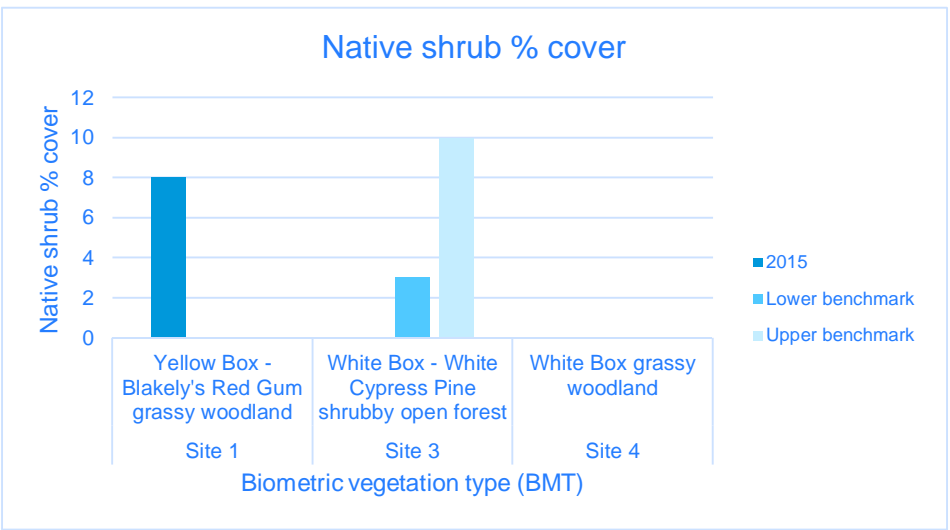
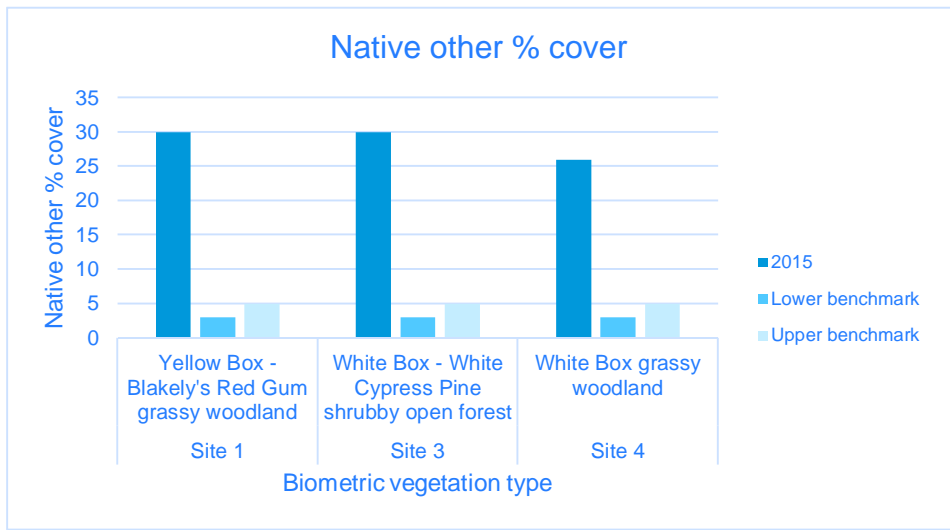
Native other cover within the Nioka North BOA habitat management zone was highest at Site 1 and Site 3. Native other cover was lowest at Site 4. All monitoring sites within the Nioka North BOA habitat management zones exceeded the upper native other percentage cover benchmark value for each of their associated vegetation types (Table 8.3).

The total number of hollow bearing trees within the Nioka North BOA habitat management zones was highest at Site 1 and lowest at Site 4 where no hollow bearing trees were recorded. Site 1 and Site 3 both either met or exceeded the hollow bearing tree benchmark values for each of their associated vegetation types. Site 4 however fell short of the benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 8.3).

The total length of fallen timber within the Nioka North BOA habitat management zone was highest at Site 1 and lowest at Site 4. Site 1 and Site 3 met the total length of fallen timber benchmark value for each of their associated vegetation types. Site 4 however fell short of the benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 8.3). This is thought to be attributed to previous vegetation clearing and agricultural grazing regimes.

Table 8.3 Nioka North BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





8.2.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Diurnal bird species richness was high in habitat management zones with replicate monitoring site Ni1 recording the highest average bird species richness at 25.5 birds recorded from duplicate surveys (Table 8.4). This was closely followed by Ni3 with an average of 24 birds. These two replicate monitoring sites occurred in areas of high quality habitat, commensurate with large tracts of extant vegetation associated with the Nandewar Range, west of the BOAs western boundary. Replicate monitoring site Ni4 recorded an average of 8.5 birds, which is somewhat lower than the previous two monitoring sites. However, monitoring site Ni4 largely retained only a canopy stratum, with mid-storey stratum absent and a managed ground layer.

Diurnal birds commonly encountered at replicate monitoring sites included, Mistletoebird, Noisy Friarbird, Rufous Whistler, Striated Pardalote and Weebill (Table D6.1 of Appendix D). Due to the presence of high quality woodland habitat (particularly at replicate monitoring site Ni1 and Ni3) two threatened species of bird, Brown Treecreeper and Speckled Warbler were recorded therein.

MICROCHIROPTERAN BATS

Ten species of microbat were recorded from replicate monitoring sites associated with habitat management zones of the Nioka North BOA (Table D6.1 of Appendix D). Microbats recorded largely comprised species common to the north-west slopes and plains. The most common microbats recorded, having been recorded at each monitoring site included Northern Free-tailed Bat, South-eastern Free-tailed Bat, Gould's Wattled Bat, Chocolate Wattled Bat and Little Forest Bat (Table D6.1 of Appendix D). Mean microbat species richness was similar between replicate monitoring sites in habitat management zones and ranged from 6.5 at Ni1 to eight and seven at Ni3 and Ni4 respectively (Table 8.4).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) ranged from an average of 119 passes at site Ni3 to 76 passes at site Ni1.

REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at the three replicate monitoring locations within habitat management zones of the Nioka North BOA. Native species recorded included Eastern Grey Kangaroo, Swamp Wallaby and Common Wallaroo (Photo 8.1). Feral species recorded included Pig (Photo 8.2), Goat, Fox and Rabbit.

NOCTURNAL BIRDS

Nocturnal call playback was completed at replicate monitoring site Ni1, whilst a spotlighting event was completed at monitoring sites Ni1 and Ni4. The Southern Boobook was recorded at monitoring site Ni1 and the Australian Owlet Nightjar was recorded from monitoring site Ni1 and Ni4.

NOCTURNAL MAMMALS

Spotlighting was completed at monitoring sites Ni1 and Ni4. One species listed as Vulnerable under the TSC Act, Squirrel Glider, was recorded at replicate monitoring site Ni5. Two other nocturnal arboreal mammals, Common Ringtail Possum and Common Brushtail Possum were recorded from monitoring site Ni1. The Common Brushtail Possum was also recorded during the spotlight event at monitoring site Ni4.

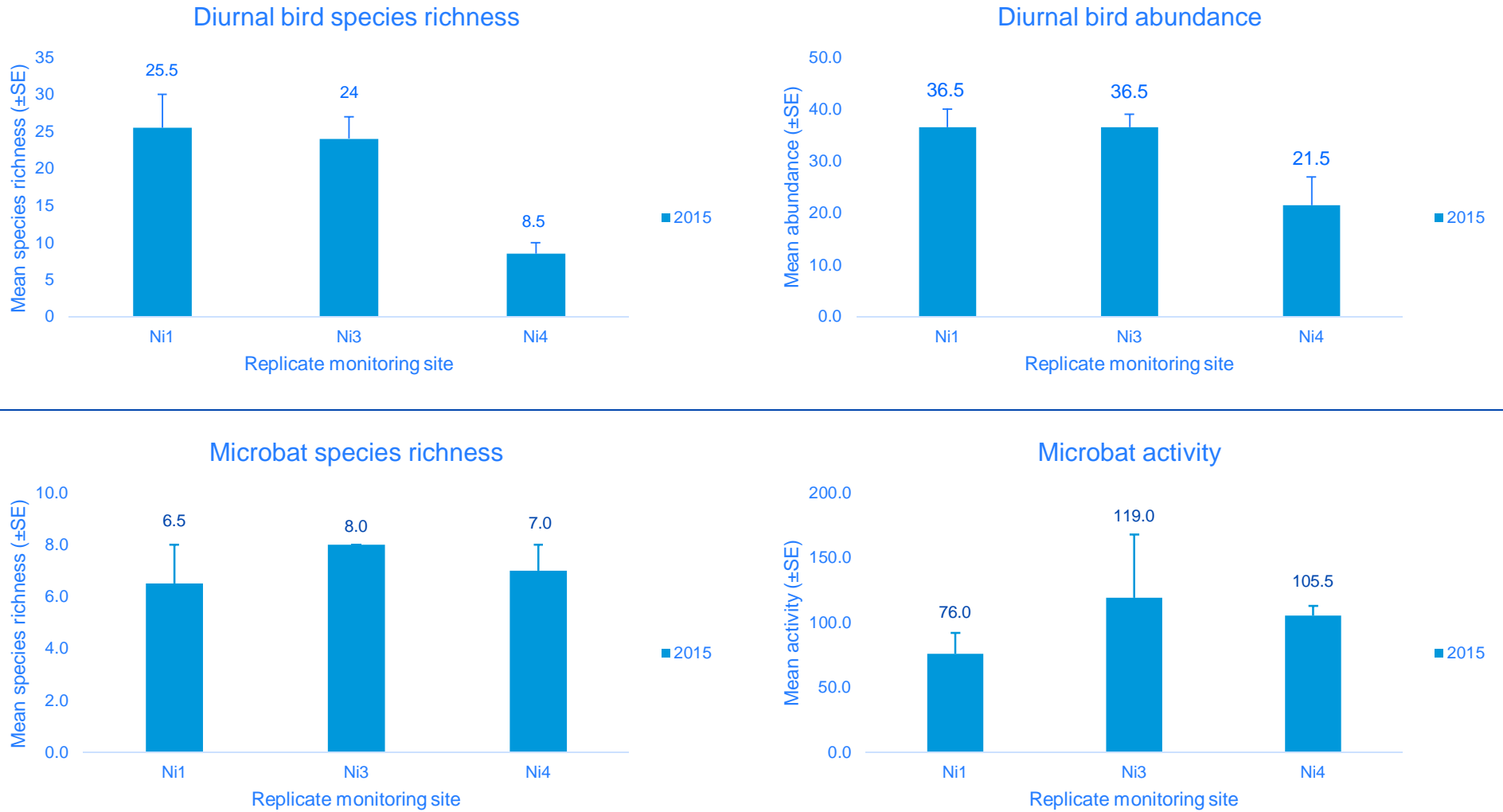


Photo 8.1 Common Wallaroo captured on remote sensing camera at replicate monitoring site Ni4



Photo 8.2 Pig captured on remote sensing camera at replicate monitoring site Ni3

Table 8.4 Nioka North BOA habitat management zone – 2015 baseline fauna monitoring



8.3 Habitat restoration zones

8.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Nioka North BOA habitat restoration zone was highest at Site 5 and lowest at Site 2. All monitoring sites within the Nioka North BOA habitat restoration zone failed to meet the native species richness benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.5).

Native overstorey cover was absent from all monitoring sites within the Nioka North BOA habitat restoration zone. Subsequently, all monitoring sites failed to meet the lower native overstorey percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.5). This is attributed to the monitoring site occurring as a derived native grassland where canopy species are generally void.

Native midstorey cover within the Nioka North BOA habitat restoration zone was highest at Site 2 and lowest at Site 5 and Site 6 where native midstorey cover was absent. Although mostly absent all monitoring sites within the Nioka North BOA habitat restoration zone were within the lower and upper native midstorey percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.5).

Native grass cover within the Nioka North BOA habitat restoration zone was highest at Site 2 and lowest at Site 5. Site 2 met the lower native grass percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type. Site 5 and Site 6 however fell short of the lower benchmark value (Table 8.5).

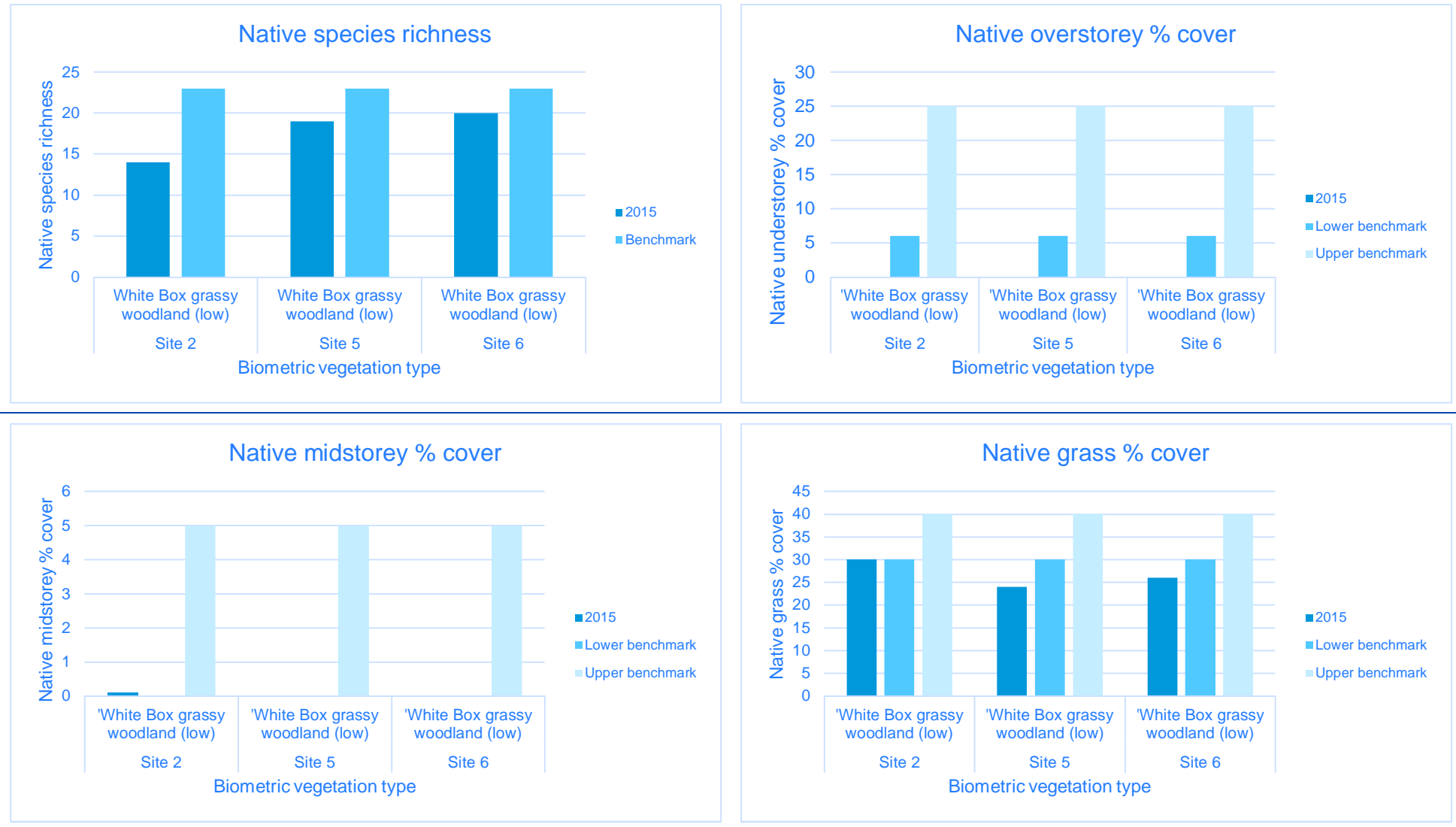
Native shrub cover was absent within the Nioka North BOA habitat restoration zone monitoring sites. Although native shrub cover was absent all monitoring sites within the Nioka North BOA habitat restoration zone were within the lower and upper benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.5).

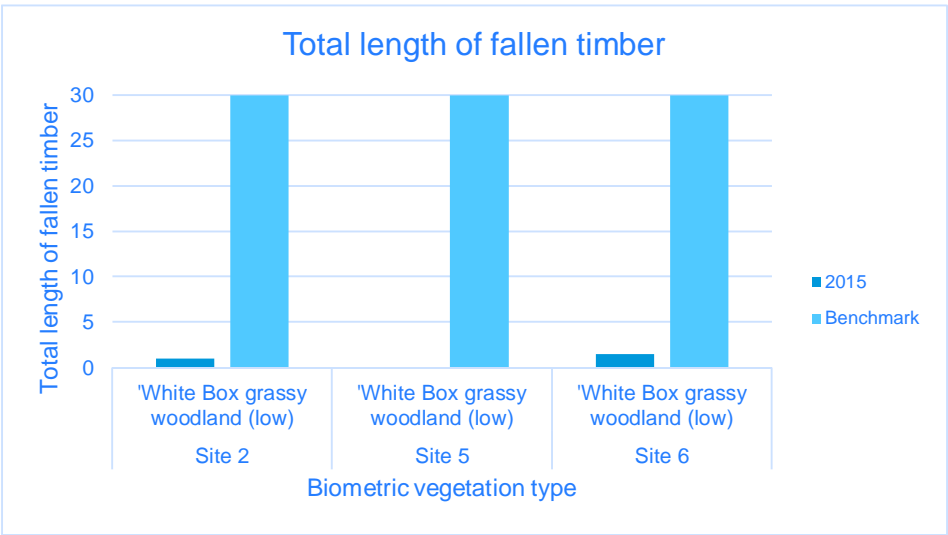
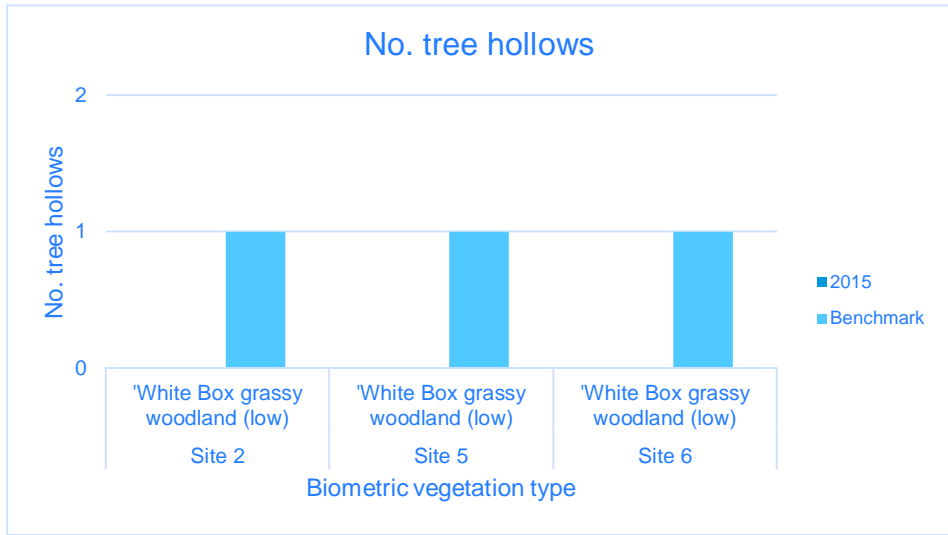
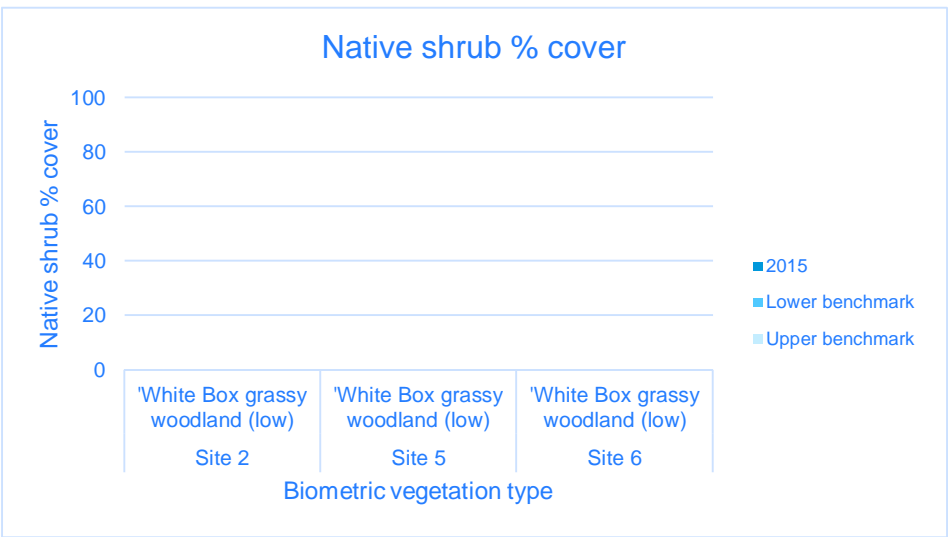
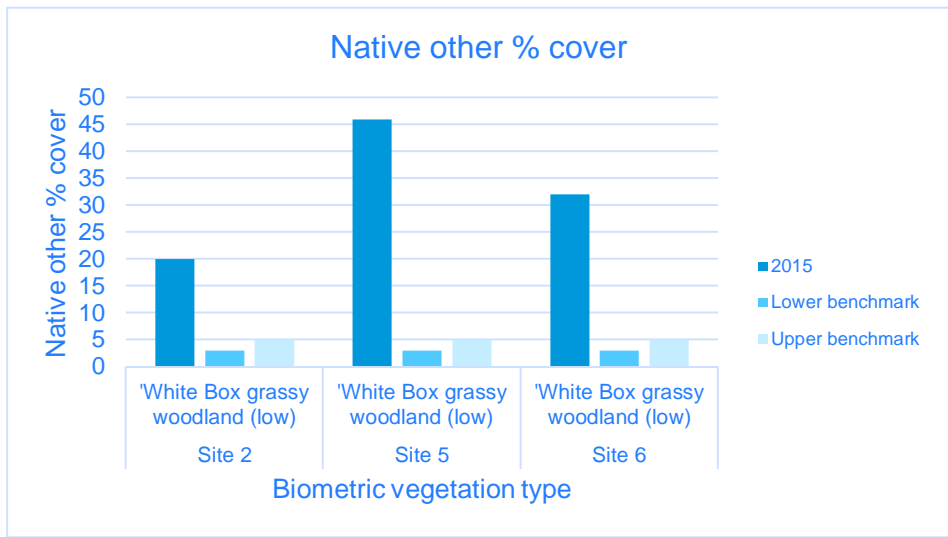
Native other cover within the Nioka North BOA habitat restoration zone was highest at Site 5 and lowest at Site 2. All monitoring sites within the Nioka North BOA habitat restoration zone exceeded the upper native other percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 8.5).

No hollow bearing trees were recorded from within the Nioka North BOA habitat restoration zone. Consequently all monitoring sites within the Nioka North BOA habitat restoration zone failed to meet the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 8.5). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland.

The total length of fallen timber within the Nioka North BOA habitat restoration zone was highest at Site 6 and lowest at Site 2 where no fallen timber was recorded. All monitoring sites within the Nioka North BOA habitat restoration zone failed to meet the total length of fallen timber benchmark values for The White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 8.5). The low amount of fallen timber recorded is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 8.5 Nioka North BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





8.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

The Nioka North BOA contains large areas that have long been dedicated to grazing of cattle, with such areas devoid of canopy and understorey cover and plant diversity that may otherwise encourage the occurrence of small woodland fauna. Accordingly, a low diversity of bird was observed from replicate monitoring sites associated with habitat restoration zones of the Nioka North BOA. Replicate monitoring site Ni2 recorded that highest mean diurnal bird species richness with an average of five birds, whilst site Ni5 and Ni6 recorded an average of 2.5 and two respectively (Table 8.6). Diurnal birds commonly recorded at habitat restoration sites included Common Myna, Common Starling and Straw-necked Ibis (Table D6.1 of Appendix D). No threatened species of bird were recorded from monitoring sites associated with habitat restoration zones.

MICROCHIROPTERAN BATS

Eight species of microbat were recorded from replicate monitoring sites associated with habitat restoration zones in the Nioka North BOA (Table D6.1 of Appendix D). Mean microbat species richness was similar between replicate monitoring site and ranged from an average of seven at site Ni2 to 5.5 at Ni5 and Ni6 (Table 8.6). The most common microbats recorded, with records from each replicate monitoring site included South-eastern Free-tailed Bat, Gould's Wattled Bat, Little Broad-nosed Bat and Little Forest Bat (Table D6.1 of Appendix D).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) was generally low, with an average of 42 and 38 passes recorded from replicate monitoring sites Ni5 and Ni6 respectively (Table 8.6). Replicate monitoring site Ni2 recorded the highest activity with 186 passes.

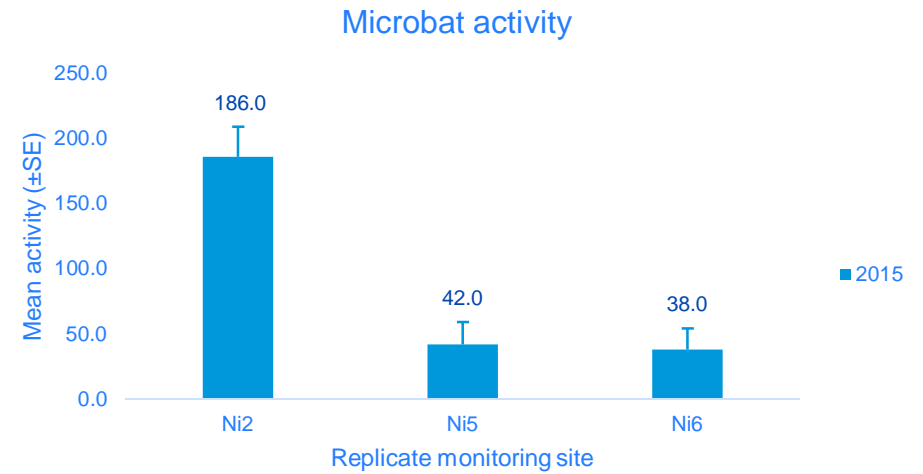
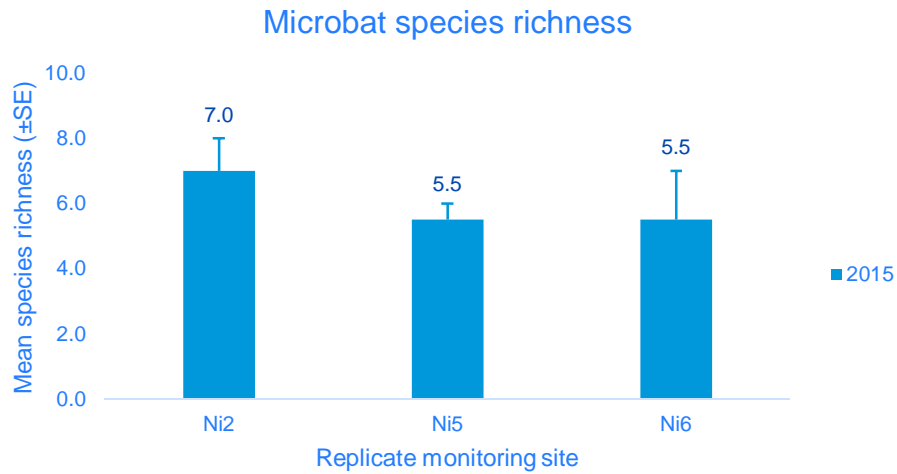
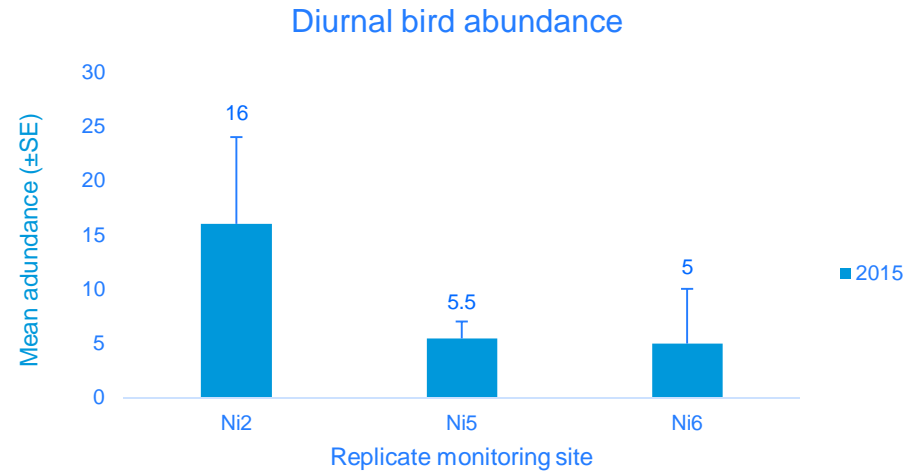
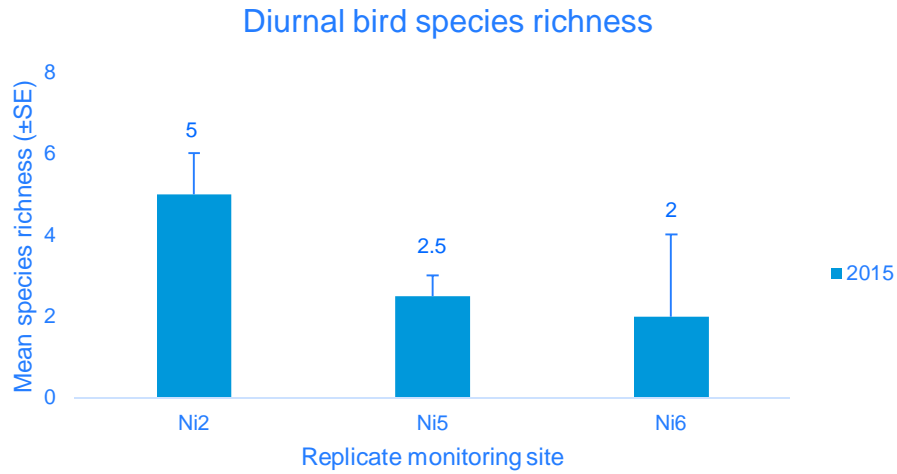
REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at each replicate monitoring location within habitat restoration zones of the Nioka North BOA. No native species were recorded therein. One introduced species, Rabbit, was recorded from replicate monitoring site Ni5 (Photo 8.3).



Photo 8.3 Rabbit captured on remote sensing camera at replicate monitoring site Ni5

Table 8.6 Nioka North BOA habitat restoration zone – 2015 baseline fauna monitoring



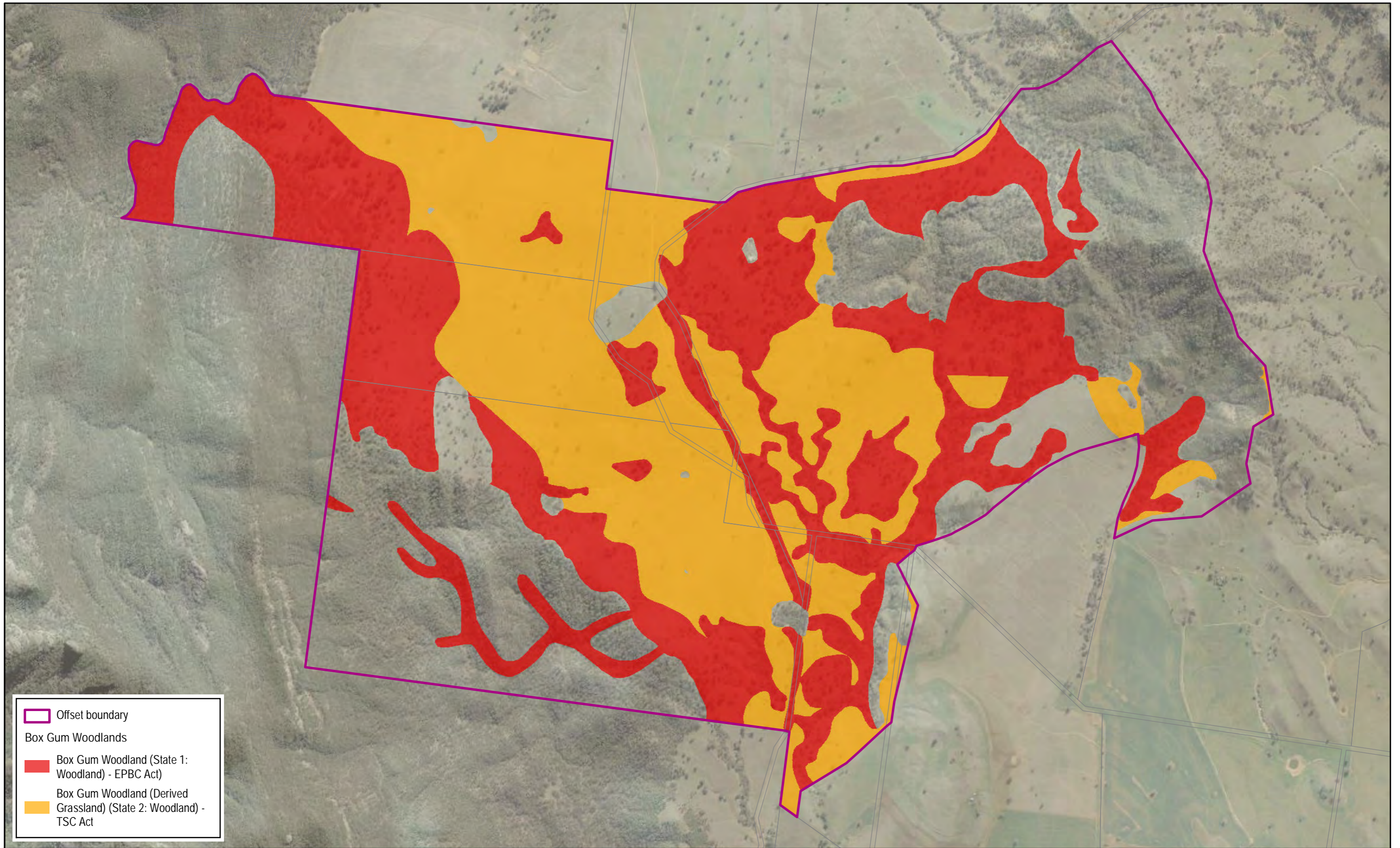
8.4 State of Box Gum Woodland




The Nioka North BOA contains approximately 566.1 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Nioka North BOA on lower slopes and flatter land (Figure 8.2).

Within the Nioka North BOA the Box Gum Woodland occurs in two states:

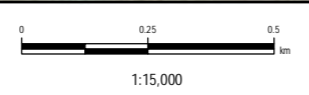
- Box Gum Woodland – State 1: Woodland – occupies 295.9 ha.
- Box Gum Woodland – State 2: Native Pasture (derived native grassland) – occupies approximately 270.2 ha.

Five monitoring sites within the Nioka North BOA (two within habitat management zone and three within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 8.7.



	Offset boundary
Box Gum Woodlands	
	Box Gum Woodland (State 1: Woodland) - EPBC Act
	Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -



Data source: © Land and Property Information 2015
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Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



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Figure 8.2
 Box Gum Woodland within Nioka North BOA

Table 8.7 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Nioka North BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage			
Habitat management zones									
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	1	✓						X 3 below	<p>Box Gum Woodland - State 2 (Woodland). Native species richness is below the benchmark value. All remaining vegetation attributes are within or above the benchmark values.</p> <p>Dominant canopy (including hollows and regeneration), shrub and groundcover species present however exotic species were also recorded in high numbers (16). Evidence of current agricultural grazing and feral herbivore grazing (rabbits and pigs) was observed on site.</p>
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	4	✓		✓	✓		✓		<p>Box Gum Woodland - State 2 (Woodland). All vegetation attributes are within or above the benchmark values.</p> <p>Dominant canopy (no hollows however regeneration is occurring), shrub and groundcover species present however exotic species were recorded in high numbers (21). Evidence of current agricultural grazing and feral herbivore grazing (rabbits and pigs) was observed on site.</p>

		VEGETATION ATTRIBUTES						BOX GUM WOODLAND STATE & GRAZING PRESSURES
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	2	X 6 below	✓	✓	✓		X 9 below	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native overstorey PFC and native species richness are below benchmark values. All remaining vegetation attributes are within or above benchmark values. Canopy and shrub species absent (no hollows or regeneration). Native groundcover species do occur however exotic species were recorded in high numbers (12). Evidence of current agricultural grazing and feral herbivore grazing (rabbits and pigs) was observed on site.
	5	X 6 below	✓	X 6 below	✓		X 4 below	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native overstorey PFC, native groundcover grass percentage cover and native species richness were below the benchmark values. All remaining vegetation attributes were within benchmark values. Canopy and shrub species absent (no hollows or regeneration). Native groundcover species do occur however exotic species were recorded in high numbers (14). Evidence of current agricultural grazing and feral herbivore grazing (rabbits and pigs) was observed on site.

VEGETATION ATTRIBUTES								
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
	6	X 6 below	✓	X 4 below	✓		X 3 below	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands).</p> <p>Native overstorey PFC, native groundcover grass percentage cover and native species richness were below the benchmark values. All remaining vegetation attributes were within benchmark values.</p> <p>Canopy and shrub species absent (no hollows or regeneration). Native groundcover species do occur however exotic species were recorded in high numbers (14). Evidence of current agricultural grazing and feral herbivore grazing (rabbits and pigs) was observed on site.</p>

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

9 SUNSHINE BOA – BASELINE RESULTS

9.1 Introduction

The Sunshine property encompasses an area of 738 ha and is located approximately 8 km north-west of the Project. The Sunshine property lies within the Nandewar Range and forms part of the south-eastern portion of the Regional East-West Wildlife Corridor. Much of the woodland within the Sunshine BOA occurs in fragmented landscape. Regeneration is present on many parts of the throughout the northern uplands, particularly along ridgetops and drainage lines.

The vegetation and management zones within the Sunshine BOA are illustrated in Figure 9.1.

9.1.1 Flora

86 plant species were recorded within the Sunshine BOA during the 2015 monitoring session. Of these, 49 (57%) were native and 37 (43%) were exotic (Appendix C). The most diverse families recorded were the Asteraceae with 16 species followed by Poaceae with 12 species. No threatened plant species were recorded.

Of the 37 exotic species that were recorded in the Sunshine BOA, *Opuntia stricta* (Prickly Pear) is the only species listed under the *Noxious Weeds Act 1993* for the Gunnedah Shire Council Local Control Authority Area (Table 9.1). No exotic species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2015). Other highly invasive species that occurred abundantly within the Sunshine BOA included *Bromus molliformis**, *Lolium perenne** (Perennial Ryegrass), *Chondrilla juncea** (Skeleton Weed) and thistle species such as *Carthamus lanatus** (Saffron Thistle), *Centaurea calcitrapa** (Star Thistle), *Centaurea melitensis** (Cockspur Thistle).

Table 9.1 Noxious weeds recorded within the Sunshine BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Prickly Pear	<i>Opuntia stricta</i>	4	No

No threatened flora species were recorded within the Sunshine BOA.

9.1.2 Fauna

Baseline monitoring recorded 80 species of animal within the Sunshine BOA, including 76 native species and four introduced species (Table 9.2 and Table D7.1 of Appendix D).

Table 9.2 Summary of terrestrial animal species identified in the Sunshine BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	60	1
Microbats	10	-
Mammals (non-bats)	3	3
Reptiles	2	-
Frogs	1	-
Total	76	4

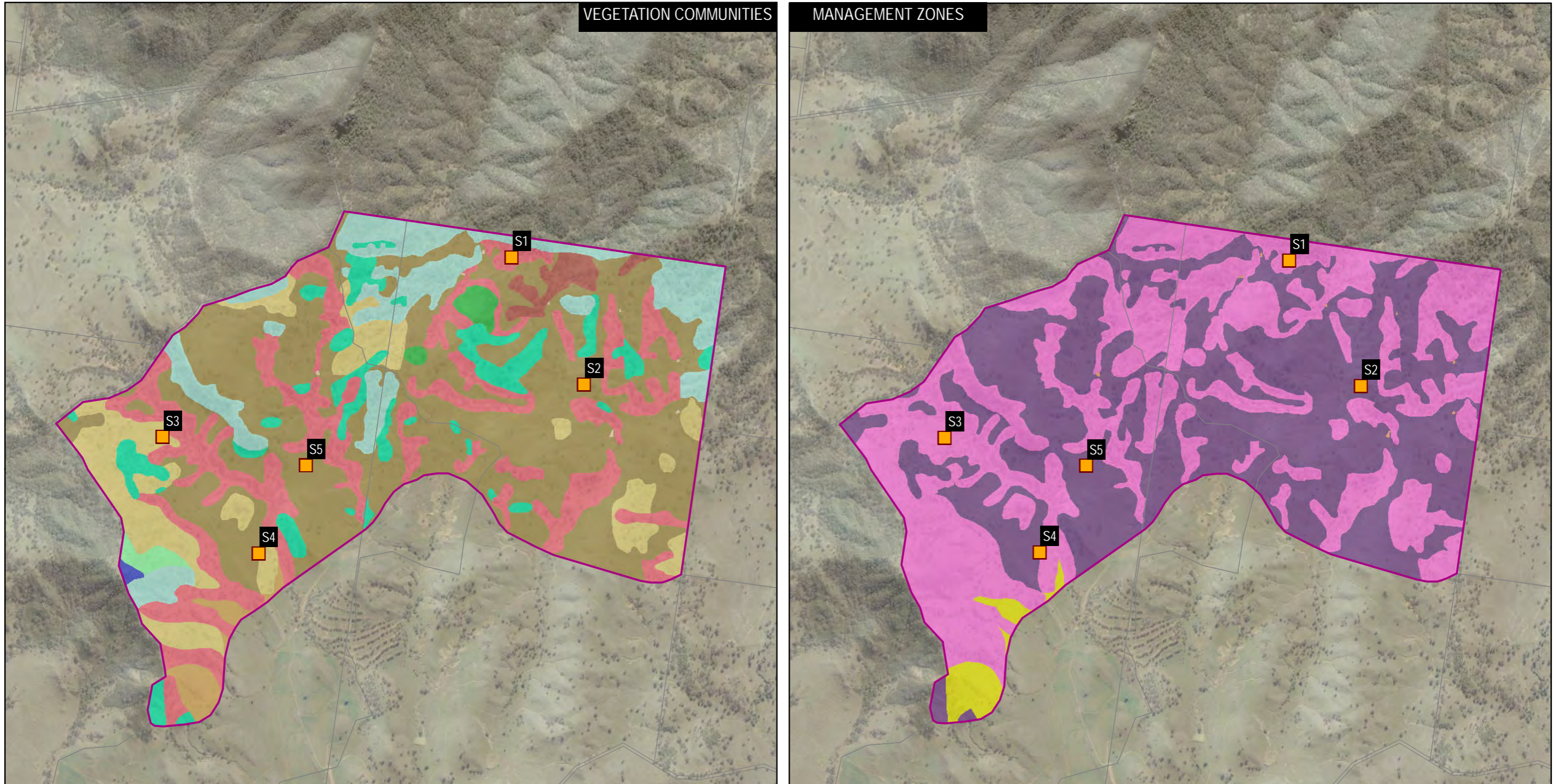
A total of five threatened species were recorded within the Sunshine BOA during the 2015 baseline monitoring session (Table 9.3, Table D7.1 of Appendix D).

Table 9.3 Threatened species recorded in the Sunshine BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Speckled Warbler	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	-	V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Little Lorikeet	<i>Glossopsitta pusilla</i>	-	V
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Offset boundary	Vegetation community	Dwyer's Red Gum woodland	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest (Shiny Bush)	White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest	Management zones	Corridor enhancement zone
		Farm dams	Intensive Agriculture	White Box Blakely's Red Gum Rough-barked Apple riparian forest (shrubby variant)	White Box Blakely's Red Gum Rough-barked Apple riparian woodland	Habitat management zone	Habitat restoration zone
		Rough-barked Apple - White Box shrubby/grassy woodland	Silver-leaved Ironbark heathy woodland	White Box Grassy Woodland	White Box Grassy Woodland (Low condition)	Other land for agriculture zone	

Map: 2267029A_GIS_F008_A1	Author: SuansriR		
Date: 6/06/2016	Approved by: -		
<small>Data source: © Land and Property Information 2015 Copyright © 2014 Esri Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3</small>			



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Figure 9.1
Vegetation communities and management zones
- Sunshine BOA

9.2 Habitat management zones

9.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Sunshine BOA habitat management zone was highest at Site 1 and lowest at Site 3. Site 1 meet the native species richness benchmark for the Rough-barked Apple riparian forb/grass open forest of the Nandewar bioregion vegetation type. Site 3 however failed to meet the benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.4).

Native overstorey cover within the Sunshine BOA habitat management zone was highest at Site 1 and lowest at Site 3 where no native overstorey cover was recorded. Site 1 exceeded the upper native overstorey percentage cover benchmark value for the Rough-barked Apple Riparian forb/grass open forest of the Nandewar Bioregion vegetation type. Site 3 however failed to meet the lower benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.4).

Native midstorey cover within the Sunshine BOA habitat management zone was highest at Site 1 and lowest at Site 3. Site 1 exceeded the upper native midstorey percentage cover benchmark value for the Rough-barked Apple Riparian forb/grass open forest of the Nandewar Bioregion vegetation type. Site 3 however failed to meet the lower benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.4).

Native grass cover within the Sunshine BOA habitat management zone was highest at Site 3 and lowest at Site 1. All monitoring sites within the Sunshine BOA habitat management zone were within the lower and upper native grass percentage cover benchmark values for each of their associated vegetation types (Table 9.4).

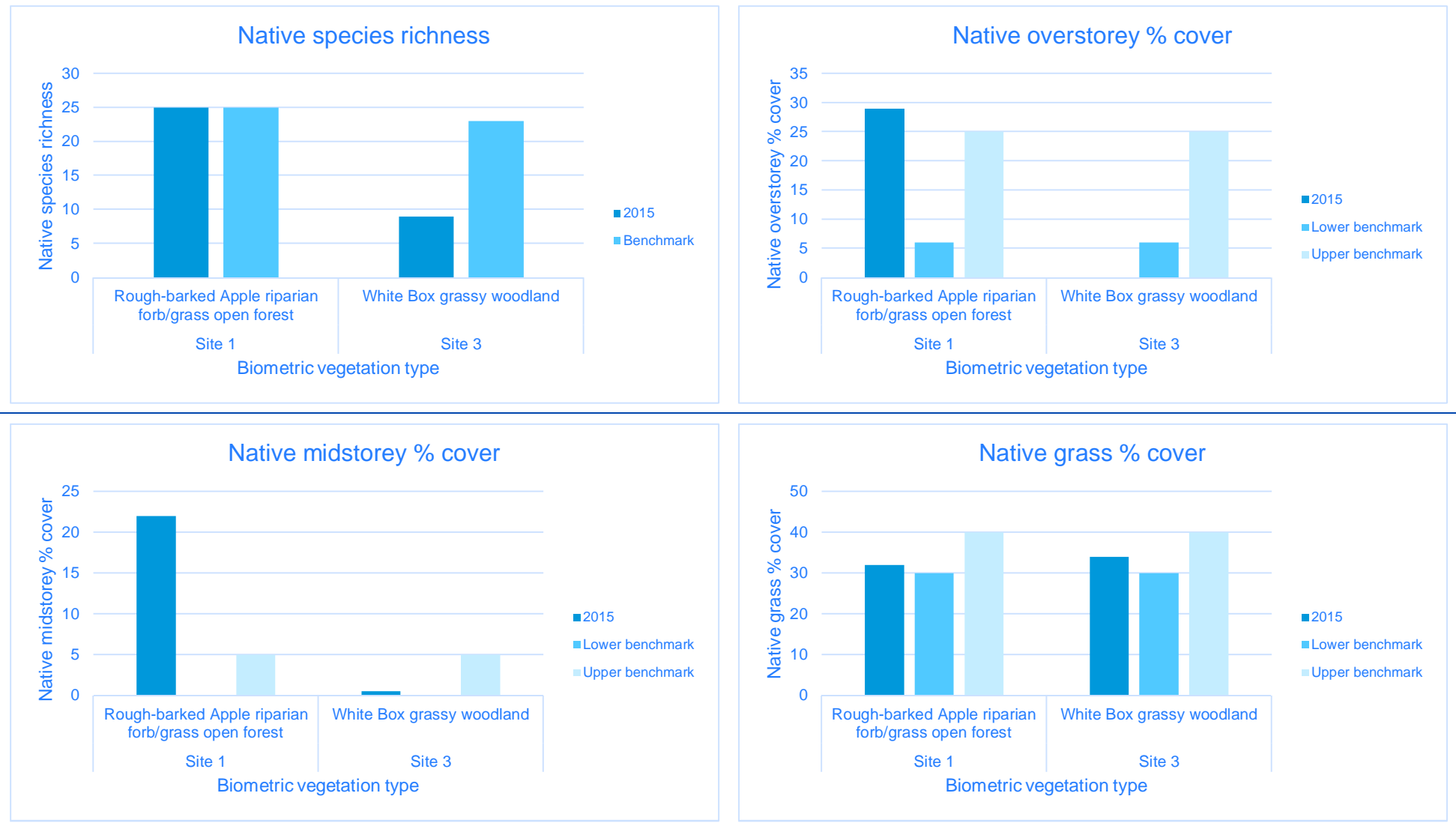
Native shrub cover was absent from all monitoring sites within the Sunshine BOA habitat management zone. Although native shrub cover was absent Site 3 was within the lower and upper native shrub percentage cover benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 1 however failed to meet the lower benchmark value for the Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion vegetation type (Table 9.4).

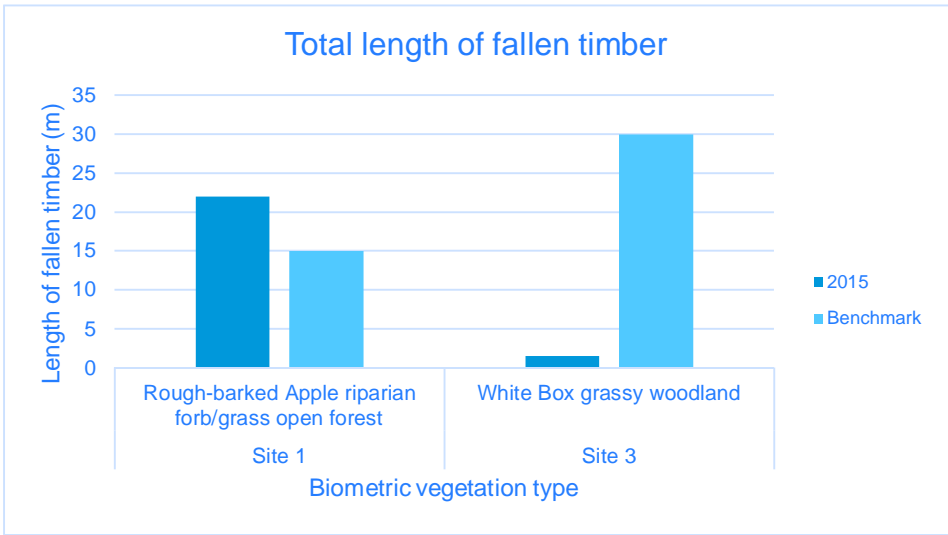
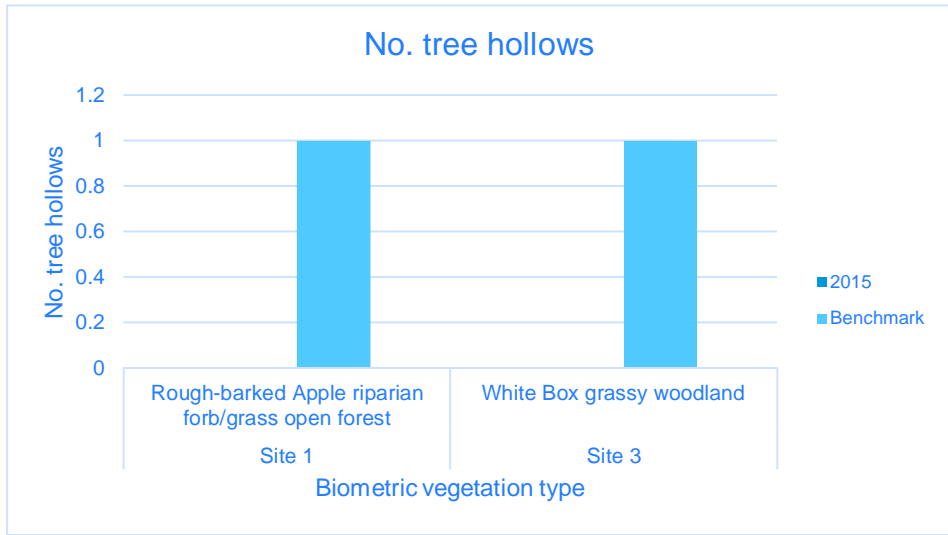
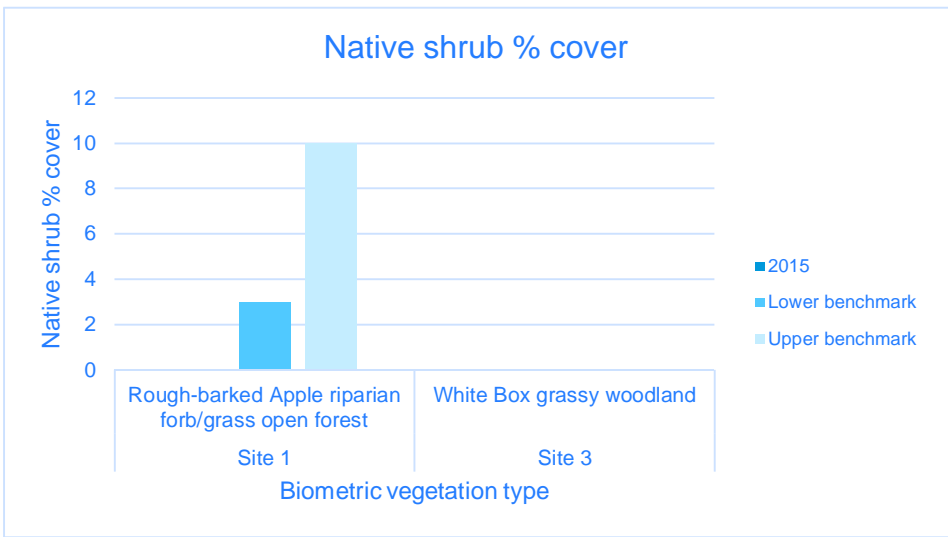
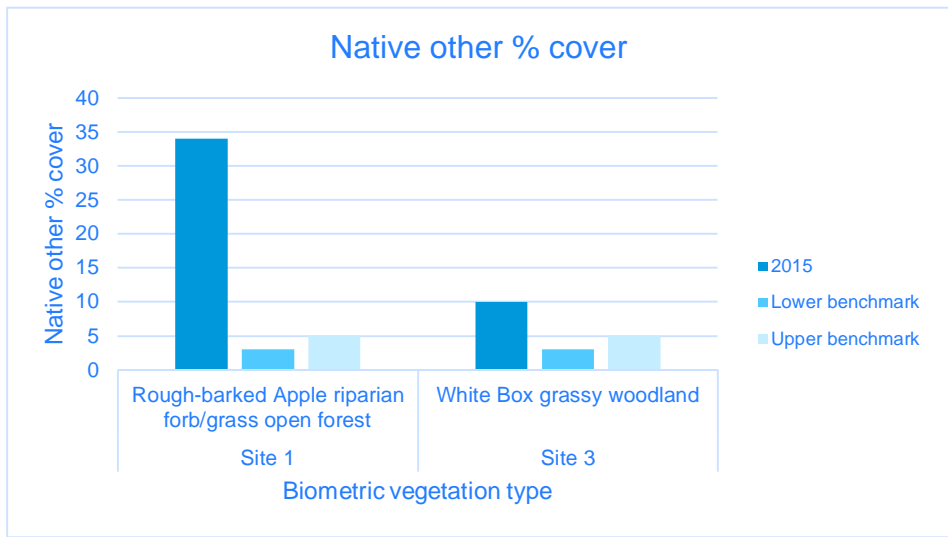
Native other cover within the Sunshine BOA habitat management zone was highest at Site 1 and lowest at Site 3. All monitoring sites within the Sunshine BOA habitat management zones exceeded the upper native other percentage cover benchmark values for each of their associated vegetation types (Table 9.4).

No hollow bearing trees were recorded from within the Sunshine BOA habitat management zone. Consequently all monitoring sites within the Sunshine BOA habitat management zone failed to meet the hollow bearing tree benchmark value for each of their associated vegetation types (Table 9.4). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which has removed the areas containing canopy tree species.

The total length of fallen timber within the Sunshine BOA habitat management zone was highest at Site 1 and lowest at Site 3. Site 1 exceeded the hollow bearing tree benchmark value for Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion vegetation type. Site 3 however failed to meet the benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion (Table 9.4). The low amount of fallen timber recorded at Site 3 is thought to be attributed past vegetation clearing and agricultural grazing.

Table 9.4 Sunshine BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





9.2.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Diurnal bird species richness was high at replicate monitoring site S1, with an average species richness of 25 birds recorded during duplicate surveys (Table 9.5). Diurnal bird abundance was also relatively high at site S1 with an average of 35.5 birds recorded. Replicate survey site S1 retained the best quality habitat in the Sunshine BOA and is associated with high quality riparian habitat (Rough-barked Apple grassy open forest) immediately adjacent to a large contiguous and extant stand of grassy/ shrubby box gum woodland which extends to the north of the Sunshine BOA into the Braefield BOA. Replicate survey site S3 returned a low mean species richness of 6.5 birds and an abundance of 11 (Table 9.5). Replicate monitoring site essentially occurred in a cleared agricultural paddock. Birds commonly recorded from habitat management zone during duplicate surveys included, Eastern Rosella, Western Gerygone and Noisy Miner. Two threatened species of bird, Speckled Warbler and Little lorikeet, were recorded from replicate survey site S1 during this monitoring session (Table D7.1 of Appendix D).

MICROCHIROPTERAN BATS

Eight species of microbat were recorded from habitat management zones during this monitoring session, with Gould's Wattlebat and Little Forest Bat commonly recorded (Table D7.1 of Appendix D). Two threatened species were recorded therein, including Yellow-bellied Sheath-tail-bat (S1 and S3) and Eastern False Pipistrelle (S3). Mean microbat species richness ranged from 6.5 at monitoring site S3 to 3.5 at monitoring site S1 (Table 9.5).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) differed substantially with an average of 522.5 passes recorded at monitoring site S3 and an average of 13 at monitoring site S1 (Table 9.5).

REMOTE CAMERA TRAPS

Remote motion sensing infra-red camera were positioned at the two replicate monitoring sites within habitat management zones of the Sunshine BOA. Native species of animal recorded included Swamp Wallaby and Grey Kangaroo, which were both recorded from monitoring site S1. Two introduced species of animal were recorded in the habitat management zone, including Fox (Photo 9.1) and Pig.

NOCTURNAL BIRDS

Nocturnal call playback was completed at replicate monitoring site S1. One nocturnal bird, White-throated Nightjar, was recorded therein.

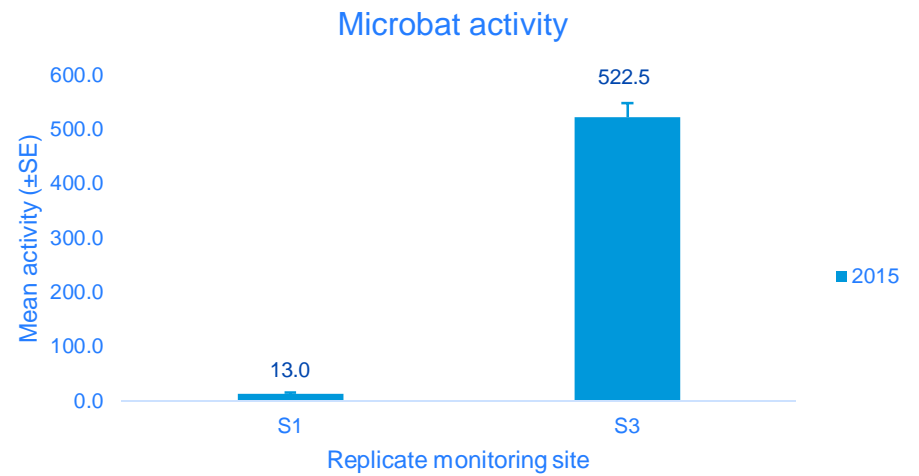
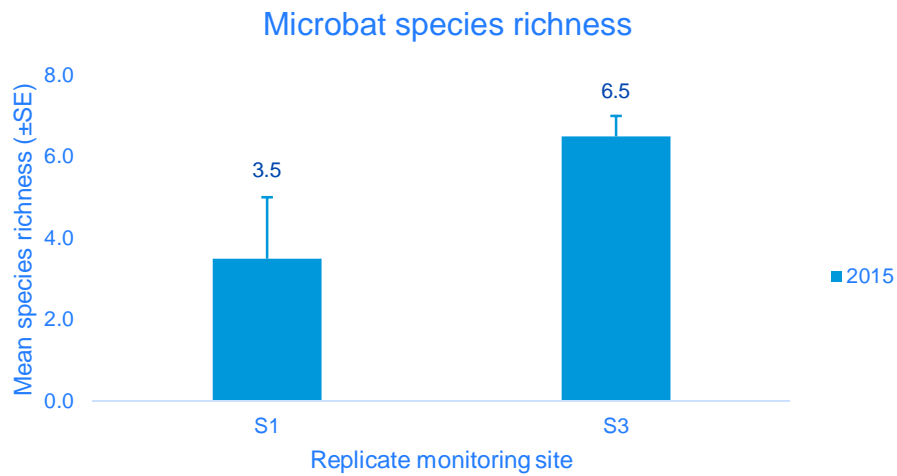
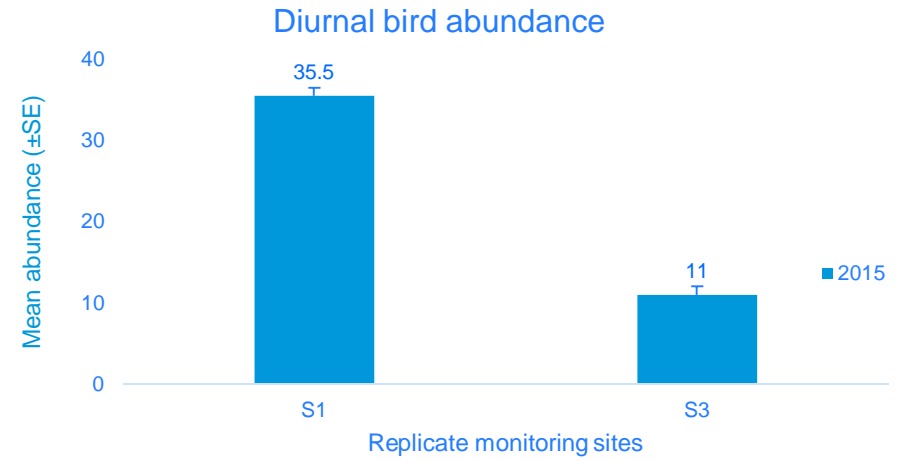
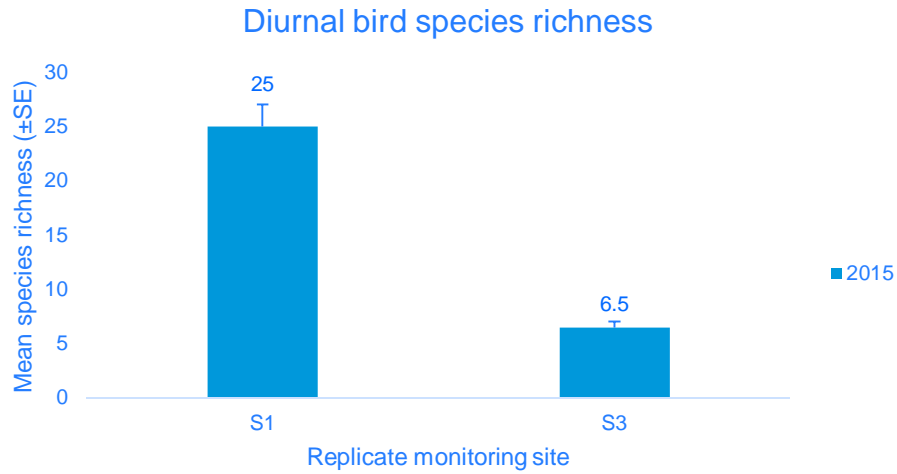
NOCTURNAL MAMMALS

One spotlight event was completed at replicate monitoring site S1. No nocturnal mammals were recorded therein.



Photo 9.1 Fox captured on remote sensing camera at replicate monitoring site S5

Table 9.5 Sunshine BOA habitat management zone – 2015 baseline fauna monitoring



9.3 Habitat restoration zones

9.3.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Sunshine BOA habitat restoration zone was highest at Site 2 and lowest at Site 5. All monitoring sites within the Sunshine BOA habitat restoration zone failed to meet the native species richness benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6).

Native overstorey cover was absent from all monitoring sites located within the Sunshine BOA habitat restoration zone. Subsequently, all monitoring sites within the Sunshine BOA habitat restoration zone failed to meet the lower native overstorey percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6). The void of native canopy cover is thought to be attributed to past vegetation clearing and land uses of the monitoring sites which now occur as derived native grassland.

Native midstorey cover within the Sunshine BOA habitat restoration zone was highest at Site 2 and lowest at Site 4 and Site 5 where no native midstorey cover was recorded. All monitoring sites within the Sunshine BOA habitat restoration zone were within the lower and upper benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6).

Native grass cover within the Sunshine BOA habitat restoration zone was highest at Site 2 and lowest at Site 4. Both Site 2 and Site 5 were within the lower and upper native grass percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 4 however failed to meet the lower benchmark value (Table 9.6).

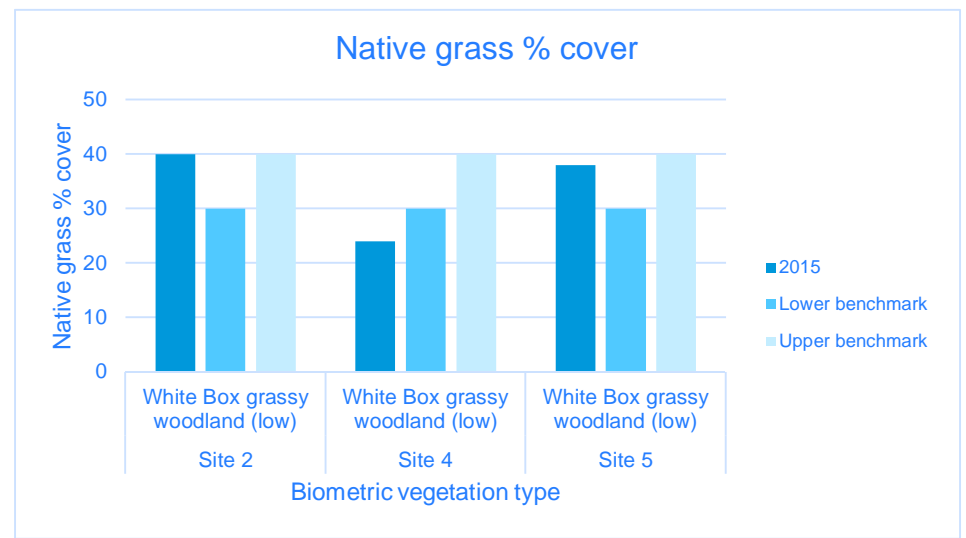
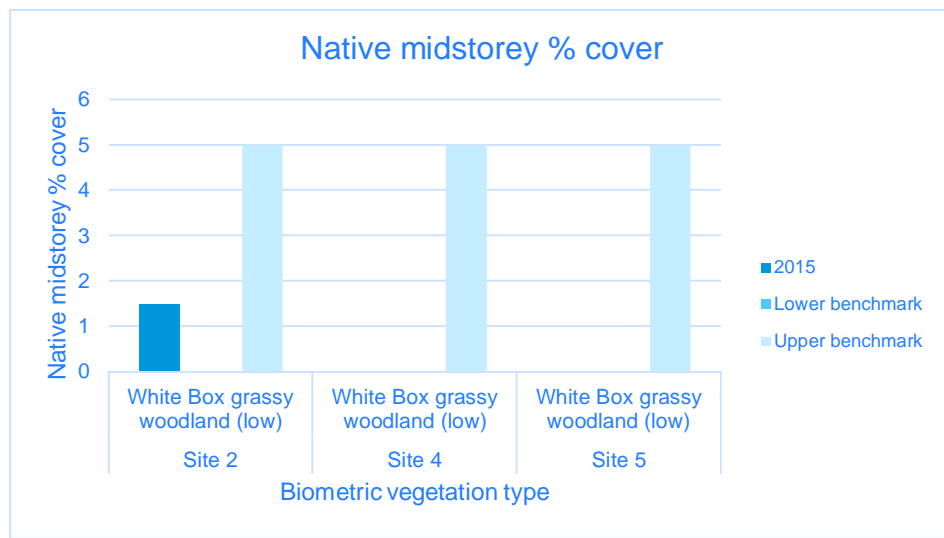
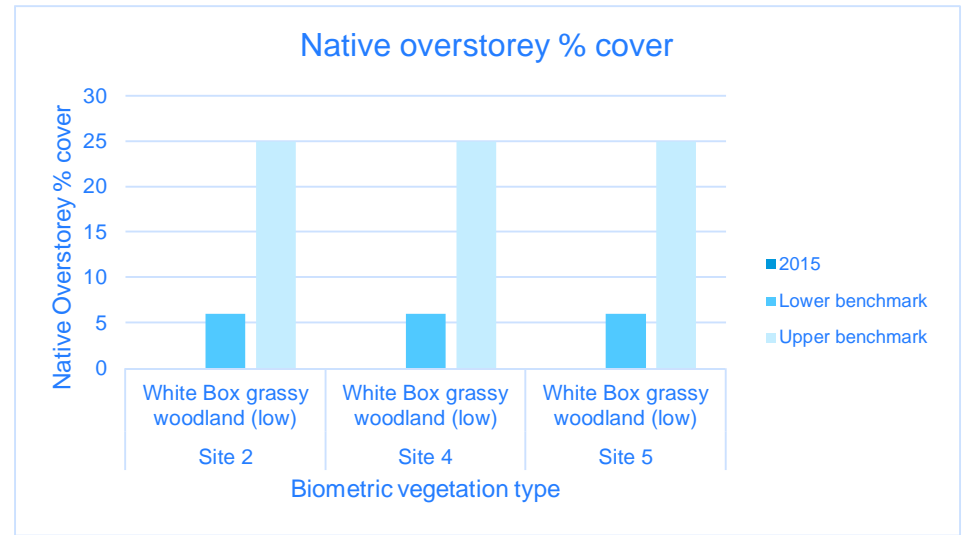
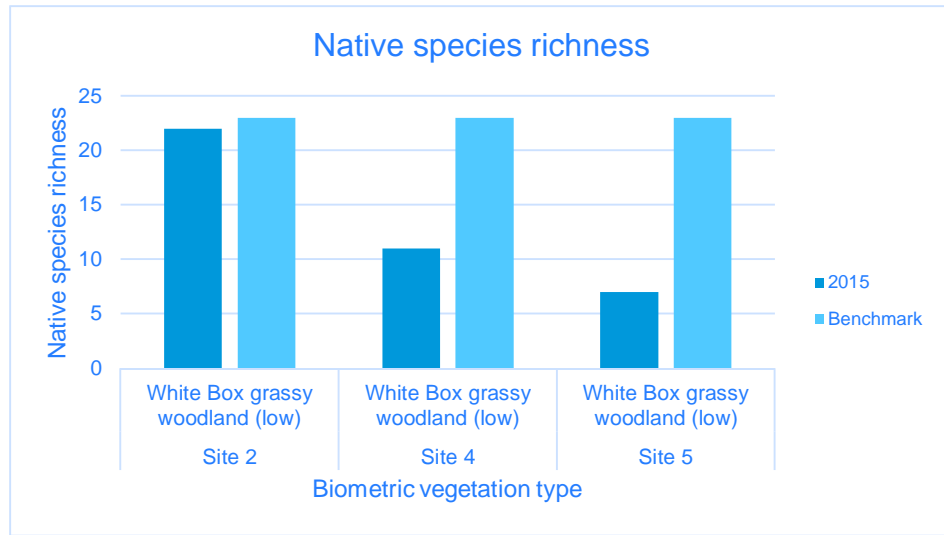
Native shrub cover was absent from all monitoring sites located within the Sunshine BOA habitat restoration zone. Although native shrub cover was absent all monitoring sites were within the lower and upper native shrub percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6).

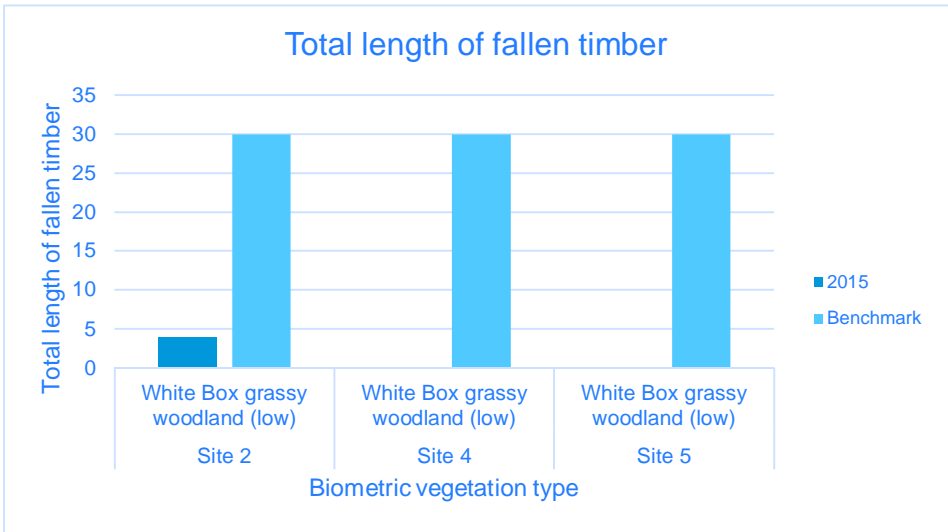
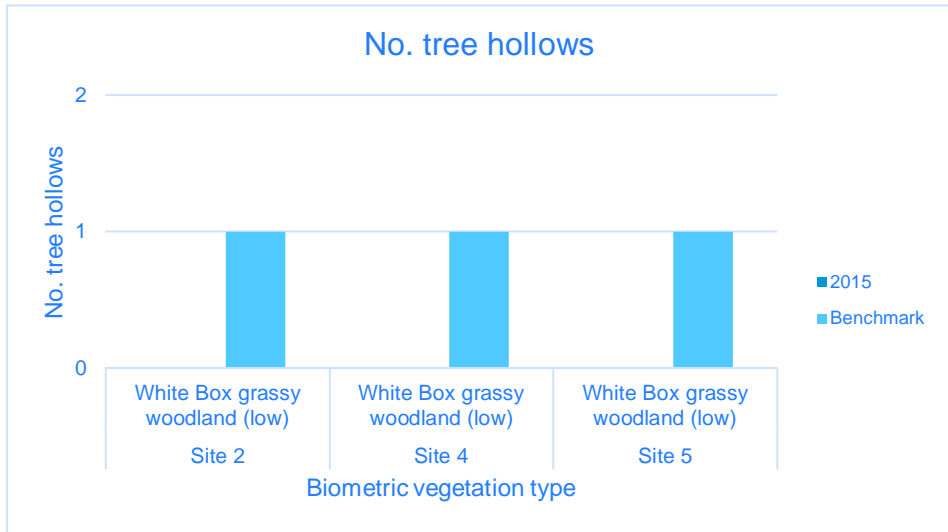
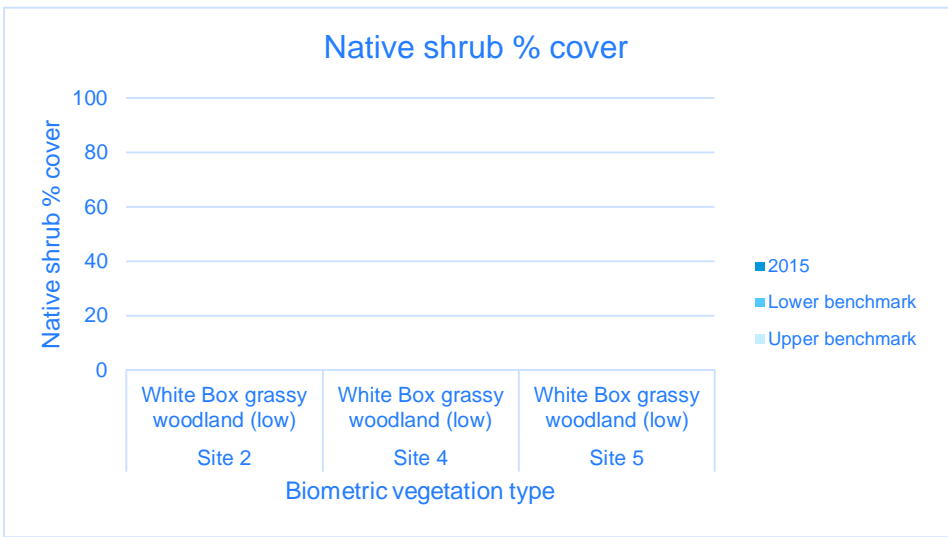
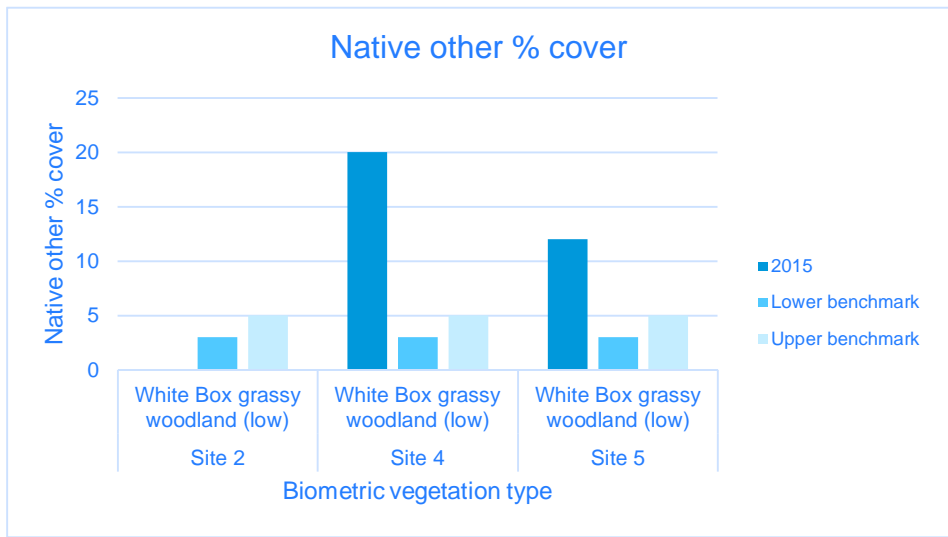
Native other cover within the Sunshine BOA habitat restoration zone was highest at Site 4 and lowest at Site 2 where no native other cover was recorded. Site 4 and Site 5 both exceeded the upper native other percentage cover benchmark value for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type. Site 2 however failed to meet the lower benchmark value (Table 9.6).

No hollow bearing trees were recorded from within the Sunshine BOA habitat restoration zone. Consequently all monitoring sites within the Sunshine BOA habitat restoration zone failed to meet the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species which have resulted in all sites occurring as derived native grassland.

The total length of fallen timber within the Sunshine BOA habitat restoration zone was highest at Site 2 and lowest at Site 4 and Site 5 where no fallen timber was recorded. All monitoring sites within the Sunshine BOA habitat restoration zone failed to meet the total length of fallen timber benchmark values for The White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 9.6). The low amount of fallen timber recorded is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 9.6 Sunshine BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





9.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Due to the long dedicated grazing of cattle and cropping in the Sunshine property, habitat restoration zones within the Sunshine BOA are somewhat degraded and often devoid of native canopy and understorey cover and plant diversity, that might otherwise encourage the occurrence of small woodland fauna. A corollary of this degradation is a low diurnal bird species richness within habitat restoration zones. Replicate monitoring site S2 recorded the highest mean diurnal bird species richness with an average of 8.5 birds, whilst sites S4 and S5 recorded an average of 2.5 and 0.5 birds respectively (Table 9.7). Diurnal birds commonly recorded at monitoring sites within habitat restoration zones included open country generalist species such as the Eastern Rosella, Noisy Miner and Galah (Table D7.1 of Appendix D). No threatened species of bird were recorded from monitoring sites associated with habitat restoration zones.

MICROCHIROPTERAN BATS

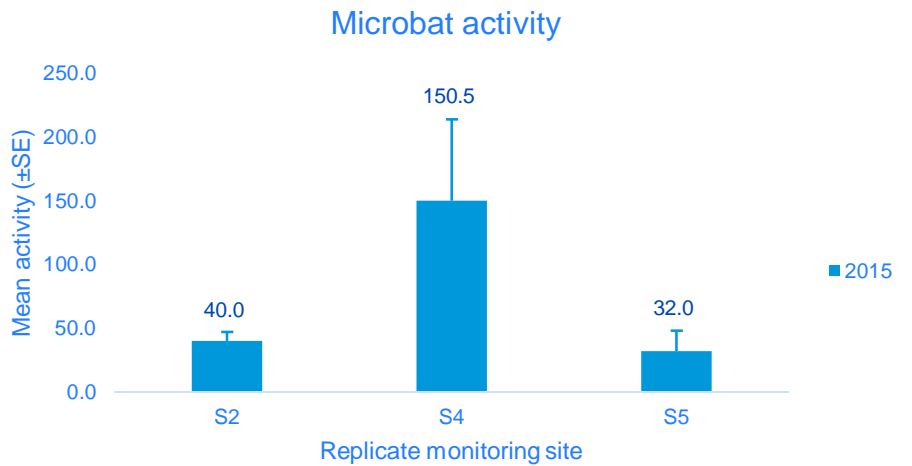
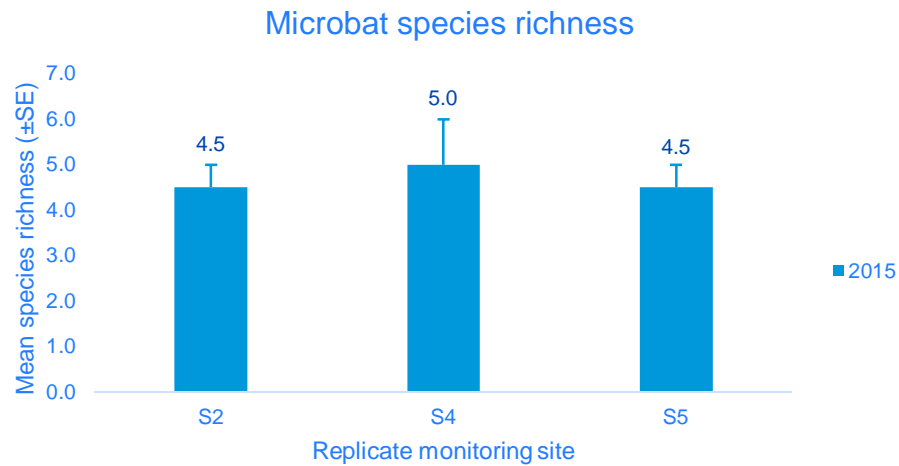
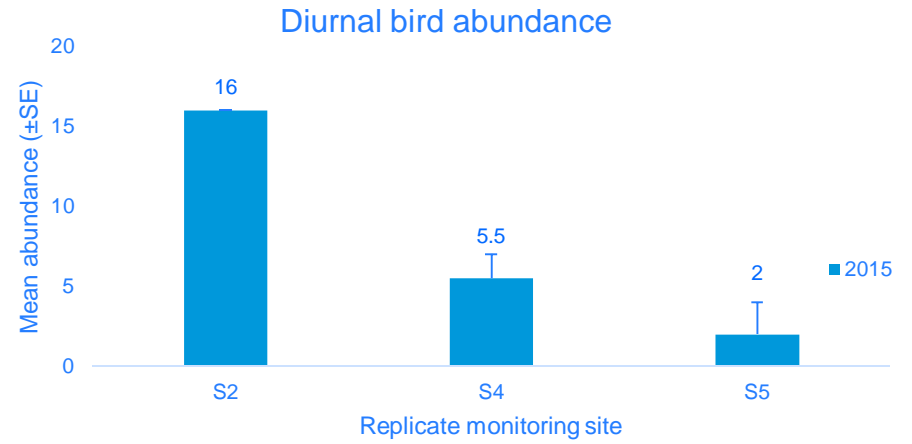
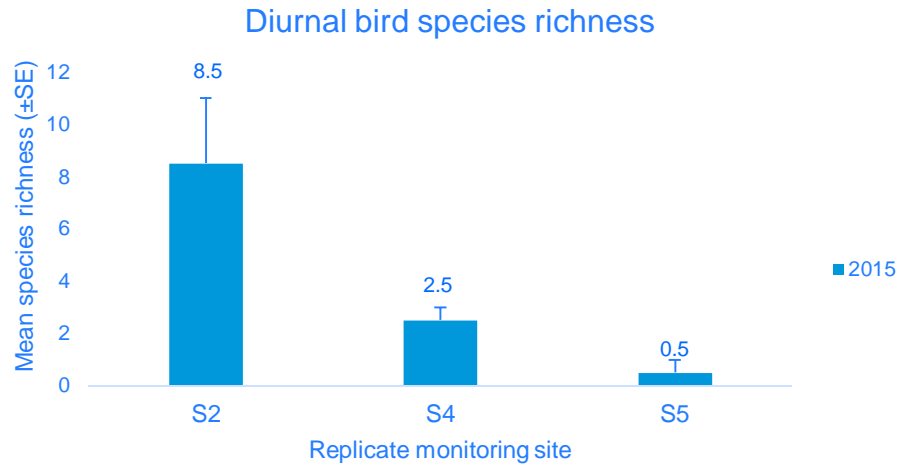
Eight species of microbat were recorded from replicate monitoring sites associated with habitat restoration zones in the Sunshine BOA (Table D7.1 of Appendix D). Mean microbat species richness was similar between replicate monitoring sites and ranged from an average of 4.5 to five microbats (Table 9.7). The most common microbats recorded, with records from each replicate monitoring site included Gould's Wattled Bat, Chocolate Wattled Bat and Little Forest Bat (Table D7.1 of Appendix D).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) was generally low, with an average of 40 and 32 passes recorded from replicate monitoring sites S2 and S5 respectively (Table 9.7). Replicate monitoring site S4 recorded the highest activity with 150.5 passes.

REMOTE CAMERA TRAPS

Remote motion sensing infra-red camera were positioned at the three replicate monitoring sites within habitat restoration zones of the Sunshine BOA. No native or introduced species of animal were recorded via remote camera trap.

Table 9.7 Sunshine BOA habitat restoration zone – 2015 baseline fauna monitoring



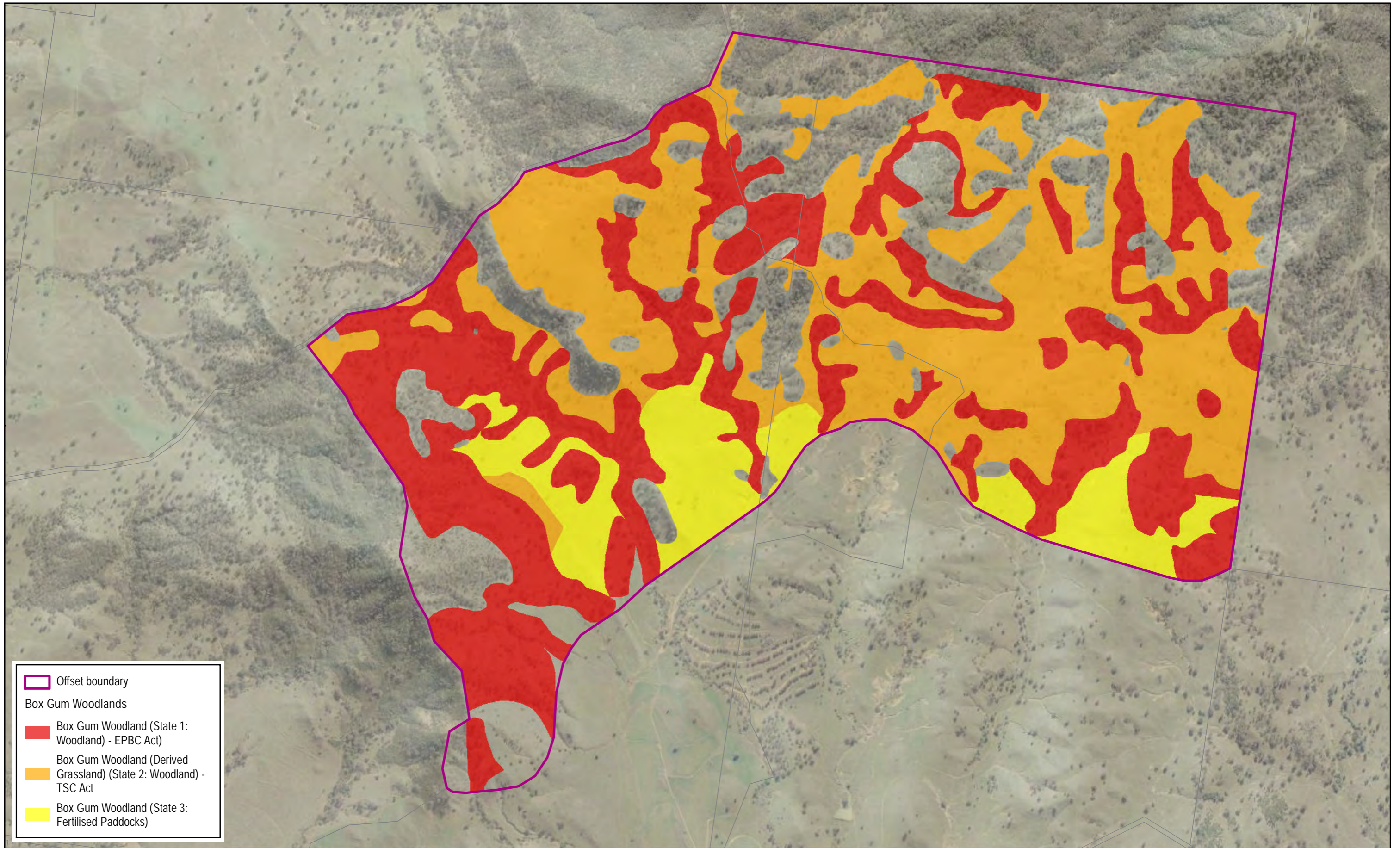
9.4 State of Box Gum Woodland





The Sunshine BOA contains approximately 561.2 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Sunshine BOA on lower slopes and flatter land (Figure 9.2).

Within the Sunshine BOA the Box Gum Woodland occurs in three states:


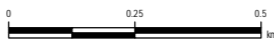
- Box Gum Woodland – State 1: Woodland – occupies approximately 243.5 ha.
- Box Gum Woodland – State 2: Native Pastures (derived native grassland) – occupies approximately 245.8 ha.
- Box Gum Woodland – State 3: Fertilised Paddock – occupies approximately 71.9 ha.

Four monitoring sites within the Sunshine BOA (one within habitat management zone and three within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 9.8.



 Offset boundary
Box Gum Woodlands
 Box Gum Woodland (State 1: Woodland) - EPBC Act
 Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act
 Box Gum Woodland (State 3: Fertilised Paddocks)

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -

	 1:15,000
Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3	

Data source: © Land and Property Information 2015
 Copyright: © 2014 Esri

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BIODIVERSITY OFFSET MONITORING

Figure 9.2
 Box Gum Woodland within Sunshine BOA

Table 9.8 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Sunshine BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native over storey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat management zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	3	X 6 below	✓	✓	✓		X 14 below	Box Gum Woodland - State 2 (Woodland). Native over storey PFC and native species richness are below the benchmark values. All remaining vegetation attributes are within or above the benchmark values. Dominant canopy (no hollows or regeneration) and shrub species absent. Native groundcover species recorded however exotic species recorded in high numbers (13). Evidence of heavy agricultural grazing pressures and feral herbivore grazing (goats, rabbits and pigs) observed on site.
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	2	X 6 below	✓	✓	✓	X 3 below	X 1 below	Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands). Native overstorey PFC, native other groundcover percentage and native species richness are below benchmark values. All remaining vegetation attributes are within or above benchmark values. Canopy and shrub species generally absent (no hollows but evidence of regeneration occurring). Native groundcover species present however exotic species recorded in high numbers (19). Evidence of heavy agricultural grazing and feral herbivore grazing was observed.

VEGETATION ATTRIBUTES								BOX GUM WOODLAND STATE & GRAZING PRESSURES
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
	4	X 6 below	✓	X 6 below	✓		X 12 below	Box Gum Woodland - State 3 Fertilised Paddocks. Native overstorey PFC, native grass groundcover percentage and native species richness are below benchmark values. All remaining vegetation attributes are within or above benchmark values. Canopy and shrub species absent (no hollows or regeneration). Native groundcover species present however exotic species recorded in high numbers (15). Evidence of heavy agricultural grazing and feral herbivore grazing was observed.
	5	X 6 below	✓	✓	✓		X 16 below	Box Gum Woodland - State 3 Fertilised Paddocks. Native overstorey PFC and native species richness are below benchmark values. All remaining vegetation attributes are within or above benchmark values. Canopy and shrub species absent (no hollows or regeneration). Native groundcover species present however exotic species recorded in high numbers (12). Evidence of heavy agricultural grazing and feral herbivore grazing was observed.

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

10 BRAEFIELD BOA – BASELINE RESULTS

10.1 Introduction

The Braefield property encompasses an area of 1,400.8 ha and is located approximately 20 km east of the Project. The Braefield property lies within the Nandewar Range and forms part of the south-eastern portion of the Regional East-West Wildlife Corridor. The Braefield property contains over 1400 ha of native vegetation including high quality remnant vegetation, particularly in the north, which will complement and adjoin high quality existing vegetation and will extend the Regional East-West Wildlife Corridor. An important environmental corridor that historically linked Leard State Forest with the Nandewar Range, Namoi River and large vegetation remnants to the west.

The vegetation and management zones within the Braefield BOA are illustrated in Figure 10.1.

10.1.1 Flora

106 plant species were recorded within the Braefield BOA during the 2015 monitoring session. Of these, 78 (74%) were native and 28 (26%) were exotic (Appendix C). The most diverse families recorded were the Poaceae with 19 species followed by Asteraceae with 22 species. No threatened plant species were recorded.

Of the 28 exotic species that were recorded in the Braefield BOA, one species of plant is listed under the *Noxious Weeds Act 1993* for the Gunnedah Shire Council Local Control Authority Area (Table 10.1). No exotic species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2015). Other highly invasive species that occurred abundantly within the Braefield BOA included *Carthamus lanatus** (Saffron Thistle), *Centaurea melitensis** (Cockspur Thistle) and several *Trifolium* species* (Clover).

Table 10.1 Noxious Weeds recorded within the Braefield BOA

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY	WEED OF NATIONAL SIGNIFICANCE
Mexican poppy	<i>Argemone mexicana</i> *	5	No

No threatened flora species were recorded within the Braefield BOA.

10.1.2 Fauna

Baseline monitoring recorded 100 species of animal within the Braefield BOA, including 96 native species and four introduced species (Table 10.2 and Table D8.1 of Appendix D).

Table 10.2 Summary of terrestrial animal species identified in the Braefield BOA

GROUP	SPECIES RICHNESS	
	NATIVE	INTRODUCED
Birds	80	-
Microbats	8	-
Mammals (non-bats)	2	4
Reptiles	4	-
Frogs	2	-
Total	96	4

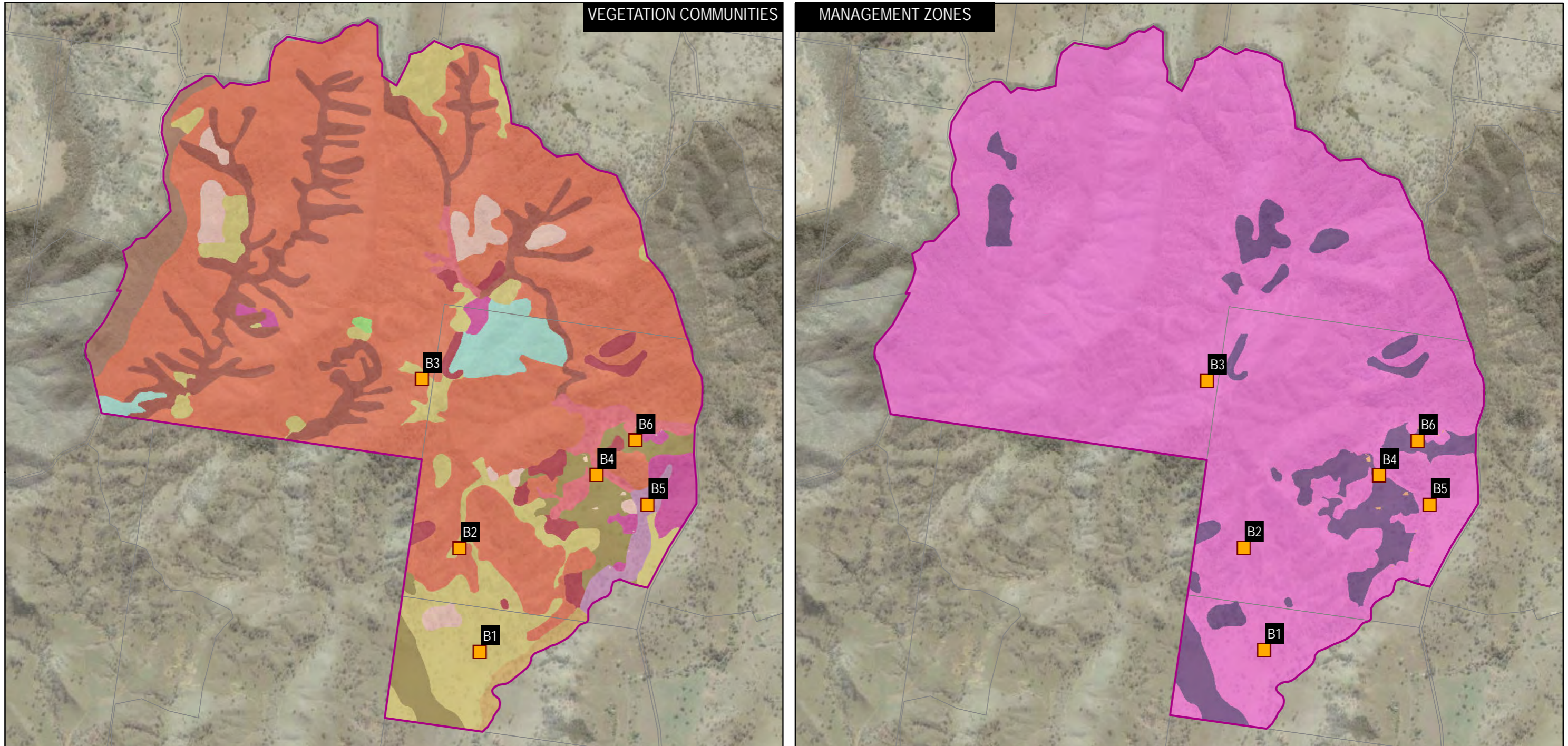
A total of seven threatened species were recorded within the Braefield BOA during the 2015 baseline monitoring session (Table 10.3, Appendix D).

Table 10.3 Threatened species recorded in the Braefield BOA

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	-	V
Varied Sittella	<i>Daphoenositta chrysoptera</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	-	V
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	-	V
Little Lorikeet	<i>Glossopsitta pusilla</i>	-	V
Turquoise Parrot	<i>Neophema pulchella</i>	-	V
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	-	V

VEGETATION COMMUNITIES

MANAGEMENT ZONES



- | | | | |
|-----------------------------|---|--|---------------------------------|
| Ecological survey locations | Vegetation community | White Box - White Cypress Pine shrubby open forest | Management zones |
| Offset boundary | Farm dams | White Box Blakely's Red Gum Rough-barked Apple riparian forest (shrubby variant) | Habitat management zone |
| | New England Blackbutt Rough-barked Apple shrubby open forest | White Box Blakely's Red Gum Rough-barked Apple riparian woodland | Habitat restoration zone |
| | Tumbledown Red Gum grassy woodland | White Box Dwyers Red Gum Manna Gum shrubby woodland | Other land for agriculture zone |
| | White Box - Melaleuca riparian forest | White Box Grassy Woodland | |
| | White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest | White Box Grassy Woodland (Low condition) | |
| | White Box - White Cypress Pine shrubby open forest (Callitris Regrowth) | Yellow Box - Blakely's Red Gum grassy woodland | |
| | White Box - White Cypress Pine shrubby open forest (Shiny Bush) | | |

10.2 Habitat management zones

10.2.1 Baseline vegetation attributes and benchmarks

Total native species richness within the Braefield BOA habitat management zones was highest at Site 2 closely followed by Site 3 and Site 1 respectively (Table 10.4). Similarities of native species richness at monitoring sites 1, 2 and 3 are thought to be associated with the fact that all sites represent the same vegetation type; being White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions. Site 5 contained the lowest native species richness within the Braefield BOA habitat management zones. This is thought to be attributed to it representing a separate vegetation type; being Tea-tree shrubland of drainage areas of the slopes and tablelands (Table 10.4). Native species richness across all habitat management zone monitoring sites were above their associated vegetation type benchmarks.

Native overstorey percentage cover within the Braefield BOA habitat management zones was highest at Site 5 closely followed by Site 2 and Site 3 respectively. Native overstorey percentage cover was lowest at Site 1. All monitoring sites within the Braefield BOA habitat management zones had native overstorey percentage covers that were either within or above their associated lower and upper vegetation type benchmark values. Native overstorey percentage cover was above the upper vegetation type benchmarks at Site 2 and Site 3 whilst values were within the lower and upper benchmark values at Site 1 and Site 5 (Table 10.4).

Native midstorey percentage cover within the Braefield BOA habitat management zones was highest at Site 2 and lowest at Site 1. All monitoring sites within the Braefield BOA habitat management zones had native midstorey percentage covers that were either within or above their associated lower and upper vegetation type benchmark values. Native midstorey percentage cover was above the upper vegetation type benchmarks at Site 1, 2 and Site 3 whilst values were within the lower and upper benchmark values at Site 5 this difference is thought to be attributed to differences between vegetation type benchmark values (Table 10.4).

Native grass percentage cover within the Braefield BOA habitat management zones was highest at Site 2 followed by Site 1 and Site 3. Native grass percentage cover was lowest at Site 5 (Table 10.4). This is thought to be attributed to Similarities of native grass percentage cover at monitoring sites 1, 2 and 3 are thought to be associated with the fact that all sites represent the same vegetation type; being White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions. Site 5 contained the lowest native grass percentage cover within the Braefield BOA habitat management zones. This is thought to be attributed to it representing a separate vegetation type; being Tea-tree shrubland of drainage areas of the slopes and tablelands (Table 10.4).

All monitoring sites were within or above their associated vegetation type benchmark values for native grass percentage cover except for Site 2 which was below the lower benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (Table 10.4).

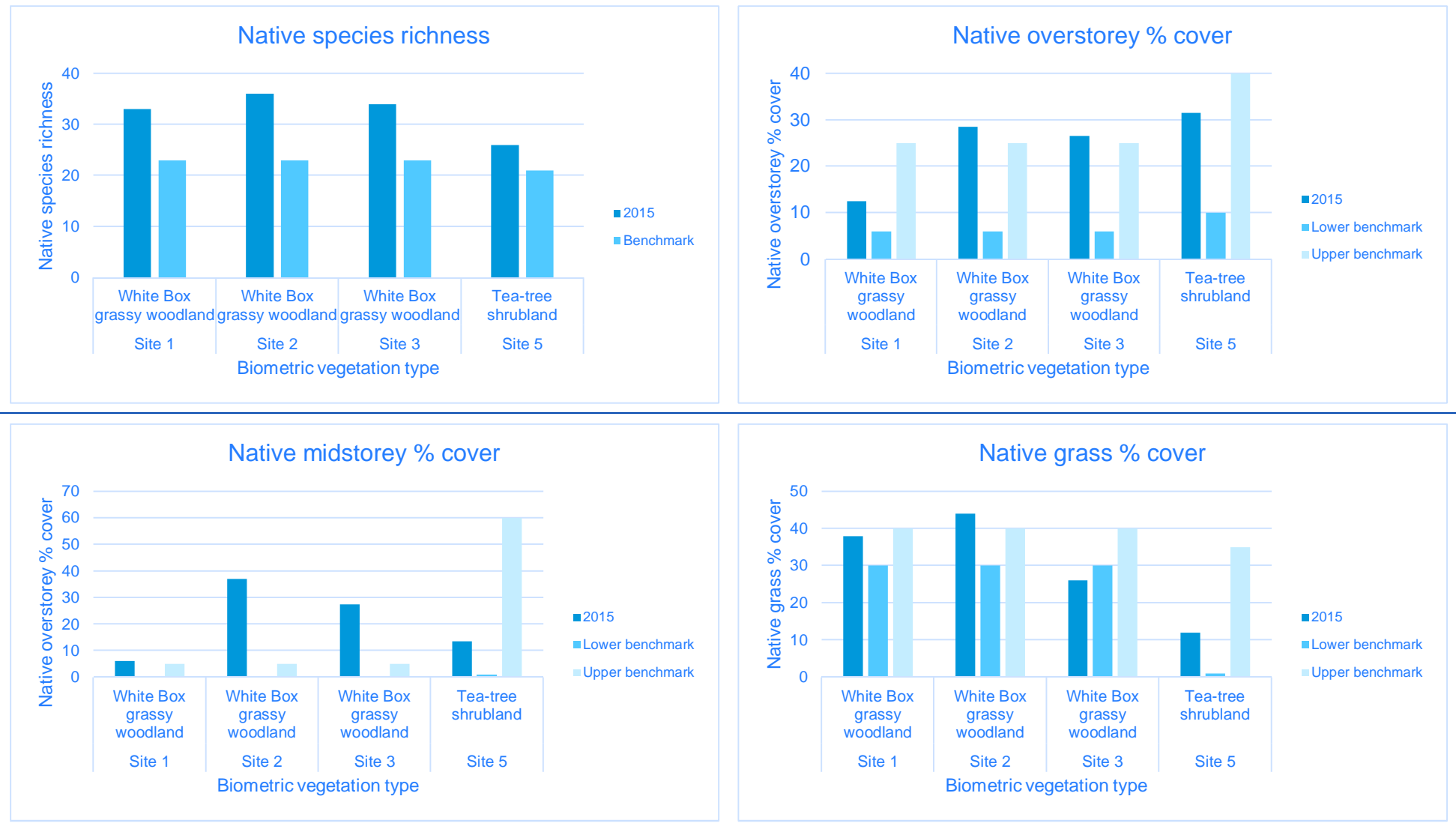
No native shrub percentage cover was observed at any of the habitat management zone monitoring sites within the Braefield BOA. All monitoring sites were within their associated vegetation type benchmark values except for Site 5. Site 5 was below the lower benchmark value for Tea-tree shrubland of drainage areas of slopes and tablelands (Table 10.4).

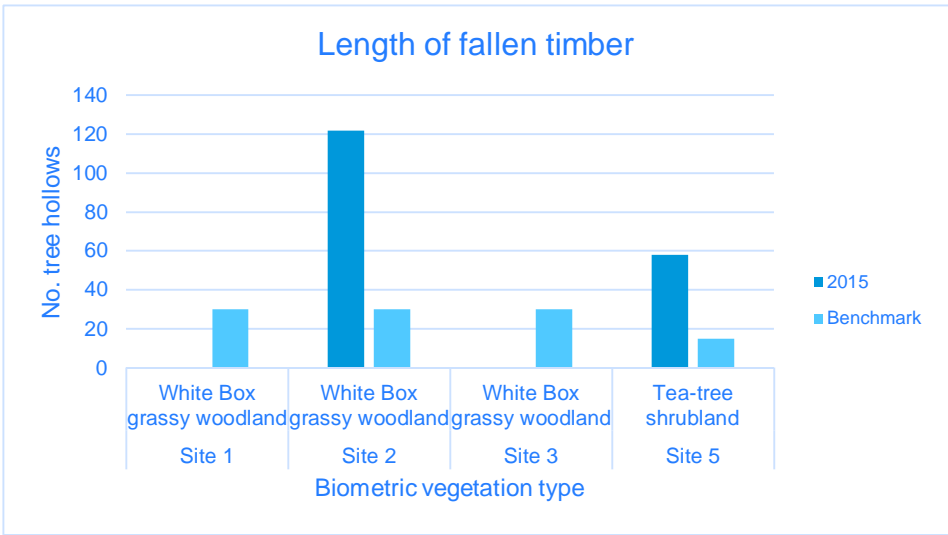
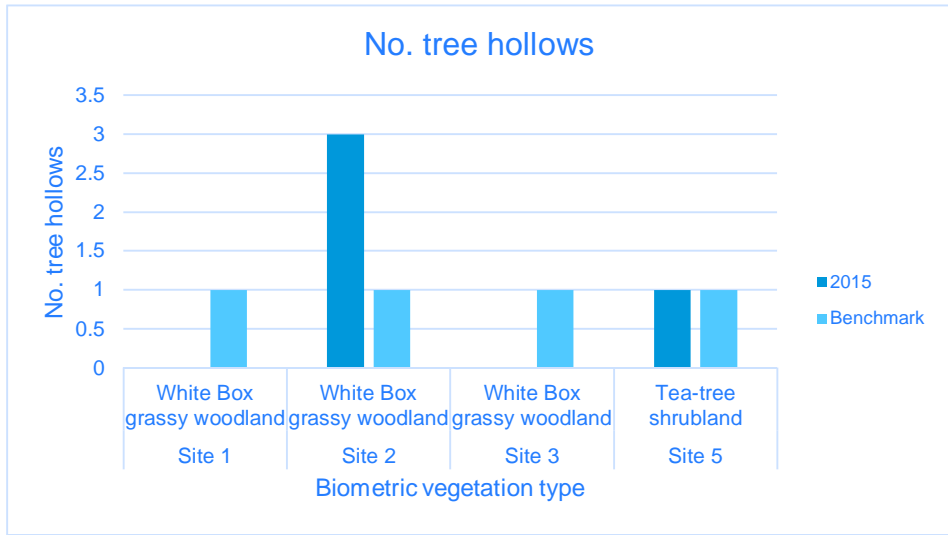
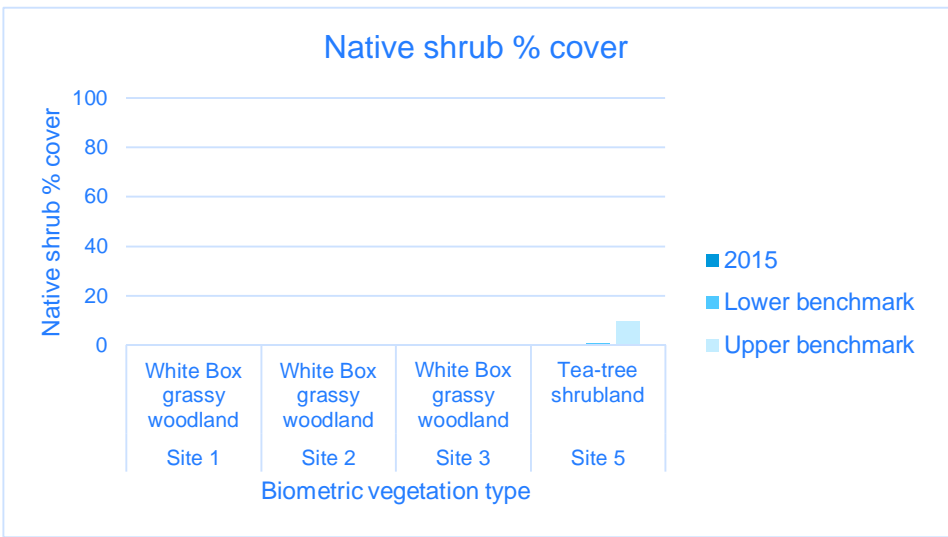
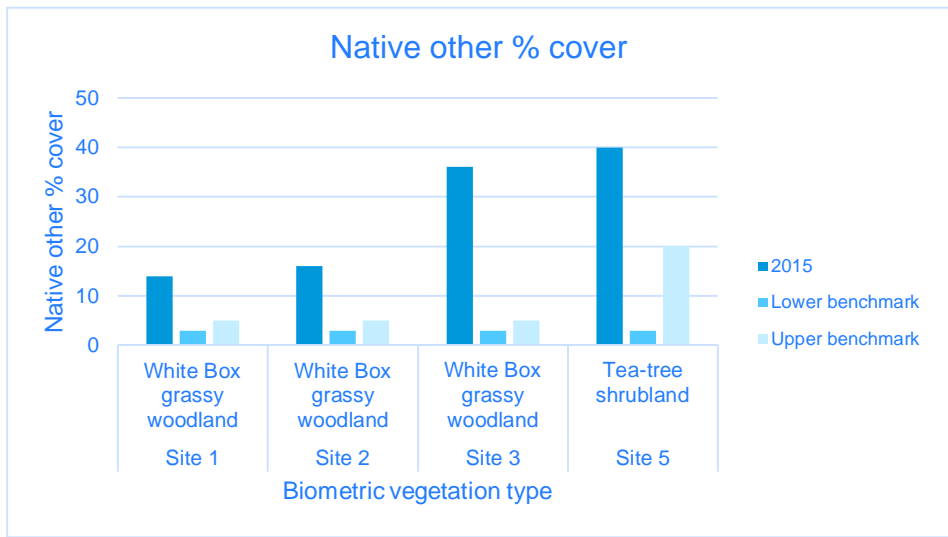
Native other percentage cover within the Braefield BOA habitat management zones was highest at Site 5 followed by Site 3 and Site 2. Native other percentage cover was lowest at Site 1 (Table 10.4). The native other percentage cover was substantially higher than the vegetation type benchmark values at all habitat management zone monitoring sites within the Braefield BOA.

The number of hollow bearing trees within the Braefield BOA habitat management zones was highest at Site 2 and Site 5. No hollow bearing trees were observed within Site 1 or Site 3. Consequently, monitoring sites 2 and 5 met their associated vegetation type benchmark values whilst monitoring sites 1 and 3 fell short of the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 10.4).

The length of fallen timber within the Braefield BOA habitat management zones was highest at Site 2 and Site 5. No fallen timber was observed within Site 1 or Site 3. Consequently, monitoring sites 2 and 5 met their associated vegetation type benchmark values whilst monitoring sites 1 and 3 fell short of the hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (Table 10.4).

Table 10.4 Braefield BOA habitat management zone – 2015 baseline vegetation attributes and benchmark data





10.2.2 Baseline fauna assemblage

DIURNAL BIRDS

Diurnal bird species richness was moderately high in habitat management zones with replicate survey site B5 recording the highest average bird species richness and abundance of 24 and 43 respectively (Table 10.5). This monitoring location is associated with a riparian drainage line that is ecotonal with adjacent forested slopes and cleared agricultural paddocks. Diurnal birds commonly encountered at replicate monitoring sites included, Mistletoebird, Willie Wagtail, Rufous Whistler and Weebill (Table D8.1 of Appendix D). Due to the widespread occurrence of shrubby understorey stratum in habitat management zones, the Speckled Warbler was the most commonly recorded threatened species, which favours such habitat. The Speckled Warbler was recorded from replicate monitoring site B2, B3 and B5.

MICROCHIROPTERAN BATS

Six species of microbat were positively recorded from replicate monitoring sites associated with habitat management zones in the Braefield BOA (Table D8.1 of Appendix D). Microbats recorded largely comprised species common to the north-west slopes and plains. The most common microbats recorded, having been recorded at each monitoring site included South-eastern Free-tailed Bat, Gould's Wattled Bat and Little Forest Bat (Table D8.1 of Appendix D). Mean microbat species richness was similar between replicate monitoring sites in habitat management zones and ranged from 2.5 at B1 to 4.5 at B3 and B5 (Table 10.5).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) ranged from an average of 109 passes at site B5 to 28 passes at site B2. This may be accounted for by replicate monitoring site B5 occurring in association with a riparian drainage line at the ecotone with forested slopes and cleared agricultural paddocks.

REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at each replicate monitoring location within habitat management zones of the Braefield BOA. One native species of animal, Australian Raven, was recorded via remote camera at monitoring site B1. No introduced species were recorded via remote camera in habitat management zones.

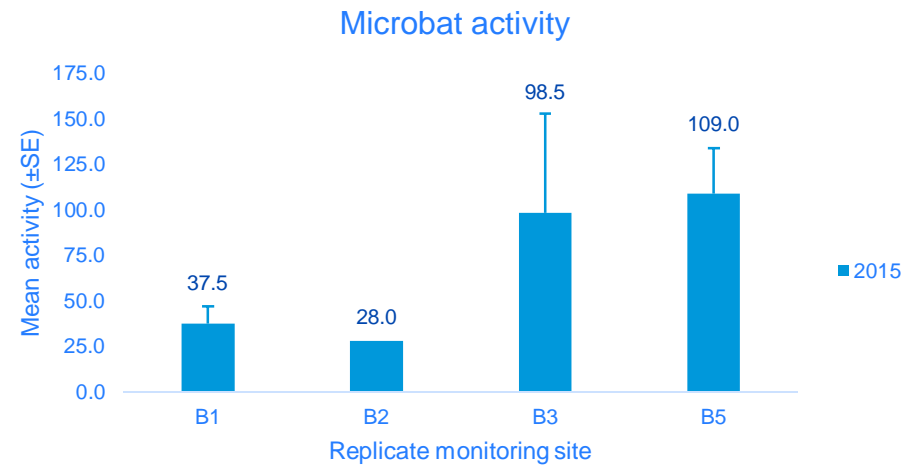
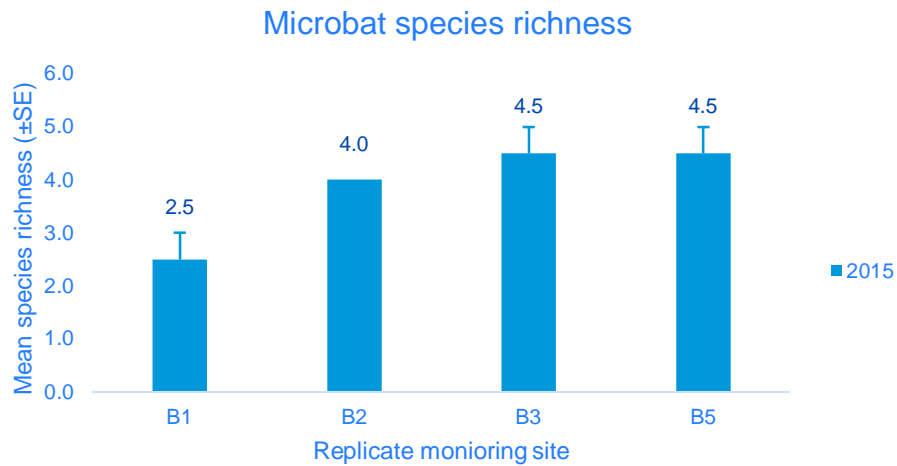
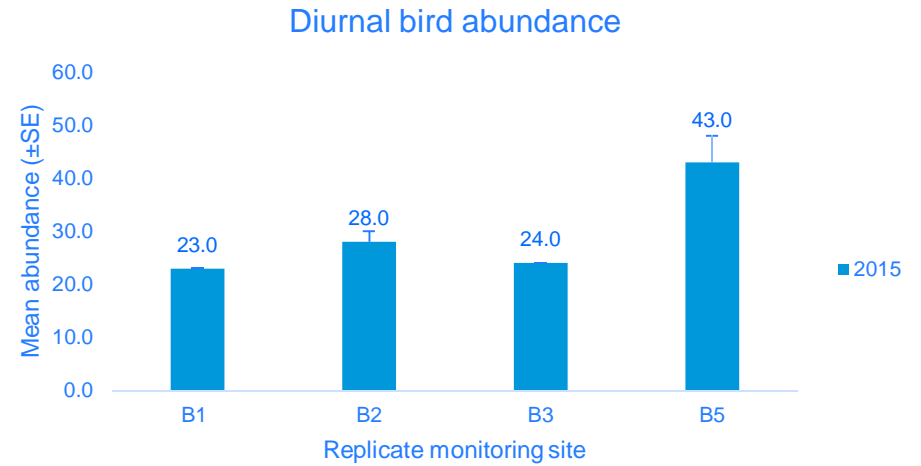
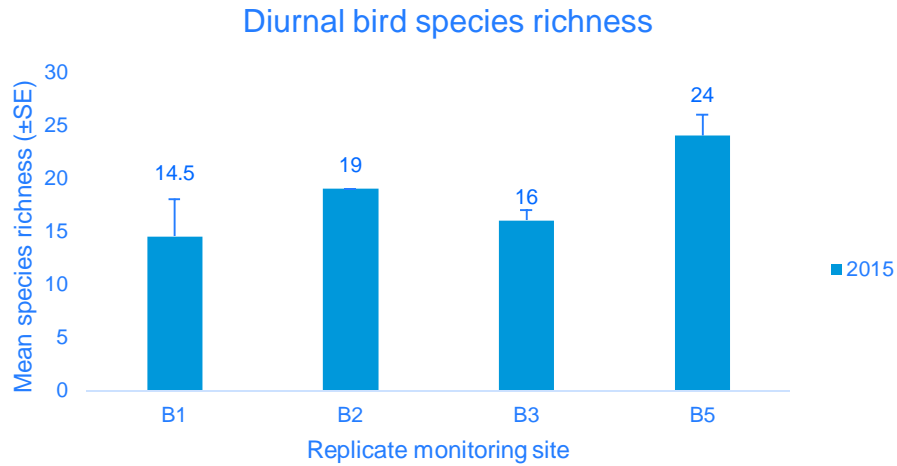
NOCTURNAL BIRDS

Nocturnal call playback was completed at replicate monitoring site B5. One nocturnal bird, Southern Boobook, was heard calling distantly.

NOCTURNAL MAMMALS

One spotlight event was completed at replicate monitoring site B5. No nocturnal mammals were recorded therein.

Table 10.5 Braefield BOA habitat management zone – 2015 baseline fauna monitoring



10.3 Habitat restoration zones

10.3.1 Baseline vegetation attributes and benchmarks

Native species richness within the Braefield BOA habitat restoration zones was highest at Site 4 followed by Site 6. Both monitoring sites within the habitat restoration zones met the native species richness benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 10.6).

Native overstorey percentage cover within the Braefield BOA habitat restoration zones was absent. Neither Site 4 nor Site 6 met the native overstorey percentage cover benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 10.6). The void of native canopy cover is thought to be attributed to past vegetation clearing and land uses which have resulted in Site 4 and Site 6 now occurring as derived native grassland.

Native midstorey percentage cover within the Braefield BOA habitat restoration zones was substantially higher at Site 6 than Site 4 (Table 10.6). The differences between the two monitoring sites is thought to be attributed to past and previous land uses which included Site 6 being exposed to less intense agricultural grazing regimes and deep ripping of the soil which was observed during the monitoring surveys. Consequently, this has allowed for the germination and establishment of colonising shrub species (i.e. *Dodonaea viscosa* and *Acacia decora*) at Site 6. Site 6 and Site 4 are within the lower sand upper benchmark values for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions respectively (Table 10.6).

Native grass percentage cover within the Braefield BOA habitat restoration zones was highest at Site 6 and lowest at Site 4. Similarly to the native midstorey percentage cover difference between the two sites is thought to be attributed to previous deep ripping and less intense agricultural grazing at Site 6. Neither Site 6 nor Site 4 met the benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 10.6).

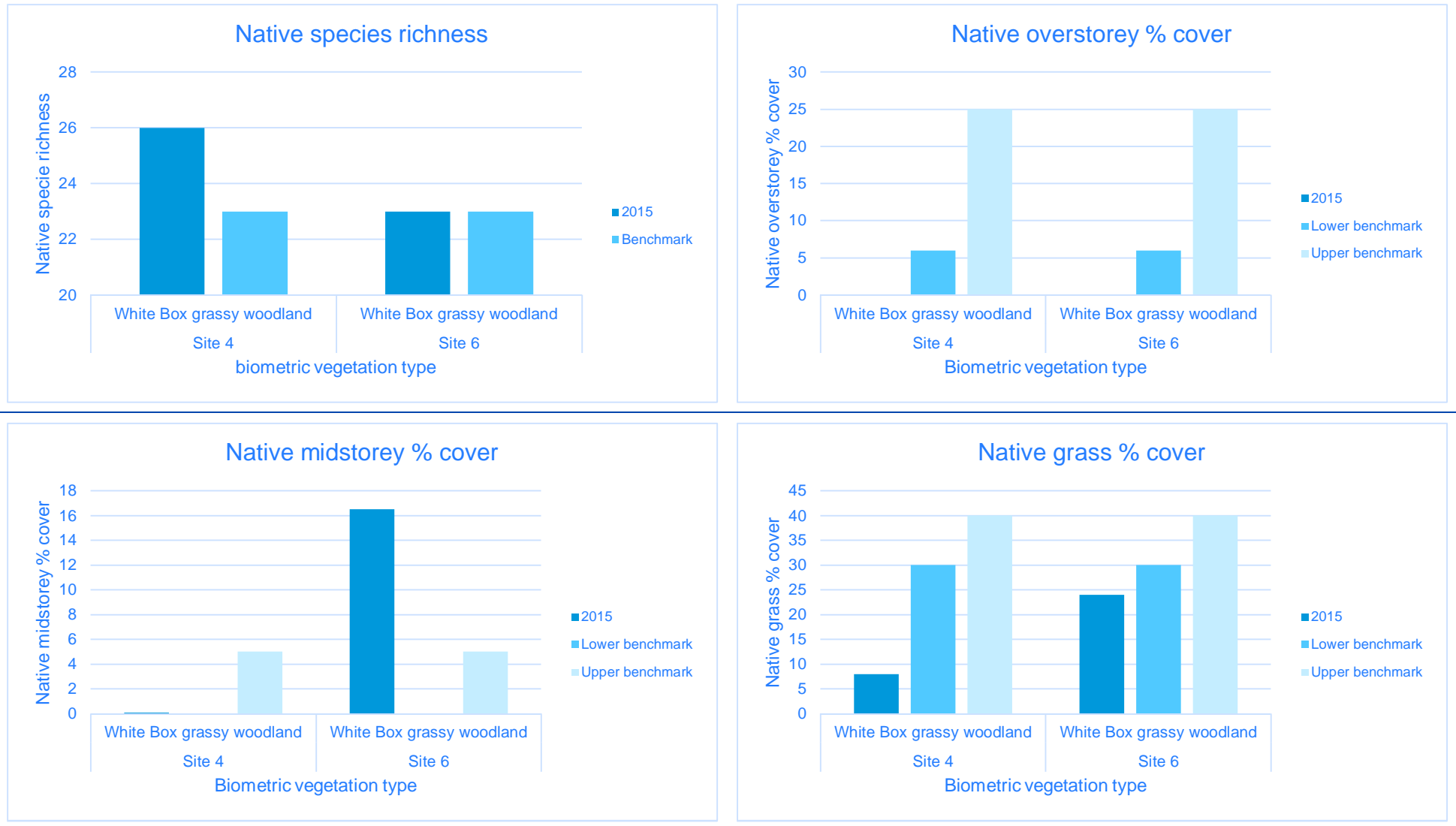
No native shrub percentage cover was observed at any of the habitat restoration zone monitoring sites within the Braefield BOA. All monitoring sites were within their associated vegetation type benchmark values (Table 10.6).

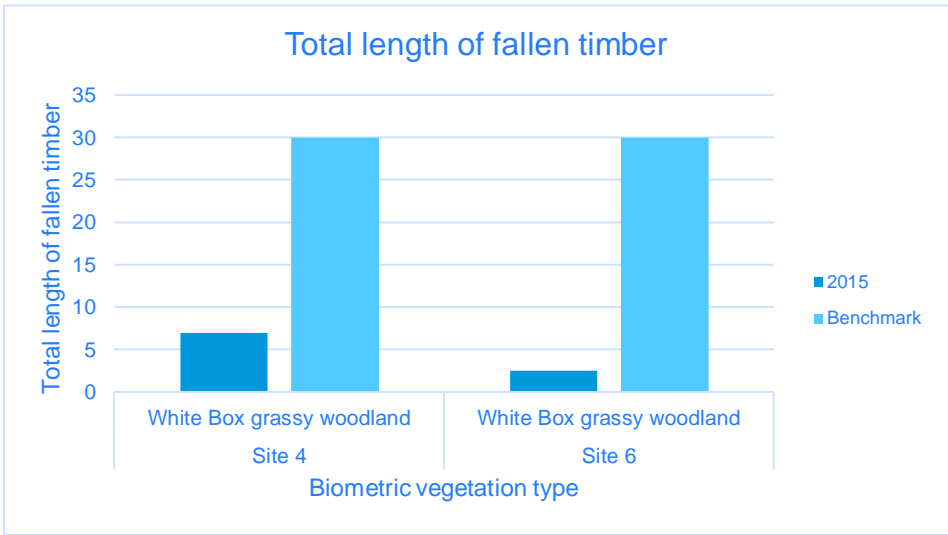
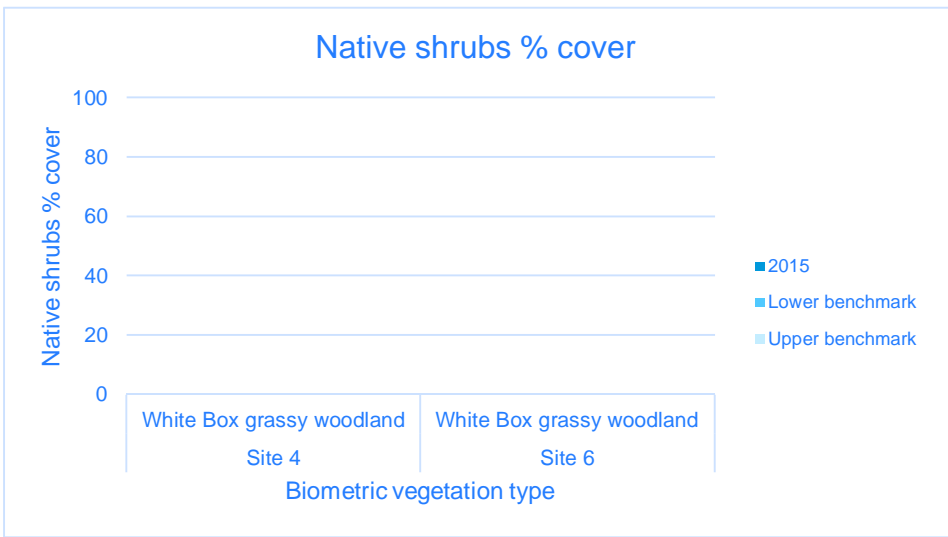
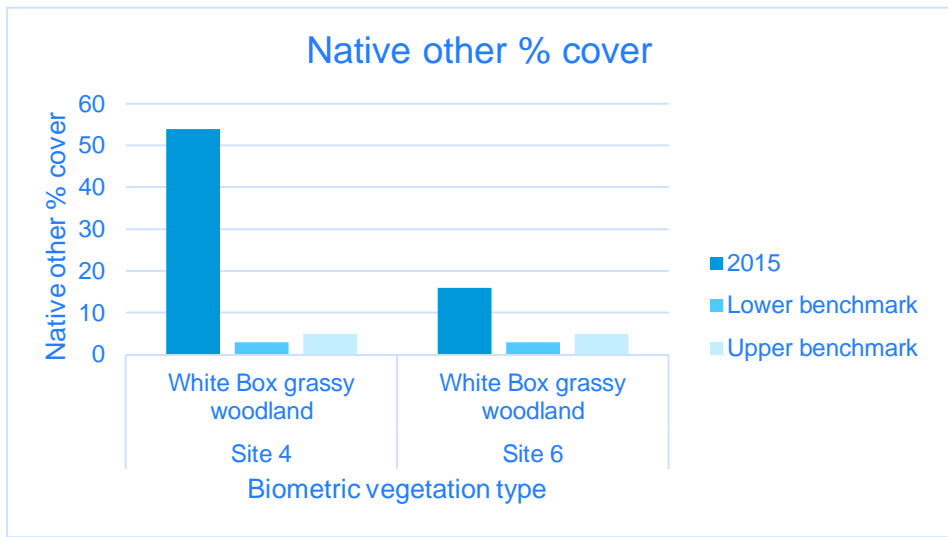
Native other percentage cover within the Braefield BOA habitat restoration zones was highest at Site 4 and lowest at Site 6. Both Site 4 and Site 6 were above the upper native other percentage cover benchmark value the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 10.6).

Hollow bearing trees within the Braefield BOA habitat restoration zones were entirely absent from both Site 4 and Site 6 (Table 10.6). The absence of hollow bearing trees is thought to be attributed past vegetation clearing which removed all canopy tree species. Subsequently vegetation at both these monitoring sites now occur as derived native grasslands. Site 4 and Site 6 were both below the number of hollow bearing tree benchmark value for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 10.6).

The total length of fallen timber within the Braefield BOA habitat restoration zones was highest at Site 4 and lowest at Site 6. Length of fallen timber at both monitoring sites were considerably low and not within the benchmark values for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions vegetation type (Table 10.6). The low amount of fallen timber recorded is thought to be attributed to past vegetation clearing which removed all or most of the fallen timber that may have once occurred.

Table 10.6 Braefield BOA habitat restoration zone – 2015 baseline vegetation attributes and benchmark data





10.3.2 Baseline fauna assemblage benchmarks

DIURNAL BIRDS

Diurnal bird species richness was moderate in habitat restoration zones with replicate survey site B4 and B6 recording an average species richness of 15 and 13 respectively (Table 10.7). The most common birds recorded included Mistletoebird, Willie Wagtail, White-winged Triller and Noisy Friarbird (Table D8.1 of Appendix D).

MICROCHIROPTERAN BATS

Seven species of microbat were positively recorded from replicate monitoring sites associated with habitat restoration zones in the Braefield BOA (Table D8.1 of Appendix D). Microbats recorded largely comprised species common to the north-west slopes and plains, including one threatened species, the Eastern False Pipistrelle. The most common microbats recorded, having been recorded at both habitat restoration sites, were Little Forest Bat, Chocolate Wattled Bat, Gould's Wattled Bat and South-eastern Free-tailed Bat. A mean microbat species richness of 5.5 and 3.0 were recorded from replicate monitoring sites B4 and B6 respectively (Table 10.7).

Mean microbat activity levels (as determined by the number of passes recorded via Anabat detector) ranged from high (133.5 passes) at replicate monitoring site B4 to low (22 passes) at replicate monitoring site B6. This may be accounted for by B4 occurring immediately adjacent to a good quality riparian corridor in association with extant vegetation, whilst B6 occurs on the upper acclivity of intensively grazed paddocks.

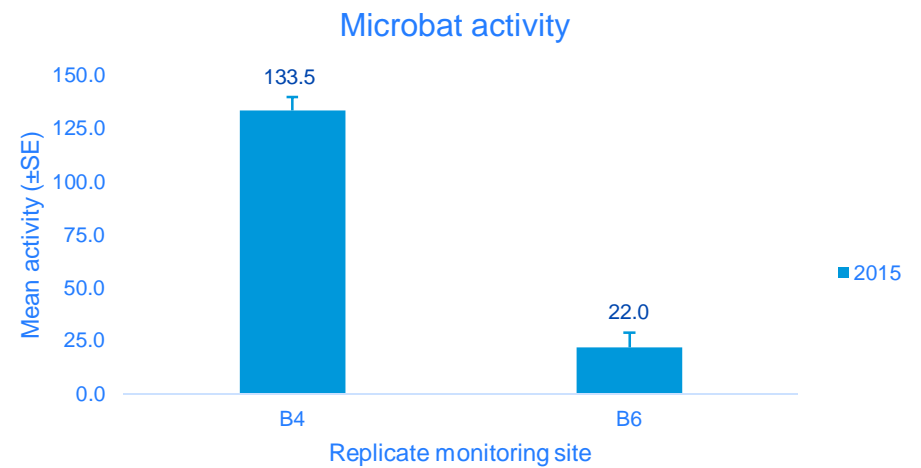
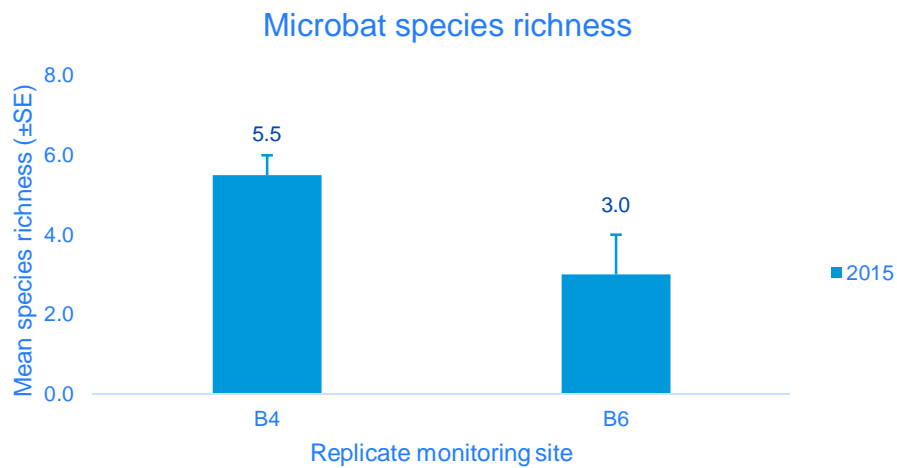
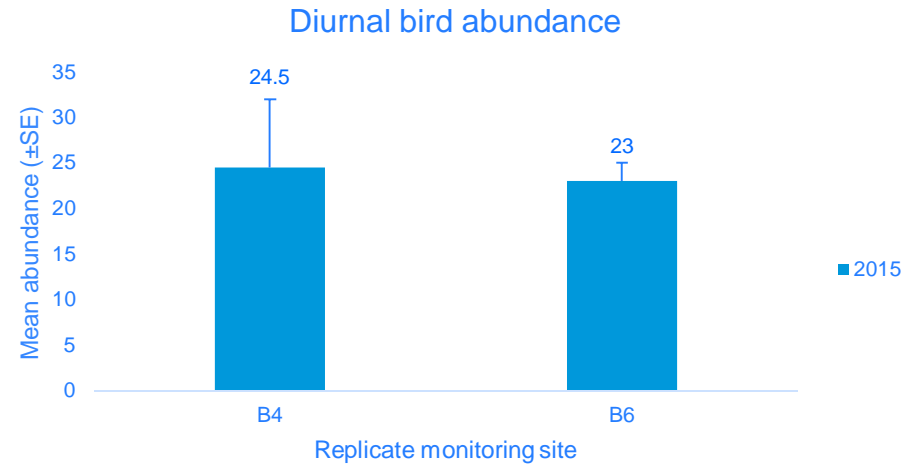
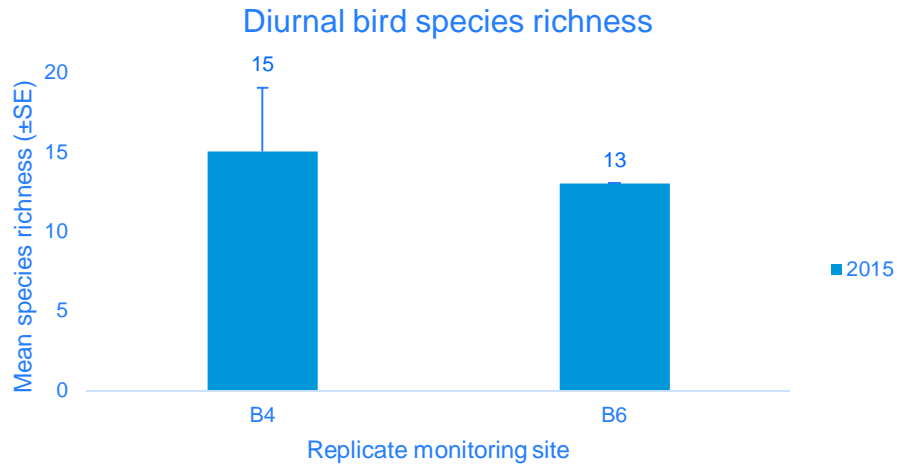
REMOTE CAMERA TRAPS

Remote motion sensing infra-red cameras were positioned at each replicate monitoring site associated with habitat restoration ones of the Braefield BOA. Native species recorded via remote camera trap included Eastern Grey Kangaroo, Pied Currawong and Australian Raven. One vertebrate pest species, Goat, and agricultural species, Cow, were recorded grazing at replicate monitoring site B6 (Photo 10.1).



Photo 10.1 Cows grazing at replicate monitoring site B6

Table 10.7 Braefield BOA habitat restoration zone – 2015 baseline fauna monitoring



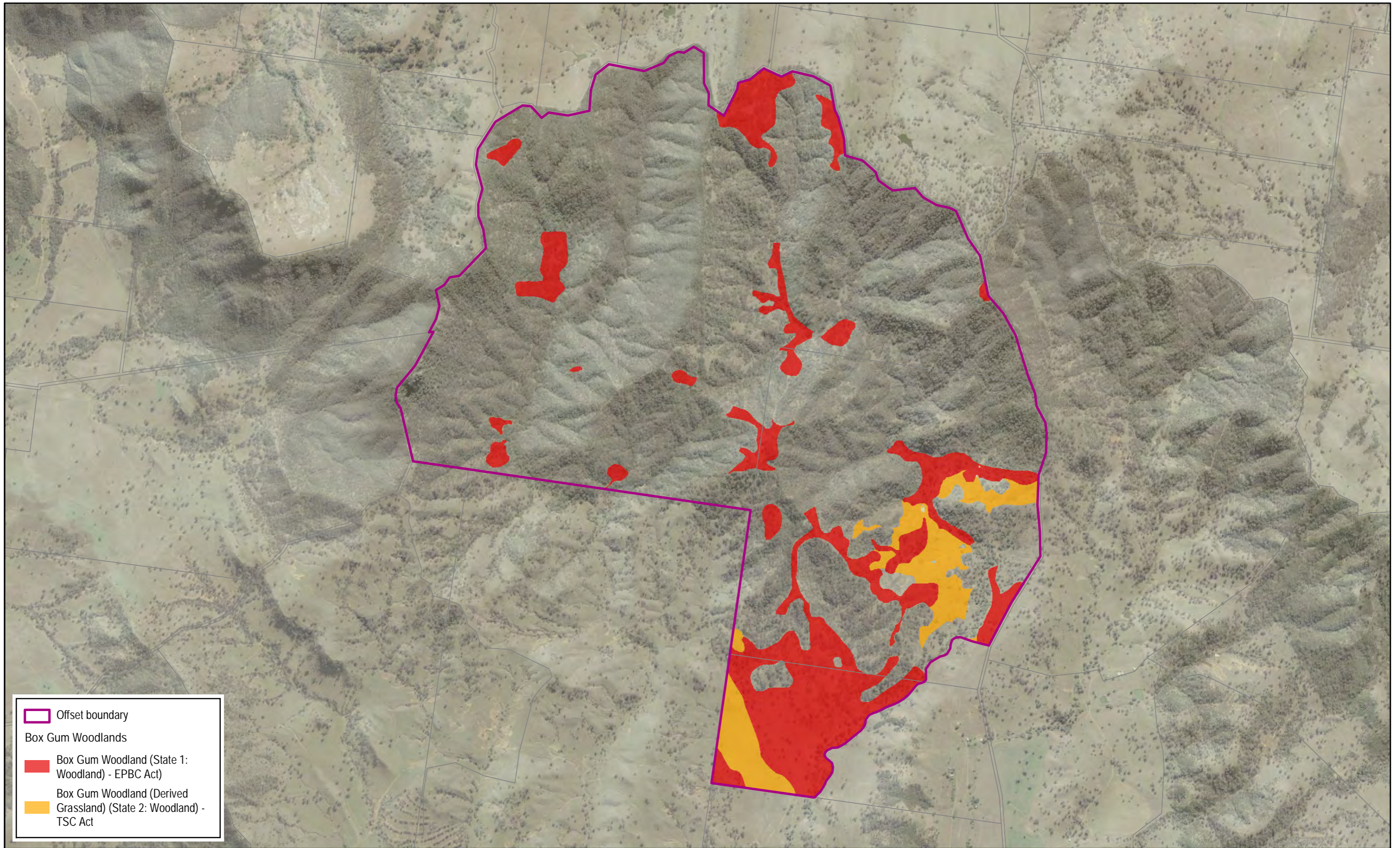
10.4 State of Box Gum Woodland

The Braefield BOA contains approximately 249.7 ha Box Gum Woodland which is listed under the TSC Act and/or EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Braefield BOA on lower slopes and flatter land (Figure 10.2).

Within the Sunshine BOA the Box Gum Woodland occurs in two states:

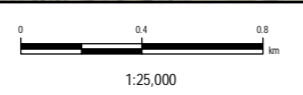
- Box Gum Woodland – State 1: Woodland – occupies approximately 194.6 ha.
- Box Gum Woodland – State 2: Native Pastures (derived native grassland) – occupies approximately 55.1 ha.

Five monitoring sites within the Braefield BOA (three within habitat management zone and two within habitat restoration zone) represent the Box Gum Woodland ecological community. A comparison of these monitoring site against vegetation type benchmarks has been completed and provided in Table 10.8.



Offset boundary
Box Gum Woodlands
 Box Gum Woodland (State 1: Woodland) - EPBC Act
 Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act

Map: 2267029A_GIS_F010_A2	Author: mitchellem
Date: 30/06/2016	Approved by: -



Data source: © Land and Property Information 2015
 Copyright: © 2014 Esri

Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 10.2
Box Gum Woodland within Braefield BOA

Table 10.8 Summary comparison of Box Gum Woodland between 2015 data and biometric data for the Braefield BOA

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES						BOX GUM WOODLAND STATE & GRAZING PRESSURES
		Native over storey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	
Habitat management zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	1	✓		✓	✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributes within or above the benchmark values. Dominant canopy (no hollows or regeneration), shrub and groundcover species present however exotic species were recorded in low numbers (4). Evidence of current agricultural and feral herbivore grazing was observed on site.
	2				✓		✓	Box Gum Woodland - State 2 (Woodland). All vegetation attributes within or above the benchmark values. Dominant canopy (including hollows and regeneration), shrub and groundcover species present however exotic species were recorded in low numbers (4). Evidence of current agricultural and feral herbivore grazing was observed on site.

VEGETATION ATTRIBUTES								
VEGETATION TYPE	MONITORING SITE	Native overstorey projected foliage cover percentage	Native midstorey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
	3			X 4 below	✓		✓	<p>Box Gum Woodland - State 2 (Woodland).</p> <p>Native grass groundcover percentage cover does not meet benchmark. All remaining vegetation attributes are within benchmark values.</p> <p>Dominant canopy (no hollows however regeneration is occurring), shrub and groundcover species present however exotic species were recorded in low numbers (4). Evidence of minor agricultural and feral herbivore grazing was observed on site. Agricultural grazing limited to the occasional escapee from southern portion of the property.</p>
Habitat restoration zones								
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	4	X 6 below	✓	X 22 below	✓		✓	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands).</p> <p>Native overstorey PFC and native groundcover grass percentage cover are below the benchmark values. The remaining vegetation attributes are within or above benchmark values.</p> <p>Canopy and shrub species absent (no hollows however regeneration is occurring). Native groundcover species present however exotic species recorded in high numbers (11). Evidence of current agricultural grazing and feral herbivore grazing observed on site.</p>

VEGETATION ATTRIBUTES								
VEGETATION TYPE	MONITORING SITE	Native over storey projected foliage cover percentage	Native mid storey cover percentage	Native ground cover (grass) percentage	Native ground cover (shrub) percentage	Native ground cover (other) percentage	Native plant species richness	BOX GUM WOODLAND STATE & GRAZING PRESSURES
	6	X 6 below		X 6 below	✓		✓	<p>Box Gum Woodland - State 2 Native Pastures (Derived Native Grasslands).</p> <p>Native overstorey PFC and native groundcover grass percentage are below benchmark values. The remaining vegetation attributes are within or above benchmark values.</p> <p>Canopy species absent (no hollows or regeneration occurring). Shrub and groundcover species present however exotic species were recorded in high numbers (13). Evidence of current agricultural grazing and feral herbivore grazing observed on site.</p>

Notes: Red shaded X = variable below benchmark value, Green shaded ✓ = variable is within benchmark range, Orange shading = variable exceeds benchmark values.

11 TARGETED REGENT HONEYEATER AND SWIFT PARROT SURVEYS

11.1 Background

The Regent Honeyeater is listed as Critically Endangered under the NSW TSC Act and the Commonwealth EPBC Act. The Swift Parrot is listed as Critically Endangered under the Commonwealth EPBC Act and Endangered under the NSW TSC Act.

Both species are declining throughout their range, for the most part as a consequence of habitat loss, so Boggabri Coal Mine's conservation of existing habitats and provision of new habitats will be an important part of ensuring there are local habitats available to them into the future.

11.2 Survey timings

Winter foraging resources are an important component the life-cycle of both Regent Honeyeaters and Swift Parrots. National survey weekends are organised by BirdLife Australia Woodland Birds for Biodiversity Project coordinators at either end of the winter season, in May and August, to allow for variations in blossom timings.

Where possible it is desirable to coincide closely to the BirdLife survey dates, although they accept data collected within a week of the set dates as part of their data sets.

In regards to the timings of BOA surveys for these species, a practical approach to the setting of annual survey dates endeavours to coincide with BLA survey dates, where the appearance of blossom is favourable. However, where spot checks of blossom resources suggest that BLA survey timings are out of sync with local blossom timings, then BOA survey timings are adjusted to coincide with local blossoming periods.

11.3 Results

Table 11.1 2015 Regent Honeyeater and Swift Parrot survey timings and results

DATE	LOCATION	BLOSSOM STATUS	TARGET SPECIES & THREATENED SPECIES OBSERVED (NUMBER)
May 16-17 August 1-2	BirdLife Australia Surveys	Most Swift Parrot records from the southern mainland Most Regent Honeyeater records from Chiltern in Victoria and the Capertee Valley in NSW with small number in northern coastal locations, including Queensland.	-
May 25	Namoi Opportunistic	No blossom recorded	-
May 26	Namoi Opportunistic	No blossom recorded	-
May 26	Merriendi Opportunistic	Some blossom present with a number of nectarivorous species present many of which are residents	Diamond Firetail (5) # Dusky Woodswallow (1) Little Lorikeet (13) Speckled Warbler (3) Turquoise Parrot (4)

DATE	LOCATION	BLOSSOM STATUS	TARGET SPECIES & THREATENED SPECIES OBSERVED (NUMBER)
May 27	Myall Plains Opportunistic	No significant blossom	Speckled Warbler (3) Turquoise Parrot (2)
May 27	Wirrilah Opportunistic	No significant blossom	Speckled Warbler (3) Turquoise Parrot (2)
May 27	Mallee Opportunistic	No significant blossom	-
May 28	Sunshine Opportunistic	Spatterings of White Box blossom in the bac of Sunshine – good view of Will Keen's canopy showed no blossom	Grey-crowned Babbler (2) Little Lorikeet (19) Speckled Warbler (1)
May 28	Nioka North Opportunistic	Spatterings of White Box blossom	#Dusky Woodswallow (1) Brown Treecreeper (3) Little Lorikeet (10) Speckled Warbler (2)
May 29	Namoi Opportunistic	No blossom recorded	-
May 29	Rocklea Opportunistic	Spatterings of White Box blossom in valleys	Little Lorikeet (1) Speckled Warbler (2)

- At the time of writing this report Dusky Woodswallow is under a preliminary determination to be listed as a Vulnerable species under the TSC Act.

11.4 Discussion

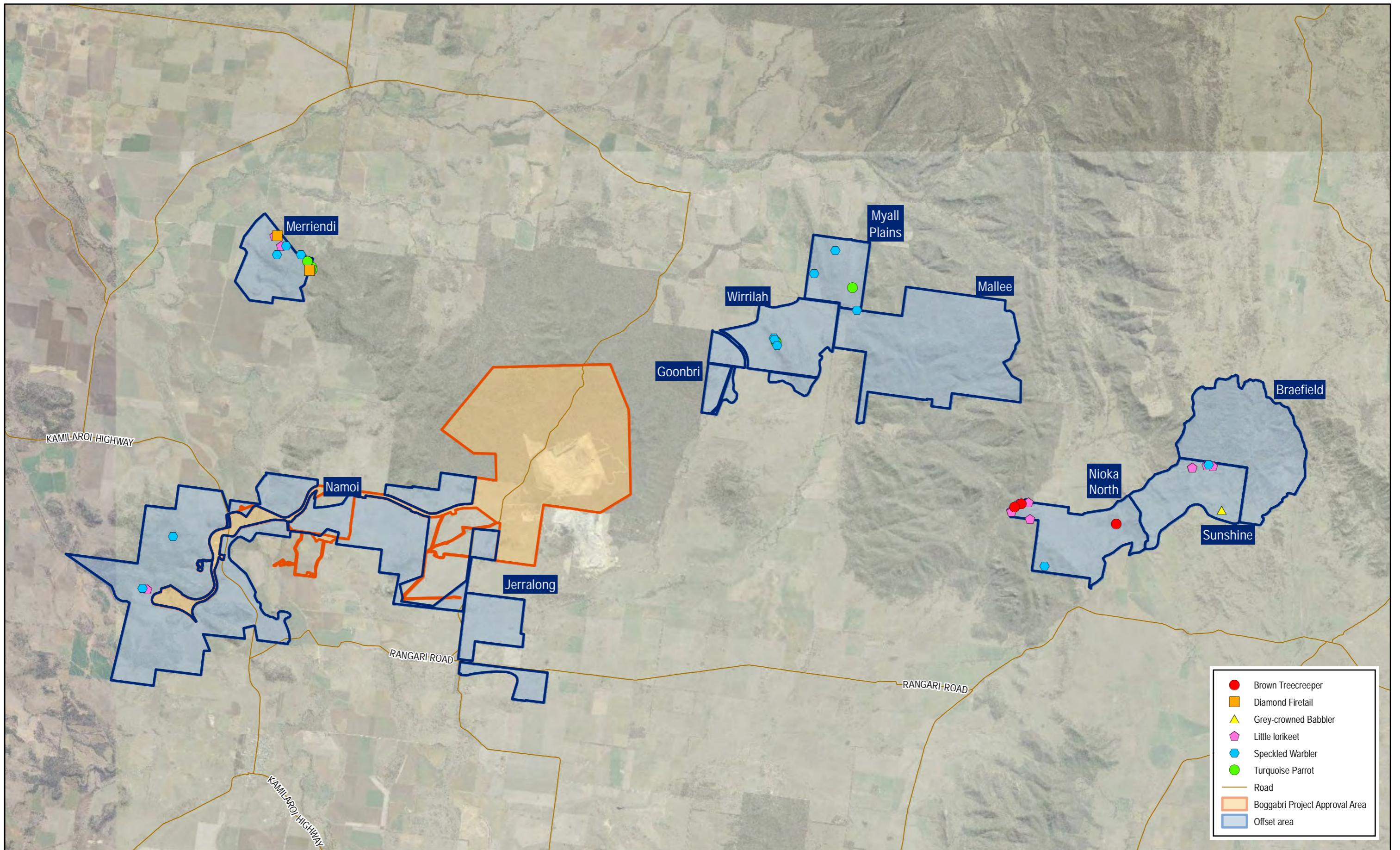
2015 surveys for Swift Parrots and Regent Honeyeaters visited BOA lands from Rocklea in the west through to the eastern offset properties. Stands of White Box were largely absent of blossom across the BOAs with small showings of blossom limited to partial sections of canopy or a small groupings of trees on Rocklea and the northwest boundary of Sunshine. Of all the BOAs Merriendi recorded the greatest incidence of blossom.

Of note was a low incidence of Noisy Friarbirds, which are usually present in high numbers in areas where blossom is prolific or important in relation to the distribution of resources across the range of Swift Parrots and Regent Honeyeaters. The occurrences of Regent Honeyeaters in particular are usually associated with high numbers of Noisy Friarbirds and influxes of other nomadic honeyeaters.

While Noisy Friarbirds were observed in only small numbers at Merriendi local honeyeater species including Little Friarbirds and a relatively high occurrence of Brown Honeyeaters were noted in woodland habitats in association of with White Box blossom.

While surveys were largely focused on the distribution of blossom as an indicator of Swift Parrots and Regent Honeyeaters, a number of other threatened woodland bird species were observed incidentally through the survey period (Table 11.1).

It is considered unlikely that significant numbers, if any numbers at all, of Swift Parrots or Regent Honeyeaters visited the Boggabri region during the 2015 winter season as BirdLife Australia survey data from May and August recorded the majority of Swift Parrot records from Victoria and southern NSW and Regent Honeyeater occurrences were observed in Victoria and in NSW at the Capertee Valley and mid-north coast locations.



Map: 2267029A_GIS_F011_A1
 Date: 30/06/2016
 Data source: © Land and Property Information 2015

Author: mitchellem
 Approved by: -

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 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 11.1
 Targeted Regent Honeyeater and Swift Parrot survey

12 TARGETED CORBEN'S LONG-EARED BAT SURVEY

12.1 Background

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

Although this species has a relatively broad distribution in south-eastern Australia capture rates for this species are relatively low in comparison with those of other bat species. In the western slopes and plains region of NSW its capture rate is only 1.4% of the total number of bat captures.

12.2 Survey timings

Corben's Long-eared Bat surveys were timed during the warmer months around the summer of 2015/2016 to coincide with the period of greatest microchiropteran bat activity when ambient temperatures are warmer and insect populations are at their peak.

12.3 Results

Table 12.1 2015/2016 summer season Corben's Long-eared Bat survey timings and results

DATE	LOCATION	TARGET SPECIES & THREATENED SPECIES OBSERVED
16/03/2016 – 17/03/2016	Rocklea/Cassidy property – Namoi BOA	-
17/03/2016 – 18/03/2016	Victoria Park property – Namoi BOA	Corben's Long-eared Bat (one individual) Diamond Firetail Speckled Warbler Varied Sittella
18/03/2016 – 19/03/2016	Daisymede property – Namoi BOA	-
20/03/2016	Merriendi BOA	-
20/03/2016 – 22/03/2016	Myall Plains BOA (site 2)	-
22/03/2016	Wirrilah BOA	-
22/03/2016 – 23/03/2016	Mallee BOA (site 2)	-
22/03/2016 – 23/03/2016	Mallee BOA (site 3)	-

12.4 Discussion

2015/2016 surveys for Corben's Long-eared Bat were conducted within BOA lands from the Namoi BOA in the west through to the eastern offset properties as far east as the Mallee BOA.

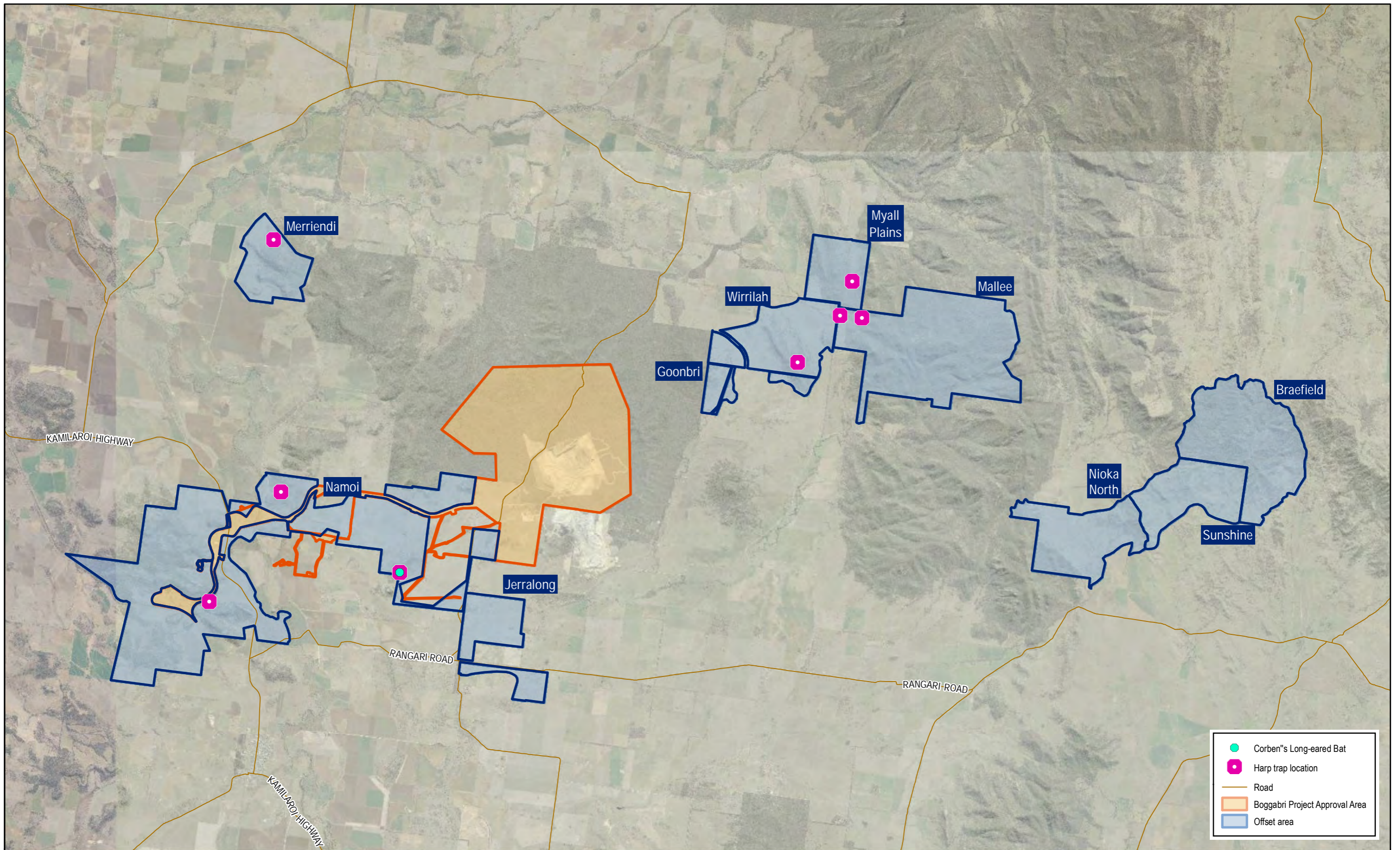
Climatic conditions in the Boggabri region through early 2016 continued to be very warm through February and into March, with mild evening conditions persisting well into April.

A single individual of Corben's Long-eared Bat was captured at the same Victoria Park location that two individuals were captured during surveys conducted in December 2014.

During the survey, no Eastern Cave Bat (*Vespadelus troughtoni*) were captured, in contrast to the December 2014 results. However, two unidentified microchiropteran bats were observed roosting in the nearby cave

during the survey. The fur colour of these individuals was consistent with Eastern Cave Bat although a positive identification could not be made. It is considered likely that the majority of Eastern Cave Bat would have vacated this maternity cave by the time the surveys were conducted in March 2016, but it is not considered unlikely that some individuals may persist locally in light of the mild conditions locally during the time of the surveys.

While surveys were focused on the capture of Corben's Long-eared Bat, a number of other threatened woodland bird species were observed incidentally through the survey period (Table 12.1).



	Corben's Long-eared Bat
	Harp trap location
	Road
	Boggabri Project Approval Area
	Offset area

Map: 2267029A_GIS_F012_A1	Author: mitchellem		
Date: 30/06/2016	Approved by: -		
Data source: © Land and Property Information 2015			Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 12.1
Targeted Corben's Long-eared Bat survey

13 CONCLUSION

The baseline monitoring event has established baseline data at 55 locations throughout the 10 Biodiversity Offset Areas (BOAs). The data provides valuable information on the condition of vegetation types and flora and assemblages in the different management zones. Importantly, the data will enable Boggabri Coal to measure the progress of habitat management and restoration works towards achievement of the completion criteria outlined in the Biodiversity Offset Strategy (Parsons Brinckerhoff 2010) and Revised BOA (Parsons Brinckerhoff 2010). The data presented in this baseline monitoring report is vital to provide a baseline against which the overall objective of meeting an 'improve or maintain' outcome can be assessed.

13.1 Habitat management zones

The baseline data suggest that the vegetation types in the habitat management zone across the 10 BOAs is in good condition overall and typical of large relatively undisturbed patches of native vegetation in the locality. Ecosystem health and ecosystem structure are good. The monitoring sites established in the habitat management zones in the 10 BOAs will provide good analogue sites for which to compare the progress of habitat restoration zones against.

Diurnal bird species richness in habitat management zones of the BOAs is typical of relatively undisturbed woodland and forest of the region. Common species ubiquitous to dry woodlands and forests of the western slopes and plains region (i.e. Rufous Whistler, Weebill, Striped Honeyeater, Striated Pardalote, Mistletoebird) and disturbed habitats (i.e. Galah, Australian Magpie, Sulphur-crested Cockatoo, Australian Raven and Eastern Rosella) were most widespread. The association of habitat management zones with areas of high quality extant vegetation with structural complexity is illustrated by the presence of 12 threatened birds listed as Vulnerable under the TSC Act:

- Spotted Harrier
- Little Eagle
- Brown Treecreeper (eastern subspecies)
- Painted Honeyeater
- Varied Sittella
- Speckled Warbler
- Diamond Firetail
- Hooded Robin (south-eastern)
- Grey-crowned Babbler (Eastern subspecies)
- Little Lorikeet
- Turquoise Parrot
- Masked Owl (Southern Mainland).

A total of 10 microbats were identified from habitat management zones across the 10 BOAs, most of which are typical to dry woodlands and forests of the NSW western slopes and plains region. Three threatened species of microbat listed as Vulnerable under the TSC Act were recorded from habitat management zones, including:

- Yellow-bellied Sheath-tail-bat
- Eastern False Pipistrelle
- Corben's Long-eared Bat.

Five nocturnal birds were recorded from habitat management zones, most of which are common to habitats found in the region. One threatened large forest owl, Masked Owl, was recorded was from the Merriendi BOA during this baseline monitoring session. The lack of large forest owls (particularly Barking Owl), elsewhere in the 10 BOAs are likely an artefact of survey effort rather than actual absence from the BOAs. Indeed, suitable habitat in the form of high quality and contiguous forested areas containing old growth trees with suitable breeding hollows exist in the BOAs; as does suitable prey items. The presence of recent forest owl records (Masked Owl and Barking Owl) in Leard State Forest and BOAs suggest their presence in the BOAs.

Nocturnal mammals were sparsely distributed throughout habitat management zones with the Common Brushtail Possum and Ringtail Possum occasionally recorded; however, this low density of nocturnal mammals is typical of dry woodlands and forests of the region. Notwithstanding this, the BOAs do provide some good habitat for nocturnal mammals, which is best illustrated by the presence of Squirrel Glider, a species listed as Vulnerable under the TSC Act, which was recorded in the habitat management zone of the Nioka North BOA.

Introduced species recorded commonly (via remote sensing camera trap and opportunistically) within habitat management zones included, Pig, Goat and Fox.

Measures to manage existing vegetation and habitat in habitat management zones will continue to maintain the current high quality and structural complexity of extant vegetation across the BOAs. Future monitoring will track the progress of works completed. Where restoration works are proposed at the ecotone of habitat restoration and habitat management zones, it may be reasonable to assume that habitat quality and species richness may improve for a range of fauna species.

13.2 Habitat restoration zone

The habitat restoration zone predominantly contained derived native grassland communities. Ecosystem health and ecosystem structure are generally poor. As such, the monitoring sites fall below the BioBanking vegetation type benchmarks for a range of attributes. However, due to the general lack of canopy, midstorey, fallen logs, and the presence of grazing pressure, native grass cover is generally high and exceeds benchmark conditions. The restoration works planned for the habitat restoration zones will result in an overall improvement in the attributes over time.

Generally, the habitat restoration zones possessed low to moderate diurnal bird species richness. This can be expected as these areas are typically disturbed areas that have long been dedicated to grazing of cattle. Such areas are structurally simplified, contain few habitat features and are generally devoid of canopy and understorey cover; attributes that may otherwise encourage a diverse woodland fauna. Despite the majority of the habitat restoration zones being disturbed, they do provide foraging habitat for the threatened species such as the Spotted Harrier and Little Eagle. The threatened Grey-crowned Babbler is also often recorded along the ecotone of or in habitat restoration zones where regenerating shrubs provide adequate cover close to open foraging grounds. Bird species common to habitat restoration zones included disturbance tolerant species and common open country species, including Galah, Sulphur-crested Cockatoo, Australian Magpie, Australian Raven, Magpie-lark, Crested Pigeon, and Eastern Rosella.

Introduced species recorded commonly (via remote sensing camera trap and opportunistically) within habitat restoration zones included, Fox, Brown Hare, Rabbit, Goat and Cow.

The proposed restoration works in these areas should result in an increase in diurnal bird species richness over time and a change in the overall species composition to that of woodland species. Future monitoring will track the species richness of these areas as it converges towards that of the habitat management zones.

13.3 Corridor enhancement zone

The corridor enhancement zone has been significantly disturbed by past land use practices, including clearing, cropping, pasture improvement and heavy grazing. The lack of canopy, midstorey and altered groundlayer composition recorded during baseline monitoring supports this assumption. Likewise, the paucity of fauna species proves how disturbed this area currently is. The planned supplementary canopy planting and some targeted weed and pest management activities should serve to increase woody canopy cover and build on adjoining existing wildlife corridors. A considerable improvement in habitat value should be seen in this area over the coming years.

13.4 Targeted Regent Honeyeater and Swift Parrot survey

2015 surveys for Swift Parrots and Regent Honeyeaters visited BOA lands from the Namoi BOA in the west through to the eastern offset properties. Stands of White Box were largely absent of blossom across the BOAs with small showings of blossom limited to partial sections of canopy or a small groupings of trees on

the Rocklea property (Namoi BOA) and the northwest boundary of the Sunshine BOA. Of all the BOAs, Merriendi recorded the greatest incidence of blossom.

Of note was a low incidence of Noisy Friarbirds, which are usually present in high numbers in areas where blossom is prolific or important in relation to the distribution of resources across the range of Swift Parrots and Regent Honeyeaters. The occurrences of Regent Honeyeaters in particular are usually associated with high numbers of Noisy Friarbirds and influxes of other nomadic honeyeaters. While Noisy Friarbirds were observed in only small numbers at Merriendi BOA, local honeyeater species including Little Friarbirds and a relatively high occurrence of Brown Honeyeaters were noted in woodland habitats in association with White Box blossom.

It is considered unlikely that significant numbers, if any numbers at all, of Swift Parrots or Regent Honeyeaters visited the Boggabri region during the 2015 winter season as BirdLife Australia survey data from May and August recorded the majority of Swift Parrot records from Victoria and southern NSW and Regent Honeyeater occurrences were observed in Victoria and in NSW at the Capertee Valley and mid-north coast location.

13.5 Targeted Corben's Long-eared Bat survey

A total of 14 harp trap nights targeting Corben's Long-eared Bat was completed within Boggabri Coal's BOA lands, from the Mallee BOA in the east to the Namoi BOA in the west. A single individual of Corben's Long-eared Bat was captured in the Namoi BOA (Victoria Park Property) at the same location that two individuals were captured during surveys conducted in December 2014.

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Appendix A

FIELD SURVEY WEATHER CONDITIONS

Appendix A – Field survey weather conditions

Table A1.1 Flora and fauna field survey weather conditions

DATE	TEMPERATURE		RAIN	9:00 AM			3:00 PM		
	MIN (°C)	MAX (°C)		TEMP (°C)	RELATIVE HUMIDITY (%)	WIND SPEED (KM/H/DIRECTION)	TEMP (°C)	RELATIVE HUMIDITY (%)	WIND SPEED (KM/H/DIRECTION)
12/10/2015	11.8	31.7	0.4	22.4	42	11/NNW	29.1	19	33/NW
13/10/2015	15.5	31.6	0.0	22.5	41	13/ESE	29.7	21	9/SSW
14/10/2015	13.1	31.1	6.4	20.4	58	15/ESE	30.2	20	13/ESE
15/10/2015	12.5	30.2	0.2	21.2	55	13/ESE	28.4	25	13/ESE
16/10/2015	10.3	31.7	0.0	22.3	51	6/SE	30.0	25	7/NE
17/10/2015	11.3	34.0	0.0	23.4	41	13/NW	33.0	17	13/SSW
18/10/2015	17.4	32.1	0.0	23.8	51	30/SSE	27.4	32	31/SE
19/10/2015	15.3	31.1	0.0	22.4	55	11/ESE	30.0	28	13/NW
20/10/2015	12.5	31.3	0.0	23.3	45	Calm	30.1	26	15/NNW
21/10/2015	12.0	32.8	0.0	24.6	35	Calm	31.0	21	24/NW
22/10/2015	16.1	24.6	17.6	18.9	84	Calm	22.8	60	24/WNW
23/10/2015	15.0	25.7	3.0	18.3	60	33/SSE	24.8	40	20/SE

Source Gunnedah Airport AWS (Station – 055024) (Bureau of Meteorology, 2015).

Appendix B

SUMMARY OF REPLICATE MONITORING SITES

Appendix B – Summary of monitoring sites

Table B1.1 Monitoring site Biometric vegetation type, management zone and location

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
Merriendi BOA				
Me1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0217519	6617933
Me2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	0216281	6617618
Me3	White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0218378	6616634
Me4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0218279	6616132
Me5	Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson 27)	Habitat Restoration Zone	0216083	6616427
Me6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	0217049	6618557
Namoi BOA				
N1	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	0224258	6604738
N2	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Restoration Zone	0224022	6603124
N3	River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)	Habitat Management Zone	0216617	6607184
N4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	0217235	6608516
N5	River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)	Habitat Restoration Zone	0218073	6607591
N6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	0218646	6608224
N7	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Management Zone	0226625	6602296

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
N8	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Management Zone	0221789	6608285
N9	Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson 27)	Habitat Management Zone	0222169	6608662
N10	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0222615	6606501
N11	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Restoration Zone	0224575	6607157
N12	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0214113	6605257
N13	Tea-tree shrubland of drainage areas of the slopes and tablelands	Habitat Management Zone	0214957	6604856
N14	Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion (Benson 187)	Habitat Management Zone	0214961	6604262
N15	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Management Zone	0217675	6603969
Wirrilah BOA				
W1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	0233578	6613593
W2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Corridor Enhancement Zone	0234038	6613773
W3	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	0234087	6614354
W4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	0235211	6614321
W5	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	0236213	6613858
W6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	0236163	6615156
Myall Plains BOA				

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
My1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	237527	6617491
My2	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Restoration Zone	238176	6617113
My3	White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	238468	6617070
My4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	236598	6616595
My5	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	237186	6616278
My6	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	238100	6615660
Mallee BOA				
Ma1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	237554	6614686
Ma2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	238099	6615066
Ma3	Heathy shrublands on rocky outcrops of the western slopes	Habitat Management Zone	240138	6614143
Ma4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	240089	6615068
Ma5	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	237632	6615124
Nioka North BOA				
Ni1	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Management Zone	244269	6608377
Ni2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	245166	6608128
Ni3	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	244650	6606905

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
Ni4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	247329	6608009
Ni5	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	246476	6607377
Ni6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	246349	6606455
Sunshine BOA				
S1	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	Habitat Management Zone	250767	6609721
S2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	251225	6608917
S3	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	248561	6608585
S4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	249168	6607850
S5	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	249467	6608406
Braefield BOA				
B1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252555	6608212
B2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252402	6608993
B3	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252121	6610268
B4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	253434	6609545
B5	Tea-tree shrubland of drainage areas of the slopes and tablelands	Habitat Management Zone	253819	6609322
B6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	253727	6609808

Appendix C

FLORA DATA

Appendix C – Flora data

1. MERRIENDI BOA

Table C1.1 Plant species recorded from within the Merriendi BOA during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native	3		3	2		
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native	1		1			
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native		1	1	1		
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic	1	2	1	2		
Asteraceae	<i>Bidens pilosa</i>	Cobblers Pegs		Exotic			1			
Asteraceae	<i>Calotis hispidula</i>	Bogan Flea	Y	Native		1				
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Y	Native	2	1				
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic		3			3	2
Asteraceae	<i>Cassinia aculeata</i>	Dolly Bush	Y	Native		2				
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic		3			3	4
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic		1				
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y	Native	4					
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Y	Native		2				
Asteraceae	<i>Euchiton sphaericus</i>	Annual Cudweed	Y	Native				1		
Asteraceae	<i>Glossogyne bidens</i>		Y	Native	1	1	1	1		
Asteraceae	<i>Hedypnois rhagadioloides</i>	Cretan Weed		Exotic		3			3	3
Asteraceae	<i>Hypochaeris glabra</i>	Smooth Catsear		Exotic		3				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic	1		1			
Asteraceae	<i>Senecio sp.</i>			Exotic						1
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native			3			
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic		2		1	2	3
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Y	Native	1					
Asteraceae	<i>Vittadinia pustulata</i>		Y	Native		1				4
Asteraceae	<i>Vittadinia sp.</i>		Y	Native	2			1		
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Y	Native						1
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine	Y	Native				1		
Brassicaceae	<i>Brassica sp.</i>			Exotic		2			4	1
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear		Exotic			1	1		
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native		2				
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling or Australian Bluebell	Y	Native	1					
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Y	Native			2	1	1	
Caryophyllaceae	<i>Moenchia erecta</i>	Erect Chickweed		Exotic		1				
Caryophyllaceae	<i>Petrorhagia nanteuillii</i>	Childling Pink		Exotic	1	3		3		
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic				1		
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native	1					
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Y	Native		1				2
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Rolypoly	Y	Native					2	1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Convolvulaceae	<i>Convolvulus graminetinus</i>		Y	Native		1				1
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native	2	1	1	2		
Crassulaceae	<i>Crassula sieberiana</i>	Australian Stonecrop	Y	Native	1		1			
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native	1		4	4		
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native			1	1		
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood	Y	Native			4	2		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native					2	1
Fabaceae (Faboideae)	<i>Cullen tenax</i>	Emu-foot	Y	Native					2	
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native	3		3	2		
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	1		1			
Fabaceae (Faboideae)	<i>Glycine canescens</i>	Silky Glycine	Y	Native	1		1			
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native	2			1		
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic	2	3	1	2	3	3
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native				2		
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	1	2	1	2		1
Fabaceae (Faboideae)	<i>Trifolium glomeratum</i>	Clustered Clover		Exotic		2		2		2
Fabaceae (Faboideae)	<i>Trifolium tomentosum</i>	Woolly Clover		Exotic						1
Fabaceae (Faboideae)	<i>Zornia dyctiocarpa</i>			Native	2					
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle		Native				2		
Geraniaceae	<i>Geranium homeanum</i>		Y	Native		3		1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native				1		
Goodeniaceae	<i>Goodenia fascicularis</i>		Y	Native					2	
Goodeniaceae	<i>Goodenia glabra</i>		Y	Native	1					
Lamiaceae	<i>Mentha satureioides</i>	Creeping Mint	Y	Native		2				
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native	1					
Linaceae	<i>Linum marginale</i>	Native Flax	Y	Native	1	2	1			
Loranthaceae	<i>Amyema sp.</i>		Y	Native	1			1		
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native					2	
Malvaceae	<i>Pavonia hastata</i>			Exotic						1
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Y	Native	3					
Malvaceae	<i>Sida spinosa</i>			Exotic		2				
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native	1			3		
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum		Native	3					
Myrtaceae	<i>Eucalyptus dealbata</i>	Tumbledown Red Gum		Native			3			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native	1	1		1		
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native	2			2		
Orchiaceae	<i>Pterostylis sp.</i>		Y	Native				1		
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	1	1	1	1		
Plantaginaceae	<i>Linaria arvensis</i>			Exotic	2	1	3	2		
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain	Y	Native		1		1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Plantaginaceae	<i>Plantago sp.</i>		Y	Native				1	1	1
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native		3	2	3		
Poaceae	<i>Aristida sp.</i>		Y	Native	3	2			2	1
Poaceae	<i>Austrostipa aristiglumis</i>	Plains Grass	Y	Native					2	
Poaceae	<i>Austrostipa bigeniculata</i>		Y	Native					4	
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	3	3	3	2		
Poaceae	<i>Austrostipa sp.</i>		Y	Native						4
Poaceae	<i>Austrostipa verticillata</i>		Y	Native		2				
Poaceae	<i>Bromus molliformis</i>			Exotic		1				
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native						2
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native	3	4	1	1		
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native	1	3		1	3	1
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Y	Native	1		2			
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Y	Native					3	5
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic					2	3
Poaceae	<i>Panicum sp.</i>		Y	Native	2	2	2		2	2
Poaceae	<i>Paspalidium sp.</i>		Y	Native						1
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native	2		1			
Poaceae	<i>Rytidosperma bipartitum</i>		Y	Native						2
Poaceae	<i>Sporobolus caroli</i>	Fairy Grass	Y	Native						1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	ME1	ME2	ME3	ME4	ME5	ME6
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Y	Native	1					
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Y	Native	1					
Poaceae	<i>Vulpia myuros</i>	Rats Tail Fescue		Exotic		2	1	3		2
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Y	Native		2				
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic		1		1		
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native				4		
Solanaceae	<i>Solanum sp.</i>		Y	Native					1	1
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong		Native			1			
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native	1			1		
Verbenaceae	<i>Verbena officinalis</i>	Common Verbena		Exotic		1			1	
				Native ground cover species richness	31	24	21	26	14	17
				Total native plant species richness	37	25	24	31	14	17

2. NAMOI BOA

Table C2.1 Plant species recorded from within the Namoi BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Acanthaceae	<i>Rostellularia adscendens</i>		Y	Native												2			
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native	2		3				3	1							
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native	3		3			1		2							
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native	1						3	2	1						
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic			1	2	1				1			3	2	2	2
Apocynaceae	<i>Parsonia eucalyptophylla</i>	Gargaloo	Y	Native	2														
Asclepiadaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Y	Native													1	2	
Asteraceae	<i>Bidens pilosa</i>	Cobblers Pegs		Exotic												1	2		
Asteraceae	<i>Brachyscome graminea</i>	Grass Daisy	Y	Native						1									
Asteraceae	<i>Calotis hispidula</i>	Bogan Flea	Y	Native											2				
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Y	Native					2				3		4				
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic	2				2	3	1	2	3	2	3		1		
Asteraceae	<i>Cassinia sp.</i>		Y	Native														1	
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic	3						2		1	1					
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic											1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y	Native										1					
Asteraceae	<i>Conyza sp.</i>			Exotic					1										
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Y	Native									1			1			
Asteraceae	<i>Glossogyne bidens</i>		Y	Native									1	2	2	2			1
Asteraceae	<i>Hedypnois rhagadioloides</i>	Cretan Weed		Exotic	3	1			2	3		2	2	1	3				
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic				1		3		3	2		1	1			
Asteraceae	<i>Lactuca serriola</i>	Prickly Lettuce		Exotic															1
Asteraceae	<i>Olearia elliptica</i>	Sticky Daisy Bush	Y	Native												2			
Asteraceae	<i>Rhodanthe diffusa subsp. leucactina</i>		Y	Native	2	2					2	2		1					
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Y	Native											1				
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native													2		
Asteraceae	<i>Silybum marianum</i>	Varigated Thistle		Exotic			3												
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic	2	2	2	1	2	2		3	2		1	1	2	1	2
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Y	Native							2								2
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native					2	2			2		2				
Asteraceae	<i>Vittadinia pustulata</i>		Y	Native					4	5					3				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Asteraceae	<i>Vittadinia sp.</i>		Y	Native			2					1				2		1	
Asteraceae	<i>Vittadinia sulcata</i>	Furrowed New Holland Daisy	Y	Native													3		
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Y	Native	1														
Boraginaceae	<i>Echium plantagineum</i>	Pattersons Curse		Exotic				4	4						1				
Brassicaceae	<i>Brassica rapa</i>	Field Mustard		Exotic			5												
Brassicaceae	<i>Brassica sp.</i>			Exotic									1						2
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass		Exotic	2			2	2	1	2	1	1				1	1	1
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear		Exotic									1	1			1	1	
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native			3		1										
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Y	Native			2							1		1		1	
Caryophyllaceae	<i>Moenchia erecta</i>	Erect Chickweed		Exotic	1														
Caryophyllaceae	<i>Petrorhagia nanteuilii</i>	Childling Pink		Exotic	1			3	2			4	3	3	3				
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic	1		1									2			
Casuarinaceae	<i>Casuarina cristata</i>	Belah		Native													2		
Chenopodiaceae	<i>Atriplex leptocarpa</i>	Slender-fruited Saltbush	Y	Native					1										
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Y	Native		2												2	3
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native	2				1										

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native													1		1
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Y	Native	1														
Chenopodiaceae	<i>Eniadia hastata</i>	Berry Saltbush	Y	Native							2	2							
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Y	Native											2				
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Y	Native			1		3	3		2		2	2			1	1
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Rolypoly	Y	Native	1				3	1	2	2							2
Commelinaceae	<i>Commelina cyanea</i>		Y	Native														1	
Convolvulaceae	<i>Convolvulus graminetinus</i>		Y	Native	1				1	1	2		2						
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Y	Native														4	
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native				2			2		1	2	1				2
Crassulaceae	<i>Crassula sieberiana</i>	Australian Stonecrop	Y	Native	1	2		3	2	2	2	2	1	2	2	2			2
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native	5			4					2	1	2	2			
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native				1									2		2
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native				2									2	2	2
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood		Native															5
Euphorbiaceae	<i>Breyenia oblongifolia</i>	Coffee Bush		Native													1		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native	1						1	1	2	2	1				
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native													3		3

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	1			2						1			1		
Fabaceae (Faboideae)	<i>Glycine canescens</i>	Silky Glycine	Y	Native				2											
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining Glycine	Y	Native								2		1					
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native	1								2	2		2	2		
Fabaceae (Faboideae)	<i>Indigofera adesmiifolia</i>	Tick Indigo	Y	Native												1			
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic		3			2	3	2			2	2	2		2	3
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native												1			
Fabaceae (Faboideae)	<i>Templetonia stenophylla</i>	Leafy Templetonia	Y	Native												1			
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	2			3	4	4	1	2	2	4	3				
Fabaceae (Faboideae)	<i>Trifolium campestre</i>	Hop Clover		Exotic					3	2		1	2		1				
Fabaceae (Faboideae)	<i>Trifolium glomeratum</i>	Clustered Clover		Exotic				1	2	2	2	2	2						
Fabaceae (Faboideae)	<i>Trifolium tomentosum</i>	Woolly Clover		Exotic		2			2	2	2	3							
Fabaceae (Faboideae)	<i>Vicia sp.</i>			Exotic			1												1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Fabaceae (Mimosoideae)	<i>Acacia cheelii</i>	Motherumbah		Native			2												
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle		Native														2	
Fabaceae (Mimosoideae)	<i>Acacia pendula</i>	Weeping Myall		Native	1														
Gentianaceae	<i>Centaurium tenuiflorum</i>			Exotic	2	1		2	2	1		1	2	1					
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Y	Native												2			
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native								2						2	
Juncaceae	<i>Juncus sp.</i>		Y	Native		1		1											1
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	Y	Native												2			
Lamiaceae	<i>Mentha satuireioides</i>	Creeping Mint	Y	Native													2		
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native	2									1				1	
Lamiaceae	<i>Stachys arvensis</i>	Stagger Weed		Exotic	3							2				1			
Linaceae	<i>Linum marginale</i>	Native Flax	Y	Native			2												
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Y	Native							2		1			1			
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native												2	2		
Malvaceae	<i>Hibiscus sturtii</i>	Hill Hibiscus	Y	Native	1														
Malvaceae	<i>Pavonia hastata</i>			Exotic							1		1						
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Y	Native	3						2	2	2	2		2		2	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Y	Native	3			2					1						
Malvaceae	<i>Sida spinosa</i>			Exotic	2	1			2	2	1								2
Marsileaceae	<i>Marsilea drummondii</i>	Common Nardoo	Y	Native		1													
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native												5		2	
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum		Native															2
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Red Gum		Native			4												
Myrtaceae	<i>Eucalyptus dealbata</i>	Tumbledown Red Gum		Native				2											
Myrtaceae	<i>Eucalyptus dwyeri</i>	Dwyers Red Gum		Native															1
Myrtaceae	<i>Homoranthus flavescens</i>			Native				1											
Myrtaceae	<i>Melaleuca bracteata</i>			Native													5		
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native	1			1	1	1		2		1		1			
Oleaceae	<i>Jasminum lineare</i>	Desert Jasmine	Y	Native													2	1	
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native				1									2	2	
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	1			1		1	1	1						1	2
Oxalidaceae	<i>Oxalis sp.</i>		Y	Native		1								1					1
Plantaginaceae	<i>Linaria arvensis</i>			Exotic				2					2			2			
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain	Y	Native													3		
Plantaginaceae	<i>Plantago sp.</i>		Y	Native		3		2				2		1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Plantaginaceae	<i>Plantago turrifera</i>		Y	Native							1								
Poaceae	<i>Aira cupaniana</i>	Silvery Hairgrass		Exotic							1								
Poaceae	<i>Aira elegantissima</i>	Delicate Hairgrass		Exotic									1						
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native								1	2	3	3				3
Poaceae	<i>Aristida sp.</i>		Y	Native			3		2	4				1	1				
Poaceae	<i>Austrostipa aristiglumis</i>	Plains Grass	Y	Native	6	2					1								3
Poaceae	<i>Austrostipa bigeniculata</i>		Y	Native												4			
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	4		4				3	6	4	4	3				3
Poaceae	<i>Austrostipa sp.</i>		Y	Native		1							2						
Poaceae	<i>Austrostipa verticillata</i>		Y	Native							2						4	3	
Poaceae	<i>Avena fatua</i>	Wild Oats		Exotic				5	6										
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Y	Native							2		3	1	1				
Poaceae	<i>Bothriochloa sp.</i>		Y	Native	2														
Poaceae	<i>Bromus catharticus</i>	Prairie Grass		Exotic			3												1
Poaceae	<i>Bromus molliformis</i>			Exotic				3	1			3	3						
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native	1			3	2	2				2	3				
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Y	Native								4						1	
Poaceae	<i>Chloris divaricata</i>	Slender Chloirs	Y	Native							2								
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native									2	1	3				2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native						3			1						
Poaceae	<i>Digitaria breviglumis</i>		Y	Native	1												2	2	
Poaceae	<i>Elymus scaber</i>		Y	Native									1						
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Y	Native										3				1	
Poaceae	<i>Enneapogon sp.</i>		Y	Native	1														
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Y	Native	3	2			3	3	3	2	2		3				2
Poaceae	<i>Eragrostis elongata</i>	Clustered Lovegrass	Y	Native	1														
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Y	Native											2				
Poaceae	<i>Eragrostis sp.</i>		Y	Native	3			1			1		2		1				
Poaceae	<i>Eragrostis sp.2</i>		Y	Native	2														
Poaceae	<i>Hordeum sp.</i>			Exotic			1												
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic	2	5	2		4	4	4	2	2		1				5
Poaceae	<i>Panicum sp.</i>		Y	Native		1				1	1	1	1		2				1
Poaceae	<i>Paspalidium sp.</i>		Y	Native			1											1	
Poaceae	<i>Rytidosperma indutum</i>		Y	Native	1														
Poaceae	<i>Rytidosperma sp.</i>		Y	Native										2			1		
Poaceae	<i>Sporobolus caroli</i>	Fairy Grass	Y	Native					1										
Poaceae	<i>Vulpia myuros</i>	Rats Tail Fescue		Exotic	4	2		2	3	3	3	5	4	3	4	2			
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Y	Native			3			1		1		1	1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NA1	NA2	NA3	NA4	NA5	NA6	NA7	NA8	NA9	NA10	NA11	NA12	NA13	NA14	NA15		
Polygonaceae	<i>Rumex crispus</i>	Curled Dock		Exotic															1		
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic	1				1	3			2		1		1				
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	Y	Native		1		2								2	2				
Rutaceae	<i>Geijera parviflora</i>	Wilga	Y	Native												3	2				
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native												3	2	4			
Scrophulariaceae	<i>Eremophila deserti</i>	Turkey Bush		Native	1																
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn		Exotic	1						2							2			
Solanaceae	<i>Solanum sp.</i>		Y	Native														1			
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Y	Native	1																
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native									1			1	1				
Verbenaceae	<i>Phyla canescens</i>	Fog-fruit		Exotic		2													3		
Verbenaceae	<i>Verbena officinalis</i>	Common Verbena		Exotic														2			
Native ground cover species richness							28	12	7	20	12	17	22	21	25	27	22	24	22	24	10
Total native plant species richness							29	13	8	25	12	17	22	21	25	27	23	27	26	30	11

3. WIRRILAH BOA

Table C3.1 Plant species recorded from within the Wirrilah BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	W1	W2	W3	W4	W5	W6
Acanthaceae	<i>Rostellularia adscendens</i>		Y	Native	2		2			
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native	2	1		1	2	
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native	2			3	2	
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native	2		2		1	
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic	2					2
Asclepiadaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Y	Native			1	1	1	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Y	Native				2	3	
Asteraceae	<i>Calotis sp.</i>		Y	Native	1					
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic		3	2			3
Asteraceae	<i>Cassinia sp.</i>		Y	Native					4	
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic		1				1
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y	Native	1			1	3	
Asteraceae	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	Y	Native					2	
Asteraceae	<i>Euchiton sphaericus</i>	Annual Cudweed	Y	Native		1				
Asteraceae	<i>Glossogyne bidens</i>		Y	Native	2			1	3	
Asteraceae	<i>Hedypnois rhagadioloides</i>	Cretan Weed		Exotic		2				
Asteraceae	<i>Hypochaeris glabra</i>	Smooth Catsear		Exotic		2	1			
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic	1				1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	W1	W2	W3	W4	W5	W6
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic		1				
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native		2	2		1	2
Asteraceae	<i>Vittadinia pustulata</i>		Y	Native			2	1		1
Asteraceae	<i>Vittadinia sp.</i>		Y	Native	2	1		1	1	1
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass		Exotic			1	1		1
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear		Exotic	1				1	
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Y	Native	1	1	1	1		
Caryophyllaceae	<i>Petrohragia nanteuillii</i>	Childling Pink		Exotic		2	2	1	1	2
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Y	Native		1		2		
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native				1		
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Y	Native		2	2	1		2
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Y	Native		2	1	1		1
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native	2		2	3		
Crassulaceae	<i>Crassula colorata</i>		Y	Native		2	1			2
Crassulaceae	<i>Crassula sieberiana</i>	Australian Stonecrop	Y	Native	2	3	1		1	2
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native	3		5	3	3	
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native	1				2	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native	2			4	1	
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush		Native					1	
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native				1	1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	W1	W2	W3	W4	W5	W6
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native				4	3	
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	3			3		
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native	2			1		
Fabaceae (Faboideae)	<i>Indigofera adesmiifolia</i>	Tick Indigo	Y	Native	1					
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic	2	3	2			2
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic		3	1		2	4
Fabaceae (Faboideae)	<i>Trifolium campestre</i>	Hop Clover		Exotic		2	1			2
Fabaceae (Faboideae)	<i>Trifolium glomeratum</i>	Clustered Clover		Exotic	2					2
Fabaceae (Faboideae)	<i>Trifolium sp.</i>			Exotic		2		1		
Gentianaceae	<i>Centaurium erythraea</i>	Common Centaury		Exotic		1				2
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Y	Native					1	
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native	3					
Goodeniaceae	<i>Goodenia sp.</i>		Y	Native	2					
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native	3		1	2	2	
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Y	Native	3					
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native				1		
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Y	Native			2	1	1	
Malvaceae	<i>Sida spinosa</i>			Exotic						2
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		Native	5			2	3	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native	2		1	1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	W1	W2	W3	W4	W5	W6
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native			1	2	2	
Orchiaceae	<i>Cymbidium canaliculatum</i>	Tiger Orchid	Y	Native				1		
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	1			2	1	
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Y	Native						2
Plantaginaceae	<i>Linaria arvensis</i>			Exotic				1	1	
Plantaginaceae	<i>Plantago sp.</i>		Y	Native	2	2	2	1		
Poaceae	<i>Aira elegantissima</i>	Delicate Hairgrass		Exotic		1				
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native	4				2	4
Poaceae	<i>Aristida sp.</i>		Y	Native			4			2
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	4	2		5	4	
Poaceae	<i>Austrostipa sp.</i>		Y	Native					1	
Poaceae	<i>Austrostipa verticillata</i>		Y	Native			2	2		
Poaceae	<i>Avena fatua</i>	Wild Oats		Exotic		1				
Poaceae	<i>Bromus molliformis</i>			Exotic		1				1
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native		5				3
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native	2		3		2	
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native		3	2		1	4
Poaceae	<i>Digitaria breviglumis</i>		Y	Native				2		
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Y	Native	2			1	3	2
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Y	Native		1	2	1		1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	W1	W2	W3	W4	W5	W6
Poaceae	<i>Eragrostis sp.</i>		Y	Native			1		1	1
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic		4		1		2
Poaceae	<i>Paspalidium sp.</i>		Y	Native	1					
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native				1	4	
Poaceae	<i>Rytidosperma sp.</i>		Y	Native			1	1	1	
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Y	Native			1			
Poaceae	<i>Sporobolus sp.</i>		Y	Native	1			1	1	
Poaceae	<i>Vulpia myuros</i>	Rats Tail Fescue		Exotic		3	2			
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic						1
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash		Native				1		
Rhamnaceae	<i>Pomaderris sp.</i>			Native				1	1	
Rutaceae	<i>Geijera parviflora</i>	Wilga		Native				2	1	
Solanaceae	<i>Solanum sp.</i>		Y	Native				2	2	
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong		Native					1	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native	2		2	1		
				Native ground cover species richness	30	15	24	36	32	15
				Total native plant species richness	32	15	26	42	37	15

4. MYALL PLAINS BOA

Table C4.1 Plant species recorded from within the Myall Plains BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native			2	2	2	
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native	2				2	2
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native	1					1
Anthericaceae	<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily	Y	Native	1					
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic		1				
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Y	Native	2	2			2	2
Asclepiadaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Y	Native			1	2		
Asteraceae	<i>Bidens subalternans</i>	Greater Beggar's Ticks		Exotic					1	
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-Daisy	Y	Native	2		2	2	2	
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic	1					
Asteraceae	<i>Cassinia aculeata</i>	Dolly Bush		Native						1
Asteraceae	<i>Centaurea calcitrapa</i>	Star Thistle		Exotic		3				
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic	1	1				
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic		1				
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y	Native	2	1	1	1		
Asteraceae	<i>Euchiton sphaericus</i>	Annual Cudweed	Y	Native			1			
Asteraceae	<i>Euchiton involucratus</i>	Star Cudweed	Y	Native	1					
Asteraceae	<i>Glossogyne bidens</i>		Y	Native	2					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic	2	2	1		1	
Asteraceae	<i>Olearia viscidula</i>	Viscid Daisy Bush	Y	Native					2	2
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood	Y	Native		1	1			
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Y	Native					1	
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native						1
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Y	Native	2					
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Y	Native	1		1		1	2
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Y	Native		2				
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native	2					1
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Y	Native	2	2				
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear		Exotic	1		1			1
Caesalpiaceae	<i>Senna form taxon zygophylla</i>	Narrow-leaf Desert Cassia		Native				1		
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native				1	1	2
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell	Y	Native	1		2		2	
Caryophyllaceae	<i>Petrorhagia nanteuillii</i>	Childling Pink		Exotic	2	2	1			
Caryophyllaceae	<i>Stellaria sp.</i>		Y	Native			1		1	
Caryophyllaceae	<i>Stellaria multiflora</i>		Y	Native		2				
Celastraceae	<i>Denhamia cunninghamii</i>		Y	Native				1	1	
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native			1	1		2
Colchicaceae	<i>Wurmbea dioica</i>	Early Nancy	Y	Native	1				1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Convolvulaceae	<i>Evolvulus alsinoides</i>		Y	Native			1			
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native	3	1		3	3	3
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native				1		2
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native			2	2		2
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood		Native		1	4	3	3	3
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush		Native					1	
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native			2			1
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	1				1	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native		1	2	2	2	2
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic	2	3		2	1	
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native		1		2	2	2
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	2	2				
Fabaceae (Mimosoideae)	<i>Acacia deanei</i>	Green Wattle		Native	3					
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle		Native	1			1	2	1
Geraniaceae	<i>Geranium molle</i>	Cranesbill Geranium		Exotic					1	
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native	2		2	1	2	
Juncaceae	<i>Juncus sp.</i>		Y	Native	1					
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native	1					
Lamiaceae	<i>Scutellaria humilis</i>	Dwarf Skullcap	Y	Native						2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Lamiaceae	<i>Stachys arvensis</i>	Stagger Weed		Exotic		1			2	
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Y	Native	1	1	1	1	1	1
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native				1		
Malvaceae	<i>Hibiscus sturtii</i>	Hill Hibiscus	Y	Native				1		
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Y	Native	2			1		
Malvaceae	<i>Sida spinosa</i>			Exotic	1					
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native			3	3	3	3
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum		Native			1			
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		Native	3		3			3
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark		Native			3			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native		1				
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native				1	1	
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	1				1	
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Y	Native	1					
Pittosporaceae	<i>Pittosporum angustifolium</i>	Weeping Pittosporum		Native				1		1
Plantaginaceae	<i>Linaria arvensis</i>			Exotic			2		1	
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Y	Native	1		1			
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native	2	3	2	3	3	3
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass	Y	Native	2		2	2	3	
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	2	2	2	2	3	3

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Y	Native				1		1
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native	1	2		2	1	3
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native		3				
Poaceae	<i>Dichelachne sp.</i>		Y	Native						1
Poaceae	<i>Digitaria sp.</i>		Y	Native				1		
Poaceae	<i>Elymus scaber</i>		Y	Native	1					
Poaceae	<i>Enneapogon sp.</i>		Y	Native	3		2	2		
Poaceae	<i>Paspalidium albobillosum</i>		Y	Native				2		
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native					2	2
Poaceae	<i>Rytidosperma sp.</i>		Y	Native				2	2	2
Poaceae	<i>Sporobolus sp.</i>		Y	Native			1	3		
Poaceae	<i>Vulpia sp.</i>			Exotic	1					
Portulacaceae	<i>Portulaca pilosa</i>	Akulikuli		Exotic				1		
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic	2	2				
Rubiaceae	<i>Galium leptogonium</i>			Exotic					1	2
Rubiaceae	<i>Galium sp.</i>		Y	Native			1			
Rubiaceae	<i>Galium murale</i>	Small Bedstraw		Exotic						1
Rutaceae	<i>Geijera parviflora</i>	Wilga		Native					1	
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native	2		1	3	3	4
Solanaceae	<i>Solanum cinereum</i>	Narrawa Burr	Y	Native						1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MY1	MY2	MY3	MY4	MY5	MY6
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Y	Native	1		1		1	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native	1	1	1	2	1	2
Verbenaceae	<i>Glandularia aristigera</i>	Mayne's Pest	Y	Native	1					
Native ground cover species richness					32	15	25	27	26	25
Total native plant species richness					37	17	31	35	34	33

5. MALLEE BOA

Table C5.1 Plant species recorded from within the Mallee BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native			2	2	3
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native				2	1
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native					1
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic	1				1
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Y	Native				1	2
Apocynaceae	<i>Alstonia constricta</i>	Quinine Bush	Y	Native					1
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	Y	Native					1
Asclepiadaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Y	Native				1	
Asteraceae	<i>Bidens subalternans</i>	Greater Beggar's Ticks		Exotic					1
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-Daisy	Y	Native		2			
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic	3	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic	1				1
Asteraceae	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	Y	Native				1	
Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane		Exotic					1
Asteraceae	<i>Euchiton involucratus</i>	Star Cudweed	Y	Native			1	1	
Asteraceae	<i>Hedypnois rhagadioloides</i>	Cretan Weed		Exotic	2				
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic	1	1	1	1	2
Asteraceae	<i>Olearia viscidula</i>	Viscid Daisy Bush	Y	Native				1	
Asteraceae	<i>Ozothamnus sp.</i>		Y	Native		1			
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native			1		
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic					2
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Y	Native	1				
Asteraceae	<i>Vernonia cinerea</i>		Y	Native					
Asteraceae	<i>Veronica calycina</i>	Hairy Speedwell	Y	Native					1
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Y	Native	1	2			
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native	2	2			
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass		Exotic		2			1
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native		1			1
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell	Y	Native				2	2
Caryophyllaceae	<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort		Exotic					1
Caryophyllaceae	<i>Petrorhagia nanteuillii</i>	Childling Pink		Exotic	2				2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic					2
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed		Exotic					1
Celastraceae	<i>Denhamia cunninghamii</i>		Y	Native					1
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native		2			1
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native					2
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Y	Native		3			
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Y	Native					2
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native					2
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native			3	4	1
Cyperaceae	<i>Carex appressa</i>	Tussock Sedge	Y	Native					1
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native	2	1		1	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native					1
Cyperaceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge	Y	Native			3		
Dillenuaceae	<i>Hibbertia obtusifolia</i>	Hoary Guinea Flower	Y	Native			1		
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood		Native			3	3	
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native	1	2			
Euphorbiaceae	<i>Ricinocarpus bowmanii</i>	Western Wedding Bush	Y	Native			1		
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native				2	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native		2		2	2
Fabaceae (Faboideae)	<i>Medicago minima</i>	Woolly Burr Medic		Exotic		2			2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native		1			
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	4	2			1
Fabaceae (Faboideae)	<i>Trifolium sp.</i>			Exotic	2				2
Fabaceae (Mimosoideae)	<i>Acacia triptera</i>	Spurwing Wattle		Native			1		
Geraniaceae	<i>Geranium sp.</i>		Y	Native					1
Haloragaceae	<i>Gonocarpus elatus</i>		Y	Native			1		
Juncaceae	<i>Juncus sp.</i>		Y	Native	2				
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native		1			
Lamiaceae	<i>Scutellaria humilis</i>	Dwarf Skullcap	Y	Native				2	
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Y	Native		1		1	
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native					1
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Y	Native		2			
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Y	Native		2			
Malvaceae	<i>Sida spinosa</i>			Exotic	2	2			
Myrtaceae	<i>Calytrix tetragona</i>	Common Fringe-myrtle	Y	Native			3		
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native		1			
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum		Native				3	3
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		Native		1		3	
Myrtaceae	<i>Eucalyptus dwyeri</i>	Dwyers Red Gum		Native			3		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Myrtaceae	<i>Melaleuca bracteata</i>			Native					3
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native		1			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native			1		3
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native		1	2	2	
Phormiaceae	<i>Dianella revoluta</i>	Blue Flax-lily	Y	Native			3		
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Y	Native		1			
Plantaginaceae	<i>Linaria arvensis</i>			Exotic		1		1	1
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Y	Native		1	1	1	
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native	3	1			1
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	1	1	2	3	
Poaceae	<i>Austrostipa verticillata</i>		Y	Native					3
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native	3	1			
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Y	Native					1
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native	1	1	1	1	1
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native		1			
Poaceae	<i>Dichelachne sp.</i>		Y	Native				1	
Poaceae	<i>Digitaria sp.</i>		Y	Native			1		
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Y	Native		1			
Poaceae	<i>Eragrostis brownii</i>	Browns Lovegrass	Y	Native		1			
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Y	Native	1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	MA1	MA2	MA3	MA4	MA5
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic	2				
Poaceae	<i>Microlaena stipoides</i>		Y	Native					3
Poaceae	<i>Panicum sp.</i>		Y	Native	1				
Poaceae	<i>Paspalidium sp.</i>		Y	Native		1			
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native		1			1
Poaceae	<i>Rostraria cristata</i>	Annual Cat's Tail		Exotic		1			
Poaceae	<i>Rytidosperma sp.</i>		Y	Native				2	
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Y	Native	1				
Poaceae	<i>Sporobolus sp.</i>		Y	Native					1
Poaceae	<i>Vulpia bromoides</i>	Silver Grass		Exotic	2			1	
Portulacaceae	<i>Calandrinia eremaea</i>		Y	Native			1		
Portulacaceae	<i>Portulaca bicolor</i>		Y	Native			1		
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic	2	1			2
Rubiaceae	<i>Galium leptogonium</i>			Exotic				2	2
Rubiaceae	<i>Galium murale</i>	Small Bedstraw		Exotic		2			
Rutaceae	<i>Geijera parviflora</i>	Wilga		Native					3
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native		1		3	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native			1	2	
Native ground cover species richness					13	29	17	20	26
Total native plant species richness					13	32	22	25	31

6. NIOKA NORTH BOA

Table C6.1 Plant species recorded from within the Nioka North BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Acanthaceae	<i>Rostellularia adscendens</i>		Y	Native			1	2	1	
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native			1			
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native			2			
Amaranthaceae	<i>Alternanthera sp. J. Palmer</i>		Y	Native	1					
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native			2	1	1	1
Anthericaceae	<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily	Y	Native		1	1			
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic	1			1		
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Y	Native	2		2	2	1	
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Y	Native	1			1		
Apocynaceae	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush		Exotic					1	
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic				2		3
Asteraceae	<i>Cassinia uncata</i>	Sticky Cassinia	Y	Native			3			
Asteraceae	<i>Centaurea calcitrapa</i>	Star Thistle		Exotic	1	3			1	
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic		1		1	1	2
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic				1	2	2
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle		Exotic		1		1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Asteraceae	<i>Crepis capillaris</i>	Smooth Hawksbeard		Exotic				1		
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Y	Native					1	1
Asteraceae	<i>Gamochoeta sp.</i>			Exotic	1					
Asteraceae	<i>Glossogyne bidens</i>		Y	Native			2			
Asteraceae	<i>Hedypnois rhagadioloides</i>	Cretan Weed		Exotic						2
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic		1	1			2
Asteraceae	<i>Olearia viscidula</i>	Viscid Daisy Bush	Y	Native			1			
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Y	Native	1			1		
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native			1			
Asteraceae	<i>Silybum marianum</i>	Varigated Thistle		Exotic	1					
Asteraceae	<i>Solenogyne bellioides</i>		Y	Native			2			
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic				1		1
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Y	Native			1		2	
Asteraceae	<i>Veronica calycina</i>	Hairy Speedwell	Y	Native				1		
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Y	Native	2	1	2	2	4	1
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Y	Native	2					1
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native		1		2		2
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine	Y	Native				1		
Brassicaceae	<i>Lepidium africanum</i>	Common Peppercross		Exotic	1	1		1		
Brassicaceae	<i>Sisymbrium officinale</i>	Hedge Mustard		Exotic				1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native			1	2	2	1
Campanulaceae	<i>Wahlenbergia planiflora subsp. longipila</i>		Y	Native			2			
Caryophyllaceae	<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort		Exotic	2		2	2	2	
Caryophyllaceae	<i>Petrorhagia nanteuillii</i>	Childling Pink		Exotic	1	1	2	2	2	2
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic	1					
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed		Exotic	1					
Chenopodiaceae	<i>Dysphania glomulifera</i>		Y	Native						1
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native		1		2		
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native	2					
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Y	Native	3					
Clusiaceae	<i>Hypericum gramineum</i>	Small St. John's Wort	Y	Native			2			
Convolvulaceae	<i>Convolvulus erubescens</i>		Y	Native					2	2
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native	2	2	2	2	2	2
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native	3	2	2	3	2	2
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native					2	2
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native			3	1		
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native		1	2	2	2	2
Fabaceae (Faboideae)	<i>Medicago minima</i>	Woolly Burr Medic		Exotic	3		2	3	2	
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic		3				3

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native			2			
Fabaceae (Faboideae)	<i>Swainsonia sp.</i>			Native				2		
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	2	4	2	2	3	2
Fabaceae (Faboideae)	<i>Trifolium sp.</i>			Exotic				2	1	
Fabaceae (Mimosoideae)	<i>Acacia sp.</i>			Native				1		
Fabaceae (Mimosoideae)	<i>Neptunia gracilis</i>	Native Sensitive Plant	Y	Native						1
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Y	Native	2		1		1	
Geraniaceae	<i>Geranium sp.</i>		Y	Native	1					
Geraniaceae	<i>Geranium molle</i>	Cranesbill Geranium		Exotic				2		
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native				1		
Lamiaceae	<i>Marrubium vulgare</i>	White Horehound		Exotic	2					
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native	1		1	1		
Lamiaceae	<i>Salvia verbenaca</i>	Vervain		Exotic					1	
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Y	Native			2	1		
Malvaceae	<i>Abutilon otocarpum</i>	Desert Lantern	Y	Native	2					
Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow		Exotic	1					
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Y	Native		1	1	1		1
Malvaceae	<i>Sida spinosa</i>			Exotic		2		2	1	2
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native			3	3		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		Native			2			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native	1			1	1	1
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native				2		
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	2		1	1		
Phormiaceae	<i>Dianella longifolia</i>		Y	Native			1			
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Y	Native					2	1
Plantaginaceae	<i>Linaria arvensis</i>			Exotic			1			
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Y	Native		1		2		1
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native		3	4		2	4
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass	Y	Native			2			
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	1	2	2	2	2	1
Poaceae	<i>Austrostipa verticillata</i>		Y	Native	4			3		
Poaceae	<i>Austrostipa setacea</i>	Corkscrew Grass	Y	Native			2			
Poaceae	<i>Bromus catharticus</i>	Prairie Grass		Exotic	2					
Poaceae	<i>Bromus molliformis</i>			Exotic	2			2		2
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native		1	1		2	1
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native				2	2	
Poaceae	<i>Digitaria didactyla</i>	Queensland Blue Couch	Y	Native				1		
Poaceae	<i>Elymus scaber</i>		Y	Native			1			
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic		2		2		2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	NN1	NN2	NN3	NN4	NN5	NN6
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native			2	1		
Poaceae	<i>Rytidosperma bipartitum</i>		Y	Native			2			
Poaceae	<i>Rytidosperma sp.</i>		Y	Native		2		2	2	
Poaceae	<i>Rytidosperma sp.2</i>		Y	Native		2				
Poaceae	<i>Vulpia sp.</i>			Exotic		2			2	2
Poaceae	<i>Vulpia bromoides</i>	Silver Grass		Exotic				2		
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Y	Native	2					
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic				2	1	2
Rubiaceae	<i>Galium aparine</i>	Goosegrass		Exotic	1					
Rubiaceae	<i>Galium murale</i>	Small Bedstraw		Exotic		1		1		
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native			4	2		
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia		Native			1			
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native				2		
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Y	Native	3					
Native ground cover species richness					19	14	35	30	20	20
Total native plant species richness					19	14	39	34	20	20

7. SUNSHINE BOA

Table C7.1 Plant species recorded from within the Sunshine BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	S1	S2	S3	S4	S5
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native		2			
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native	1	2			
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Y	Native	3	1			
Apiaceae	<i>Torilis nodosa</i>	Knotted Hedge-parsley		Exotic	1				
Ashodelaceae	<i>Asphodelus fistulosus</i>	Onion Weed		Exotic				1	
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic				3	
Asteraceae	<i>Centaurea calcitrapa</i>	Star Thistle		Exotic		3	3	3	
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic		2	1		2
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic	1	2		3	1
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Y	Native		2			
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle		Exotic	1				
Asteraceae	<i>Conyza sp.</i>			Exotic	1				
Asteraceae	<i>Cotula australis</i>	Common Cotula	Y	Native			1		
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Y	Native	2				
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic	4		1		
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Y	Native	1				
Asteraceae	<i>Silybum marianum</i>	Varigated Thistle		Exotic					3
Asteraceae	<i>Solenogyne bellioides</i>		Y	Native	1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	S1	S2	S3	S4	S5
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic		1			
Asteraceae	<i>Veronica calycina</i>	Hairy Speedwell	Y	Native	2				
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Y	Native		2			1
Boraginaceae	<i>Myosotis discolor</i>	Forget-me-not		Exotic	2				
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass		Exotic		1	1	1	2
Brassicaceae	<i>Sisymbrium officinale</i>	Hedge Mustard		Exotic	2			2	1
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear		Exotic		1			
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native		1			
Caryophyllaceae	<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort		Exotic	2	2	2	3	2
Caryophyllaceae	<i>Petrorhagia nanteuilii</i>	Childling Pink		Exotic	2	3		2	
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic			1		
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed		Exotic			1	1	
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native			1		2
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Y	Native			3		
Convolvulaceae	<i>Convolvulus erubescens</i>		Y	Native				1	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Y	Native	3				
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native		2		2	1
Cyperaceae	<i>Carex appressa</i>	Tussock Sedge	Y	Native	1				
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native	4	3	4	2	3
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native		2		2	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	S1	S2	S3	S4	S5
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Y	Native	1				
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	1				
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native	2	2		1	1
Fabaceae (Faboideae)	<i>Medicago minima</i>	Woolly Burr Medic		Exotic		3	4	4	4
Fabaceae (Faboideae)	<i>Medicago polymorpha</i>	Burr Medic		Exotic	2				
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native	1	1			
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	2	3		2	
Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover		Exotic		1			
Fabaceae (Faboideae)	<i>Trifolium sp.</i>			Exotic	2	3	3		
Fabaceae (Mimosoideae)	<i>Acacia implexa</i>	Hickory Wattle		Native	1				
Fabaceae (Mimosoideae)	<i>Neptunia gracilis</i>	Native Sensitive Plant	Y	Native				2	
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Y	Native	2				
Geraniaceae	<i>Geranium sp.</i>		Y	Native		1			
Geraniaceae	<i>Geranium molle</i>	Cranesbill Geranium		Exotic	1				
Iridaceae	<i>Romulea rosea</i>	Onion Grass		Exotic	2	1			
Lamiaceae	<i>Mentha diemenica</i>	Slender mint	Y	Native	1				
Lamiaceae	<i>Salvia verbenaca</i>	Vervain		Exotic	1			2	
Malvaceae	<i>Malva sp.</i>			Exotic			1		2
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Y	Native			1		
Malvaceae	<i>Sida spinosa</i>			Exotic		1		2	2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	S1	S2	S3	S4	S5
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple		Native	3				
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native		1			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native				2	
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native	1				
Onagraceae	<i>Epilobium billardierianum</i>		Y	Native		1			
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native	2				
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Y	Native	2				
Plantaginaceae	<i>Veronica peregrina</i>	Wandering Speedwell	Y	Native			1		
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native	3	3	1	3	3
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native		2		3	
Poaceae	<i>Austrostipa verticillata</i>		Y	Native			4	3	
Poaceae	<i>Bothriochloa sp.</i>		Y	Native		2			
Poaceae	<i>Briza minor</i>	Quaking grass		Exotic	1	2			
Poaceae	<i>Bromus molliformis</i>			Exotic		3	2	2	2
Poaceae	<i>Bromus sp.</i>			Exotic		3			
Poaceae	<i>Elymus scaber</i>		Y	Native		2			
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass		Exotic	2	2	2	2	2
Poaceae	<i>Microlaena stipoides</i>		Y	Native	4				
Poaceae	<i>Rostraria cristata</i>	Annual Cat's Tail		Exotic			1		
Poaceae	<i>Rytidosperma sp.</i>		Y	Native	1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	S1	S2	S3	S4	S5
Polygonaceae	<i>Polygonum aviculare</i>	Wireweed		Exotic					1
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Y	Native		2		2	1
Primulaceae	<i>Anagallis arvensis</i>	Scarlet/Blue Pimpernel		Exotic	2	1			
Rubiaceae	<i>Galium leptogonium</i>			Exotic	1				
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native	1				
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong		Native		1			
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native	1				
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Y	Native			1		
Native ground cover species richness					21	20	9	11	7
Total native plant species richness					25	22	9	11	7

8. BRAEFIELD BOA

Table C8.1 Plant species recorded from within the Braefield BOA sites during the 2015 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Acanthaceae	<i>Rostellularia adscendens</i>		Y	Native	2		1			
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Y	Native	2	2	2	1		
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	Native		2				
Amaranthaceae	<i>Alternanthera sp. J. Palmer</i>		Y	Native					1	
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Y	Native	2	2	3	1	2	1
Apiaceae	<i>Cyclospermum leptophyllum</i>	Slender Celery		Exotic					1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Y	Native	2	2	2	1	3	2
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Y	Native					4	
Apocynaceae	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush		Exotic					2	3
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Y	Native			2	2		
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle		Exotic	1			1		2
Asteraceae	<i>Centaurea melitensis</i>	Cockspur Thistle		Exotic				1		2
Asteraceae	<i>Chondrilla juncea</i>	Skeleton Weed		Exotic				1	1	2
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle		Exotic					1	
Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane		Exotic					2	
Asteraceae	<i>Crepis capillaris</i>	Smooth Hawksbeard		Exotic					2	2
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Y	Native	1	1	2	2		
Asteraceae	<i>Euchiton involucratus</i>	Star Cudweed	Y	Native				1		
Asteraceae	<i>Glossogyne bidens</i>		Y	Native	2			2		2
Asteraceae	<i>Hypochaeris glabra</i>	Smooth Catsear		Exotic					1	
Asteraceae	<i>Hypochaeris radicata</i>	Catsear		Exotic				1	2	
Asteraceae	<i>Olearia viscidula</i>	Viscid Daisy Bush	Y	Native		5	4			
Asteraceae	<i>Sigesbeckia australiensis</i>		Y	Native		1	2		1	
Asteraceae	<i>Solenogyne bellioides</i>		Y	Native	1					
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle		Exotic					1	
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Y	Native				2		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Asteraceae	<i>Veronica calycina</i>	Hairy Speedwell	Y	Native		1	1			
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Y	Native		2		1		
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Y	Native			2			
Asteraceae	<i>Vittadinia muelleri</i>		Y	Native	1		1	4		3
Asteraceae	<i>Vittadinia cuneata var. hirsuta</i>	Fuzzweed	Y	Native	1					
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass		Exotic					1	
Brassicaceae	<i>Lepidium bonariense</i>			Exotic						1
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Y	Native	2	2	2	2	2	2
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell	Y	Native		2				
Caryophyllaceae	<i>Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort		Exotic		1		2		
Caryophyllaceae	<i>Petrorhagia nanteuillii</i>	Childling Pink		Exotic	2	1	1	2	1	3
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed		Exotic						2
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed		Exotic					1	
Chenopodiaceae	<i>Einadia polygonoides</i>		Y	Native		1				1
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Y	Native					1	
Clusiaceae	<i>Hypericum gramineum</i>	Small St. John's Wort	Y	Native			2			
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Y	Native					4	
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Y	Native	3	3	3	3		2
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine		Native	2	1	2			
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Y	Native		3		2	2	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Y	Native	2		1			
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Y	Native				1		1
Fabaceae (Faboideae)	<i>Desmodium brachypodium</i>	Large Tick-trefoil	Y	Native	1	2	3			
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Y	Native	1	1	1	1	2	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Y	Native	2	2	4	2	2	2
Fabaceae (Faboideae)	<i>Medicago minima</i>	Woolly Burr Medic		Exotic			2	2	2	2
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Y	Native	3	2	3			
Fabaceae (Faboideae)	<i>Swainsonia sp.</i>		Y	Native	1					
Fabaceae (Faboideae)	<i>Trifolium arvense</i>	Haresfoot Clover		Exotic	3	2	2		3	3
Fabaceae (Faboideae)	<i>Trifolium campestre</i>	Hop Clover		Exotic				4		
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle		Native						3
Geraniaceae	<i>Erodium cicutarium</i>	Common Storksbill		Exotic						2
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Y	Native					2	1
Geraniaceae	<i>Geranium molle</i>	Cranesbill Geranium		Exotic	1		2	2		
Geraniaceae	<i>Geranium potentilloides</i>		Y	Native		1				
Geraniaceae	<i>Geranium retrorsum</i>	Common Cranesbill	Y	Native					3	
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Y	Native	1					
Lamiaceae	<i>Mentha satuireioides</i>	Creeping Mint	Y	Native		2				1
Lamiaceae	<i>Ocinocalyx betchei</i>		Y	Native		1	2			1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Matt-rush	Y	Native	1		2			
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Y	Native	2	2		2		1
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple		Native					1	
Myrtaceae	<i>Eucalyptus albens</i>	White Box		Native	3	4	3			
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum		Native					2	
Myrtaceae	<i>Melaleuca bracteata</i>			Native					1	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Y	Native	1			1		
Oleaceae	<i>Jasminum lineare</i>	Desert Jasmine	Y	Native	1					
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive		Native		1	1		2	
Oxalidaceae	<i>Oxalis perennans</i>		Y	Native		1		1	1	
Papaveraceae	<i>Argemone ochroleuca</i>	Mexican Poppy		Exotic						1
Pittosporaceae	<i>Pittosporum angustifolium</i>	Weeping Pittosporum		Native		2				
Plantaginaceae	<i>Linaria arvensis</i>			Exotic						2
Plantaginaceae	<i>Plantago cunninghamii</i>		Y	Native	2					
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Y	Native				2	3	2
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Y	Native					2	
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Y	Native	2	3	2	2		2
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Y	Native	2	2	3	1		3
Poaceae	<i>Austrostipa verticillata</i>		Y	Native		1			2	
Poaceae	<i>Bothriochloa sp.</i>		Y	Native			1			2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Y	Native				1		
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Y	Native	2		1			
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Y	Native	2	2		2		
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass	Y	Native						1
Poaceae	<i>Elymus scaber</i>		Y	Native			1			
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Y	Native				1		
Poaceae	<i>Enneapogon sp.</i>		Y	Native	1					
Poaceae	<i>Microlaena stipoides</i>		Y	Native					4	
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Y	Native		1	1			
Poaceae	<i>Rytidosperma sp.</i>		Y	Native	2	2	1		2	1
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Y	Native		1				
Poaceae	<i>Sporobolus mitchellii</i>	Rat's Tail Couch	Y	Native	1					
Poaceae	<i>Triticum aestivum</i>	Wheat		Exotic						
Poaceae	<i>Vulpia sp.</i>			Exotic				3		
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Y	Native				1	2	1
Polygonaceae	<i>Rumex crispus</i>	Curled Dock	Y	Exotic				1		
Rubiaceae	<i>Galium leptogonium</i>			Exotic		1				
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush		Native			1			1
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong		Native		1	1			
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Y	Native	1	2	2		2	1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NGC	NATIVE	B1	B2	B3	B4	B5	B6
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Y	Native					2	
Native ground cover species richness					31	31	29	26	22	21
Total native plant species richness					33	36	34	26	26	23

Appendix D

FAUNA DATA

Appendix D – Fauna data

1. MERRIENDI BOA

Table D1.1 Fauna species recorded from the Merriendi BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	SPOTLIGHTING – ME1, ME3
Birds																	
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle															
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite															
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite															
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar															
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra															
Anatidae	<i>Anas gracilis</i>	Grey Teal															
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron															
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow															
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow															
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird															
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie															
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird															
Artamidae	<i>Strepera graculina</i>	Pied Currawong															
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo															
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah															
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella															
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel															
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike															
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller															
Caprimulgidae	<i>Eurostopodus mystacalis</i>	White-throated Nightjar															
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)															
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper															
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove															
Columbidae	<i>Geopelia striata</i>	Peaceful Dove															
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon															
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing															
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough															
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird															

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	SPOTLIGHTING – ME1, ME3
Corvidae	<i>Corvus coronoides</i>	Australian Raven			O			O	O		O	O	O		O	O	
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo			O				O								
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo								O							
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo						O				O	O		O		
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird			O	O			O		O	O					
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark			O			O					O				
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher			O					O							
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail							O								
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			O	O	O					O					
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel													O	O	
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin													O		
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren									O	O					
Maluridae	<i>Malurus lamberti</i>	Variiegated Fairy-wren							O	O							
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren													O	O	
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			O	O			O		O	O					
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater								O							
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater												O		O	
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater							O			O					
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			O						O	O					
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater					O	O				O		O			
Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner											O	O			
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner			O	O											
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird															O
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird															
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater				O			O	O		O	O		O	O	
Muscicapidae	<i>Cinclorhampus mathewsi</i>	Rufous Songlark			O					O		O					
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole								O							
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush			O				O		O	O					
Pachycephalidae	<i>Falcunculus frontatus frontatus</i>	Crested Shrike-tit								O							
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler							O	O							
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			O				O	O	O	O					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	SPOTLIGHTING - ME1, ME3
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill										O					
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			O												
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill								O		O					
Pardalotidae	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	Speckled Warbler		V						O		O					
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone			O	O											
Pardalotidae	<i>Gerygone olivacea</i>	White-throated Gerygone				O			O								
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote								O							
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote			O	O	O		O			O				O	
Pardalotidae	<i>Sericornis frontalis</i>	White-browed Scrubwren								O							
Passeridae	<i>Stagonopleura guttata</i>	Diamond Firetail		V					O	O							
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch								O		O					
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin							O	O		O					
Petroicidae	<i>Melanodryas cucullata cucullata</i>	Hooded Robin (South-Eastern)		V					O	O							
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter							O		O	O					
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V		O										O	
Psittacidae	<i>Northiella haematogaster</i>	Blue Bonnet											O	O	O		
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella				O				O			O	O	O	O	
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot					O	O				O					
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird							O	O							
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook															O
Sturnidae	<i>Acridotheres tristis</i>	Common Myna		U									O		O	O	
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling		U				O					O	O	O		
Turnicidae	<i>Turnix varia</i>	Painted Button-quail										O					
Tytonidae	<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (southern mainland)		V													O
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye							O	O	O						

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	SPOTLIGHTING – ME1, ME3
Microchiropteran bats																	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V							3	2					
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat									3	1					
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat						1			8	15					
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat												1			
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V							4						
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat									10	5					
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat										1					
Reptiles																	
Agamidae	<i>Pogona barbata</i>	Bearded Dragon															O

2. NAMOI BOA

Table D2.1 Fauna species recorded from the Namoi BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	N1A	N1B	N2A	N2B	N3A	N3B	N4A	N4B	N5A	N5B	N6A	N6B	N7A	N7B	N8A	N8B	N9A	N9B	N10A	N10B	N11A	N11B	N12A	N12B	N13A	N13B	N14A	N14B	N15A	N15B	SPOTLIGHTING - N3			
Birds																																						
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle																																				
Accipitridae	<i>Circus assimilis</i>	Spotted Harrier		V																																		
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite							O						O				O	O																		
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle		V		O																																
Accipitridae	<i>Milvus migrans</i>	Black Kite						O																														
Alaudidae	<i>Mirafrja javanica</i>	Singing Bushlark					O	O							O	O																						
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra												O					O	O									O									
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher								O		O																			O		O	O				
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck																									O								O			
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck					O																		O													
Anhingidae	<i>Anhinga melanogaster</i>	Darter									O																											
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron																																				
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron											O																			O						
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow																																				
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow																				O			O	O	O											
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow																				O		O	O	O							O					
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird						O	O				O	O	O	O	O	O			O	O	O		O		O	O				O						
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie						O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	N1A	N1B	N2A	N2B	N3A	N3B	N4A	N4B	N5A	N5B	N6A	N6B	N7A	N7B	N8A	N8B	N9A	N9B	N10A	N10B	N11A	N11B	N12A	N12B	N13A	N13B	N14A	N14B	N15A	N15B	SPOTLIGHTING - N3			
Psittacidae	<i>Northiella haematogaster</i>	Blue Bonnet																		0	0	0	0		0													
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			0	0	0	0	0	0		0	0		0		0	0	0	0	0	0	0	0	0	0	0							0				
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot			0				0	0			0	0						0	0		0	0	0									0				
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird			0	0																																
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook																																	0			
Sturnidae	<i>Acridotheres tristis</i>	Common Myna		U											0	0									0		0											
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling		U		0			0			0								0	0				0	0							0	0				
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis						0										0															0	0				
Tytonidae	<i>Tyto javanica</i>	Pacific Barn Owl						0																														
Zosteropidae	<i>Zosterops lateralis</i>	Silvereeye																																	0			
Microchiropteran bats																																						
Molossidae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V		1																																
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat					2										20																					
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat			1																																	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat			4	23	3	No data collected	No data collected	No data collected	No data collected	No data collected	1	No data collected	No data collected		21	No data collected	57	22			14	9	No data collected	No data collected	6	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			2	10		No data collected	No data collected	No data collected	No data collected	No data collected		No data collected	No data collected		1	No data collected	1				3	5	No data collected	No data collected	8	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	No data collected	
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattle Bat			4	3	3						1				44		1	4			2	4			19											
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattle Bat					1												10				3	3														
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V			7						1		2		8										1											

3. WIRRILAH BOA

Table D3.1 Fauna species recorded from the Wirrilah BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B
Birds																
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk			O											
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle					O	O			O					O
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite					O									
Alaudidae	<i>Mirafra javanica</i>	Singing Bushlark					O	O							O	O
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow											O			
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow										O	O	O		
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird			O		O		O		O			O		O
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie			O		O		O	O	O		O			O
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird			O	O			O	O		O	O	O	O	
Artamidae	<i>Strepera graculina</i>	Pied Currawong									O					
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo			O			O								O
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah			O	O	O	O		O			O		O	O
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella				O	O									
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike								O	O			O		
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller							O			O			O	
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper							O			O	O			
Columbidae	<i>Geopelia striata</i>	Peaceful Dove													O	
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon			O	O			O				O	O		
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing												O		
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird			O	O		O					O	O	O	
Corvidae	<i>Corvus coronoides</i>	Australian Raven			O	O	O	O	O	O	O	O	O	O	O	O
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo									O					O
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel													O	
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo			O						O				O	
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird									O	O	O			
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark				O	O	O							O	
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail							O	O		O				
Falconidae	<i>Falco berigora</i>	Brown Falcon											O		O	O
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel													O	O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin											O			
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren							O							
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren					O	O							O	O
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater							O	O	O		O			
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater										O				
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater				O			O							
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater									O	O				
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater					O		O	O	O					
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner			O	O	O			O			O	O		
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird												O		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater							O		O		O	O		
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit					O	O							O	O
Muscicapidae	<i>Cinclorhampus cruralis</i>	Brown Songlark											O		O	O
Muscicapidae	<i>Cinclorhampus mathewsi</i>	Rufous Songlark					O		O	O						
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella		V							O					
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush									O	O				
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler							O	O	O	O	O			
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill							O		O	O				
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill									O					
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill								O						
Pardalotidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill									O					
Pardalotidae	<i>Aphelocephala leucopsis</i>	Southern Whiteface									O					
Pardalotidae	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	Speckled Warbler		V							O	O				
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote				O						O				
Pardalotidae	<i>Smicrornis brevirostris</i>	Weebill									O	O				
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin									O	O				
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter							O	O						
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V						O			O	O		
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot											O			
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot												O		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B
Psittacidae	<i>Northiella haematogaster</i>	Blue Bonnet							O							
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			O	O						O		O		
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot				O										
Sturnidae	<i>Acridotheres tristis</i>	Common Myna		U			O	O								
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling		U			O	O								
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis					O									
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye									O	O				
Microchiropteran bats																
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V					1		1					
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat													2	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat			No data collected	No data collected	No data collected	No data collected			7	1	11			
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			No data collected	No data collected	No data collected	No data collected		7		3				
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			No data collected	No data collected	No data collected	No data collected		5		1			3	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			No data collected	No data collected	No data collected	No data collected			2	1				
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			No data collected	No data collected	No data collected	No data collected				1	1			
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat			No data collected	No data collected	No data collected	No data collected					1		1	

4. MYALL PLAINS BOA

Table D4.1 Fauna species recorded from the Myall Plains BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	SPOTLIGHTING OPPORTUNISTIC - MY6
Birds																	
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle					1										
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar															W
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra						2			2						
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher									2						
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow															O
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow						20						10			
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow						40			2	15	2	10	2		
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie			1	1								1			
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird															W
Artamidae	<i>Strepera graculina</i>	Pied Currawong															W
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah			1	5		6									
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			1						1	1					
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V							1				1		
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper							1		2	2		1	1	2	
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove															W
Columbidae	<i>Geopelia striata</i>	Peaceful Dove			2	1					3	1	1		1	1	
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon															W
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing				1				1	1			1		2	
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird															O
Corvidae	<i>Corvus coronoides</i>	Australian Raven												1			
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo			1							1					
Cuculidae	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo														1	
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo			1	1											
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird			1	1		1	1		3	2	1	2		1	
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher													2	3	
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail			2	1				1	1	1				1	
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			1	1	1				2	2					
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren			2	1							1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	SPOTLIGHTING – MY6	OPPORTUNISTIC
Maluridae	<i>Malurus lamberti</i>	Variegated Fairy-wren											1					
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			1	2	3	3			2	2			1			
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater				2			1	2			2	1	2	2		
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater											2	4	4	2		
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater				1				1								
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater									1	2						
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner					2											
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			1									1				
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird								1								
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird											2	1				
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater				1						1	1	1		1		
Muscicapidae	<i>Cinclorhampus mathewsi</i>	Rufous Songlark			1													
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole													1	1		
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush									1	1				1		
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler										1	1					
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			1	2			2	1	2	2	2	4	4	2		
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			2		1	3										
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill				2			2				4		1			
Pardalotidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill				2			2	1								
Pardalotidae	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	Speckled Warbler		V								1	2	2				
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone			1	2												
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote											1					
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote			2	2	2	2	1	2				1				
Pardalotidae	<i>Smicrornis brevirostris</i>	Weebill			5	4	2	1	1	3			1		2			
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch				1					1	1	2					
Passeridae	<i>Taeniopygia guttata</i>	Zebra Finch																
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin			1	1			1	1	1	1	1	1	1	1		
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter				2					2	1						
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth															O	
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V														W

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	SPOTLIGHTING - MY6	OPPORTUNISTIC
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot		V								1						
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella																O
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot					1	4										
Turnicidae	<i>Turnix varia</i>	Painted Button-quail																O
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye											1					
Microchiropteran bats																		
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Shearwater-bat		V			1			1	1	1	1	3	1	8		
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat				1	1	2		1	4		1		2	3	37	
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat			2	3		1	5	14	1	2				1		
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			2	2		6	3	15		3	2	4	3			
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			6	12		13	1	11	22	9	9	10	5	7		
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			1	1		3			1		1	1	1			
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V	1	3		3			8			2		2		
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat			5	1	3	8		2	18	15	7	5		1		
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat			2	5	1	5		2	5	7	6	6	14	15		
Mammals (other)																		
Bovidae	<i>Bos taurus</i>	Cattle (feral)		U														O
Bovidae	<i>Capra hircus</i>	Goat (feral)		U														O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		U														O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo																O
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum															O	O

5. MALLEE BOA

Table D5.1 Fauna species recorded from the Mallee BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	SPOTLIGHTING – MA3	MALLEE OPPORTUNISTIC
Birds																
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle										2				
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar											1		W	
Alcedinidae	<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher												1		
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow														O
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow					10	10								
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird										1				
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird									2					
Artamidae	<i>Strepera graculina</i>	Pied Currawong					1			2						
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					1									
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V				1								
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper									1	1				
Columbidae	<i>Geopelia striata</i>	Peaceful Dove						2					2			
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon														W
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing							1		1	1				
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird									2					
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough												5		
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird														O
Corvidae	<i>Corvus coronoides</i>	Australian Raven														O
Cuculidae	<i>Chrysococcyx basalus</i>	Horsfield's Bronze-Cuckoo						2								
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel													W	
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo														W
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird					3	1	1	3			1			
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark														W
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher														O
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail						1				1	2	1		
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail					1	2					2	2		
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel				1										
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow			2			2					1	2		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	SPOTLIGHTING – MA3	MALLEE OPPORTUNISTIC
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren					1							1		
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					1						1	1		
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird									2	1				
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater					1			1	2	2				
Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater		V												
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater					2	2				1				
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater							1	1						
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater						1						1		
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner												1		
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					2	1								
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird									1	3				
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater					1	1				1		1		
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark														O
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella		V					1	2						
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole					1	1			2	1				
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush										1	2			
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler					2	2	2	2	2	2	2	3		
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill										1				
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill						2								
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill										4				
Pardalotidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill							1	1	1					
Pardalotidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill														O
Pardalotidae	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	Speckled Warbler		V			1	1		1			2	2		
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone											1			
Pardalotidae	<i>Gerygone olivacea</i>	White-throated Gerygone														O
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote								1	1					
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote					1		2	2	2	2				
Pardalotidae	<i>Smicromnis brevirostris</i>	Weebill					1	1	2	1	4	3	3	2		
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch					2	1					1	2		
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin					1	1	1	2			1	1		
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter					1	1								

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	SPOTLIGHTING – MA3	MALLEE OPPORTUNISTIC
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot		V				3								
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella								1	1	2				
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella														W
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot						1								
Microchiropteran bats																
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat		V				1			1	1		5		
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat				1		3	3	1	4			4		
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat									1		2	1		
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			7				2	4	3	1	8			
Vespertilionidae	<i>Chalinobus gouldii</i>	Gould's Wattled Bat			1	1	9	16	7	3	8	3	3	1		
Vespertilionidae	<i>Chalinobus morio</i>	Chocolate Wattled Bat					4	4	2			4		1		
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V			2	22			1	7	4	2		
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat			2		2	4	1	3		1	6	2		
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat			2		103	73	1	3		12	8	2		
Mammals (other)																
Bovidae	<i>Capra hircus</i>	Goat (feral)		U												O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		U												O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo														O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo/Euro														O
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby														O
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby														O
Reptiles																
Scincidae	<i>Egernia striolata</i>	Tree Skink														O
Scincidae	<i>Morethia boulengeri</i>	Boulenger's Skink														O
Amphibians																
Hylidae	<i>Litoria rubella</i>	Desert Tree Frog														W

6. NIOKA NORTH BOA

Table D6.1 Fauna species recorded from the Nioka North BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	SPOTLIGHTING	NIOKA 4 - SPOTLIGHTING	NIOKA - OPPORTUNISTIC
Birds																			
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle								1									
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar															W	W	
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra																	O
Alcedinidae	<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher											1						
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher			1	1													
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck																	O
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow										1							
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow										9							
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird								1	1					1			
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie			1	2			1										
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird								1									
Artamidae	<i>Strepera graculina</i>	Pied Currawong									1								
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo			1												O		
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah			3	2	2					2							
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella			1														
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				2			1										
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller							1										
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing																	O
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V	1				2										
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper			1				2	1									
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon																	O
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing			1	2			1	1									
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird																	W
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird																	O
Corvidae	<i>Corvus coronoides</i>	Australian Raven																	O
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo												2					
Cuculidae	<i>Eudynamys orientalis</i>	Eastern Koel																	W
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird			1	1			2	2		1							

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	SPOTLIGHTING	NIOKA 4 - SPOTLIGHTING	NIOKA - OPPORTUNISTIC
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark			1	1	2									5			
Dicruridae	<i>Myiagra inquieta</i>	Restless Flycatcher			1														
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher							1										
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail								1									
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			3	2			1					1			O		
Falconidae	<i>Falco berigora</i>	Brown Falcon																	
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel						2						3					
Falconidae	<i>Falco longipennis</i>	Australian Hobby					1												
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow																	O
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren			1	4			1	1									
Maluridae	<i>Malurus lamberti</i>	Variiegated Fairy-wren								3									
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			1														
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater			1	1			1	1									
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater							1										
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			2	1													
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner									1	1				2			
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			1				2	1									
Meliphagidae	<i>Melithreptus lunatus</i>	White-naped Honeyeater							1										
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird																	O
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird			1	2			2	2									
Meliphagidae	<i>Plectorhyncha lanceolate</i>	Striped Honeyeater			1														
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M		2														
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole			1														
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush			2	3			1										
Pachycephalidae	<i>Falcunculus frontatus frontatus</i>	Crested Shrike-tit			1	1													
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler							1										
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			1	2			1	3									
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill							2	2									
Pardalotidae	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	Speckled Warbler		V	1				1	3									
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone			1	1			1	1									
Pardalotidae	<i>Gerygone olivacea</i>	White-throated Gerygone								2									

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	SPOTLIGHTING	NIOKA 4 - SPOTLIGHTING	NIOKA - OPPORTUNISTIC
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote																	W
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote				1			2	2	2	1							
Pardalotidae	<i>Smicronis brevirostris</i>	Weebill			2	1			2	2	1								
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch			2				2										
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin							2	2									
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter				1													
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V					1										
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot										1							
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot										1							
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet																	O
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot		V															O
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella			1														
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			2	1		1	3		2	4							
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot									8	6		4					
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook															W		
Sturnidae	<i>Acridotheres tristis</i>	Common Myna		U			2	2											
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling		U			1	3								2			
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis					16												
Zosteropidae	<i>Zosterops lateralis</i>	Silvereeye				1				1									
Microchiropteran bats																			
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V		1			3										
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat							1			1							
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat				3	2	3	2	1	3	4	2	3					
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat			1			3		2		1				1			
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			3	9	23	40	10	19	2	5	4	15	2	7			
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			26	26	23	30	36	57	22	38		6	3	10			
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			1	2	38	20		5	7	32	10	5		4			
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V		1		6	2	8						1			
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat				5	4	3	3	20	6	4	2	2	1	1			
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat			13	21	74	39	1	33	18	7	2	2	7	6			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	SPOTLIGHTING	NIOKA 4 - SPOTLIGHTING	NIOKA - OPPORTUNISTIC
Mammals (other)																			
Bovidae	<i>Bos taurus</i>	Cattle (feral)		U											9				O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		U															O
Leporidae	<i>Lepus capensis</i>	Brown Hare		U															O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo																	O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo/Euro																	O
Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider		V													O		
Petauridae	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum															O		
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum															O	O	
Suidae	<i>Sus scrofa</i>	Pig (feral)		U															O
Reptiles																			
Agamidae	<i>Pogona barbata</i>	Bearded Dragon																	O
Scincidae	<i>Ctenotus robustus</i>	Striped Skink																	O
Varanidae	<i>Varanus varius</i>	Lace Monitor																	O
Amphibians																			
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet															W		

7. SUNSHINE BOA

Table D7.1 Fauna species recorded from the Sunshine BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS										SPOTLIGHTING (SITE 1)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B		
Birds																
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle						1								
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra														W
Anatidae	<i>Anas gracilis</i>	Grey Teal														O
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck														O
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron														O
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron														O
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow														O
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird			1		1		1							
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie														O
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird				1		1								
Artamidae	<i>Strepera graculina</i>	Pied Currawong					1									
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah					2		2	3	6	2	4			
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike										1				
Campephagidae	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike									1					
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller			4	2										
Caprimulgidae	<i>Eurostopodus mystacalis</i>	White-throated Nightjar													2	
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper					1									
Columbidae	<i>Geopelia striata</i>	Peaceful Dove			1	1										
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon								3						
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing			1		1									
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird						3								
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo														W
Cuculidae	<i>Chrysococcyx basalís</i>	Horsfield's Bronze-Cuckoo			1											
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird			1	2										
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark					1	1								
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail			1	1										
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			2	2										
Falconidae	<i>Falco berigora</i>	Brown Falcon														O

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS										SPOTLIGHTING (SITE 1)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B		
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel					1		1							
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren			2	4										
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater				1										
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater			1											
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater				1										
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			1	4										
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner			1		2	5	2	2		1				
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			1	1										
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird			2	2										
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater			1	1										
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M			1										
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit														O
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole				1										
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush			2	1										
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			2											
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			1	1										
Pardalotidae	<i>Chthonicola sagittata (syn. Pyrrholaemus sagittatus)</i>	Speckled Warbler		V	1											
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone			1	1			2							
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote			1											
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote				1	1	1		1						
Pardalotidae	<i>Sericornis frontalis</i>	White-browed Scrubwren			1											
Pardalotidae	<i>Smicronis brevirostris</i>	Weebill			1											
Passeridae	<i>Neochmia temporalis</i>	Red-browed Finch			1											
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin			1											
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter														W
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V												W
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot				2		2								
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot														O
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet		V		1										
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			2		2	2	1	2						
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot			2											

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS										SPOTLIGHTING (SITE 1)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B		
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling		U			1	5		1						
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis														O
Microchiropteran bats																
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat		V	1					1						
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat			1			1			2					
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat										3	1			
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat									1					
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			1		6		4	3	1		10	1		
Vespertilionidae	<i>Chalinobus gouldii</i>	Gould's Wattled Bat			2	7	8	12	90	225	108	19	4	2		
Vespertilionidae	<i>Chalinobus morio</i>	Chocolate Wattled Bat					7	3	37	26	12	10	6	1		
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V					14	3						
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat					3		31	8						
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat			2	2	10	9	304	156	75	28	6	4		
Mammals (other)																
Bovidae	<i>Bos taurus</i>	Cattle (feral)		U												O
Canidae	<i>Vulpes vulpes</i>	Fox		U												O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo														O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo/Euro														O
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby														O
Suidae	<i>Sus scrofa</i>	Pig (feral)		U												O
Reptiles																
Agamidae	<i>Pogona barbata</i>	Bearded Dragon														O
Scincidae	<i>Ctenotus robustus</i>	Striped Skink														1
Amphibians																
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog														1

8. BRAEFIELD BOA

Table D8.1 Fauna species recorded from the Braefield BOA during the 2015 baseline monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS												SPOTLIGHTING (SITE 5)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B		
Birds																		
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle									1	1				2		
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra															W	
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher															O	
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck															O	
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow															O	
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow					4											
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird			1				1									
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie							1									
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird				1	1			1			1	1				
Artamidae	<i>Strepera graculina</i>	Pied Currawong				1						1	2	1		1		
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo															O	
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah				9				2	5							
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel															W	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					1											
Campephagidae	<i>Coracina tenuirostris</i>	Cicadabird					1											
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller			1	1						4		1	2	2		
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)		V													W	
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper							1	2								
Columbidae	<i>Geopelia striata</i>	Peaceful Dove						1						3	2			
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon										1		1				
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing					1					1	1	1				
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird					1											
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird															W	
Corvidae	<i>Corvus coronoides</i>	Australian Raven															O	
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo						1			1	1						
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo												1	1			
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo															W	
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo													2			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS												SPOTLIGHTING (SITE 5)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B		
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird			1		1	2	1	2	1	1	1	1	1	1		
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark									1	3		2	2	2		
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail					1						1					
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			2	2		1			2	1	1		1	2		
Hirundinidae	<i>Cheramoeca leucosternus</i>	White-backed Swallow												2	2			
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow								1								
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren			1	1	3	2						6	1			
Maluridae	<i>Malurus lamberti</i>	Variegated Fairy-wren							1									
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			1	1				1			1				1	
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill											1					
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird			1											1	1	
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater					1	1	2	3					1			
Meliphagidae	<i>Epthianura tricolor</i>	Crimson Chat																O
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater					1		1	1								
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			1	2						1						
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner										1					1	
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					1		1									
Meliphagidae	<i>Melithreptus lunatus</i>	White-naped Honeyeater																W
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird										2						
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird			1		1	1				2	2	2	3	7		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater			1		2	2				1				1		
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	M										2					
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit																O
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella		V														W
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole														2		
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush					1	1	2				1					
Pachycephalidae	<i>Falcunculus frontatus frontatus</i>	Crested Shrike-tit																W
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			1	1	2	1	2	2	4		1	3	2			
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill							1									
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			1						2	2			1			
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill							2				4					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS												SPOTLIGHTING (SITE 5)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B		
Pardalotidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill					2						3	6				
Pardalotidae	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	Speckled Warbler		V			2		3	4			2	2				
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone					1						1	1	1	2		
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote						1						1				
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote			1	2	2	1		1			1	1				
Pardalotidae	<i>Smicromis brevirostris</i>	Weebill			1	2	4	2	1	1			3	2	1	2		
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch								1			2					
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin					1	2	2									
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter			1	1		1			1							
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe															O	
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)		V									4					
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot			1								1	3				
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot				1					1	1						
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet		V													W	
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot		V						1		1	1			2		
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella										2						
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			2		2					1						
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot			4													
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird															W	
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook															W	
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye							1	1			1					
Microchiropteran bats																		
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat			1													
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat								1		1						
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat			8		3											
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			12		10											
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat				3												
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V								1						
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed bat					4				1		2		2			
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat				3	5					19	4	44	95	29	53	

No data collected

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT	TSC ACT	DUPLICATE BIRD AND MICROCHIROPTERAN BAT SURVEYS												SPOTLIGHTING (SITE 5)	OPPORTUNISTIC
					1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B		
Mammals (other)																		
Bovidae	<i>Bos taurus</i>	Cattle (feral)		U														O
Canidae	<i>Vulpes vulpes</i>	Fox		U														O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		U														O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo																O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo/Euro																O
Suidae	<i>Sus scrofa</i>	Pig (feral)		U														O
Reptiles																		
Agamidae	<i>Pogona barbata</i>	Bearded Dragon																O
Scincidae	<i>Ctenotus robustus</i>	Striped Skink																O
Scincidae	<i>Egernia striolata</i>	Tree Skink																O
Varanidae	<i>Varanus varius</i>	Lace Monitor																O
Amphibians																		
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Frog															W	W
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog															W	W

Appendix E

VEGETATION BENCHMARK DATA

Appendix E – Vegetation Benchmark Data

Table E1.1 Baseline monitoring benchmark scores (Plant Community Types and Biometric Vegetation Types) for vegetation attributes

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT -MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Merriendi BOA														
Me1	Habitat Management Zone	3.5	100	1	0	37	0	0	6	18.2	52	26	0	0
Me2	Habitat Restoration Zone	0	0	0	0	25	0	0	19	0	64	18	0	18
Me3	Habitat Management Zone	11.5	100	0	10.5	24	0	0	8	0	26	22	4	0
Me4	Habitat Management Zone	15.5	100	2	24.5	31	0	0	11	3	32	10	0	0
Me5	Habitat Restoration Zone	0	0	0	0	14	0	0	8	0	80	2	0	18
Me6	Habitat Restoration Zone	0	0	0	0	16	0	0	14	0	66	16	0	18
Namoi BOA														
N1	Habitat Management Zone	14.5	100	0	0	29	0	0	13	7.4	44	10	0	42
N2	Habitat Restoration Zone	0	0	0	0	14	0	0	12	0	50	0	0	50
N3	Habitat Management Zone	7.5	0	2	0	8	0	0	8	100	0	0	0	100
N4	Habitat Management Zone	12.5	100	1	2.5	25	0	0	8	19	20	24	0	0
N5	Habitat Restoration Zone	0	0	0	0	12	0	0	20	0	28	10	0	62
N6	Habitat Restoration Zone	0	0	0	0	17	0	0	19	0	14	46	0	40
N7	Habitat Management Zone	0	0	0	1.5	24	0	0.5	14	0	70	6	0	16
N8	Habitat Management Zone	0	0	0	0	21	0	0	13	21.7	76	8	0	16
N9	Habitat Management Zone	0	0	0	0	27	0	0	21	0	60	12	0	18

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT-MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
N10	Habitat Management Zone	0	100	0	0	27	0	0	10	4	72	0	2	24
N11	Habitat Restoration Zone	0	0	0	0	23	0	0	14	0	52	14	0	34
N12	Habitat Management Zone	11.5	0	0	18.5	28	0	0	10	63	50	6	4	0
N13	Habitat Management Zone	30.5	100	5	10.5	26	0	0	9	39	38	16	20	2
N14	Habitat Management Zone	10	100	6	29.5	30	0	0	5	11	12	16	16	0
N15	Habitat Management Zone	0.5	100	0	0	11	0	0	12	7.1	44	22	0	34
Wirrilah BOA														
W1	Habitat Management Zone	20	0	1	0.2	32	0	0	5	12	62	22	0	0
W2	Corridor Enhancement Zone	0	0	0	0	15	0	0	16	0	50	6	0	18
W3	Habitat Restoration Zone	0.1	100	0	6.5	26	0	0	8	0	62	16	4	2
W4	Habitat Management Zone	8.5	100	0	12.5	42	0	0	5	43	44	14	0	0
W5	Habitat Management Zone	0.3	100	0	17.5	38	0	0	5	19	48	14	2	2
W6	Habitat Restoration Zone	0	0	0	0	15	0	0	14	0	88	0	0	8
Myall Plains BOA														
My1	Habitat Restoration Zone	6	50	0	20	37	0	0	10	3	28	26	0	26
My2	Habitat Restoration Zone	0.1	50	1	3.5	17	0	0	10	28	34	6	0	40
My3	Habitat Management Zone	23	100	1	7.5	31	0	0	4	23	30	14	0	0
My4	Habitat Management Zone	25.5	100	2	31.5	34	0	0	3	42	34	14	0	0

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT-MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
My5	Habitat Management Zone	34.5	100	3	32	34	0	0	7	65	36	28	0	2
My6	Habitat Management Zone	34	100	0	24.5	33	0	0	3	84	50	26	0	0
Mallee BOA														
Ma1	Habitat Restoration Zone	0	100	0	6	13	0	0	12	0	38	24	0	46
Ma2	Habitat Management Zone	22	50	1	18	32	12	0	10	17	50	14	0	12
Ma3	Habitat Management Zone	6	30	0	8	22	0	0	1	6	10	6	16	0
Ma4	Habitat Management Zone	32	100	0	8	25	0	0	4	32	36	24	0	4
Ma5	Habitat Management Zone	32	100	2	8	31	0	0	17	54	30	26	0	18
Nioka North BOA														
NN1	Habitat Management Zone	22.5	100	2	13.5	20	0	0	16	64	48	30	8	10
NN2	Habitat Restoration Zone	0	0	0	0.1	14	0	0	12	1	30	20	0	40
NN3	Habitat Management Zone	14	100	1	29.5	39	0	0	6	42	40	30	0	18
NN4	Habitat Management Zone	18	100	0	5.5	34	0	0	21	2.5	32	26	0	30
NN5	Habitat Restoration Zone	0	0	0	0	19	0	0	14	0	24	46	0	20
NN6	Habitat Restoration Zone	0	0	0	0	20	0	0	14	1.5	26	32	0	36

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT-MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Sunshine BOA														
S1	Habitat Management Zone	29	100	0	22	25	0	0	19	22	32	34	0	24
S2	Habitat Restoration Zone	0	50	0	1.5	22	0	0.5	19	4	40	0	0	54
S3	Habitat Management Zone	0	0	0	0.5	9	0	0	13	1.5	34	10	0	48
S4	Habitat Restoration Zone	0	0	0	0	11	0	0	15	0	24	20	0	54
S5	Habitat Restoration Zone	0	0	0	0	7	0	0	12	0	38	12	0	60
Braefield BOA														
B1	Habitat Management Zone	12.5	0	0	6	33	0	0	4	0	38	14	0	28
B2	Habitat Management Zone	28.5	100	3	37	36	0	0	4	122	44	16	0	6
B3	Habitat Management Zone	26.5	100	0	27.5	34	0	0	4	0	26	36	0	8
B4	Habitat Restoration Zone	0	50	0	0.1	26	0	0	11	7	8	54	0	36
B5	Habitat Management Zone	31.5	50	1	13.5	26	0	4.5	14	58	12	40	0	30
B6	Habitat Restoration Zone	0	0	0	16.5	23	0	0	13	2.5	24	16	0	24

Appendix F

REPLICATE MONITORING SITE PHOTOGRAPHS

Appendix F – Site photographs

1. MERRIENDI BOA



Photo 1.1 Merriendi Site 1



Photo 1.2 Merriendi Site 2



Photo 1.3 Merriendi Site 3



Photo 1.4 Merriendi Site 4



Photo 1.5 Merriendi Site 5



Photo 1.6 Merriendi Site 6

2. NAMOI BOA



Photo 2.1 Namoi Site 1



Photo 2.2 Namoi Site 2



Photo 2.3 Namoi Site 3



Photo 2.4 Namoi Site 4



Photo 2.5 **Namoi Site 5**



Photo 2.6 **Namoi Site 6**



Photo 2.7 Namoi Site 7



Photo 2.8 Namoi Site 8



Photo 2.9 Namoi Site 9



Photo 2.10 Namoi Site 10



Photo 2.11 Namoi Site 11



Photo 2.12 Namoi Site 12



Photo 2.13 Namoi Site 13



Photo 2.14 Namoi Site 14



Photo 2.15 Namoi Site 15

3. WIRRILAH BOA



Photo 3.1 Wirrilah Site 1



Photo 3.2 Wirrilah Site 2



Photo 3.3 Wirrilah Site 3



Photo 3.4 Wirrilah Site 4



Photo 3.5 Wirrilah Site 5



Photo 3.6 Wirrilah Site 6

4. MYALL PLAINS BOA



Photo 4.1 Myall Plains Site 1



Photo 4.2 Myall Plains Site 2



Photo 4.3 Myall Plains Site 3



Photo 4.4 Myall Plains Site 4



Photo 4.5 Myall Plains Site 5



Photo 4.6 Myall Plains Site 6

5. MALLEE BOA



Photo 5.1 Mallee Site 1



Photo 5.2 Mallee Site 2



Photo 5.3 Mallee Site 3



Photo 5.4 Mallee Site 4



Photo 5.5 Mallee Site 5

6. NIOKA NORTH BOA



Photo 6.1 Nioka North Site 1



Photo 6.2 Nioka North Site 2



Photo 6.3 Nioka North Site 3



Photo 6.4 Nioka North Site 4



Photo 6.5 Nioka North Site 5



Photo 6.6 Nioka North Site 6

7. SUNSHINE BOA



Photo 7.1 Sunshine Site 1



Photo 7.2 Sunshine Site 2



Photo 7.3 Sunshine Site 3



Photo 7.4 Sunshine Site 4



Photo 7.5 **Sunshine Site 5**

8. BRAEFIELD BOA



Photo 8.1 Braefield Site 1



Photo 8.2 Braefield Site 2



Photo 8.3 Braefield Site 3



Photo 8.4 Braefield Site 4



Photo 8.5 Braefield Site 5



Photo 8.6 Braefield Site 6

Table 1 Tree stem class attribute data 2019

MONITORING SITE	STEM CLASS (CM DBH)						
	<5	5-9	10-19	20-29	30-49	50-79	80+
Merriendi BOA							
Me1	0	3	6	0	2	2	0
Me2	0	0	0	0	0	0	0
Me3	2	4	10	0	0	0	0
Me4	1	4	2	2	4	1	0
Me5	0	0	0	0	0	0	0
Me6	0	0	0	0	0	0	0
Namoi BOA							
Na1	0	0	2	34	15	0	0
Na2	0	0	0	0	0	0	0
Na3	1	0	0	0	0	0	2
Na4	3	4	2	0	2	1	1
Na5	0	0	0	0	0	0	0
Na6	0	0	0	0	0	0	0
Na7	0	0	0	0	0	2	1
Na8	0	0	0	0	0	1	1
Na9	0	0	3	0	0	0	0
Na10	0	0	0	0	0	0	0
Na11	0	0	0	0	0	0	0
Na12	0	0	0	0	4	0	0
Na13	1	0	4	12	17	3	0
Na14	1	1	9	13	2	0	0
Na15	0	0	0	0	0	0	1
Na16	0	0	0	0	0	0	0
Na17	0	0	0	0	0	0	0
Wirrilah BOA							

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MONITORING SITE	STEM CLASS (CM DBH)						
	<5	5-9	10-19	20-29	30-49	50-79	80+
W1	0	0	2	15	3	0	0
W2	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0
W4	1	3	0	2	1	0	0
W5	19	14	2	0	2	1	0
W6	0	0	0	0	0	0	0
W7	0	0	0	0	0	0	0
Myall Plains							
My1	5	2	9	0	0	0	1
My2	0	1	0	0	0	0	0
My3	1	2	12	19	6	0	0
My4	0	0	0	1	6	2	1
My5	4	0	4	9	4	4	0
My6	1	7	27	32	3	1	0
Mallee BOA							
Ma1	0	0	0	0	0	0	0
Ma2	1	0	0	0	0	0	0
Ma3	0	2	3	3	0	0	0
Ma4	2	0	7	6	0	1	0
Ma5	0	0	0	5	3	2	0
Goonbri BOA							
G1	1	1	2	13	3	0	0
G2	0	0	0	0	0	0	0
Nioka North							
Ni1	0	0	0	0	0	0	2
Ni2	0	0	0	0	0	0	0
Ni3	1	2	2	3	2	1	0
Ni4	8	1	1	0	0	0	1
Ni5	0	0	0	0	0	0	0
Ni6	0	0	0	0	0	0	0
Sunshine							

MONITORING SITE	STEM CLASS (CM DBH)						
	<5	5-9	10-19	20-29	30-49	50-79	80+
S1	73	6	2	1	4	1	1
S2	0	3	0	0	0	0	0
S3	0	0	0	0	0	0	0
S4	0	0	0	0	0	0	0
S5	0	0	0	0	0	0	0
Braefield							
B1	11	14	7	3	3	1	0
B2	1	1	0	0	0	2	2
B3	1	1	6	3	7	3	2
B4	0	0	0	0	0	0	0
B5	5	0	2	1	2	2	1
B6	0	0	0	0	0	0	0

APPENDIX D

THREATENED BIODIVERSITY IMPLEMENTATION PLANS



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1 INTRODUCTION

These Threatened Biodiversity Implementation Plans outline specific implementation plans for Commonwealth listed threatened biodiversity identified in CoA 12 and additional Commonwealth listed species recorded or predicted to occur in the Project Boundary and BOAs. They have been prepared to address the relevant sections of CoA 13(d) and 20 (EPBC 2009/5256) of Commonwealth approval for the Project. Specific matters addressed in this Appendix are provided in bold text below.

Offset management plan

Condition 12

*To offset the impacts to the **White box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland and the habitat of the Regent Honeyeater, Swift Parrot and Greater Long-eared Bat**, the person taking the action must submit to the Minister for approval an Offset management plan for all of the offset areas, specified in condition 7, within 6 months of the date of this approval. The approved Offset management plan must be implemented prior to the commencement of new mining operations.*

Condition 13

*d) **Plans to improve upon the baseline condition (identified in the surveys required by condition 13c) consistent with the State and Transition Model, EPBC listing advice, and threatened species habitat defined as native vegetation communities, including but not limited to:***

*i) **a map showing areas to be managed***

*ii) **management actions for each area and details of management methods to be used***

*iii) **timing of management activity for each area***

*iv) **performance criteria for each area***

*v) **a set of measurable ecological indicators for detecting changes to the White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, including those that may be ascribed to ongoing water stress***

*vi) **a monitoring plan to assess the success of the management activities measured against the baseline condition. The monitoring must be statistically robust and able to quantify change of White Box - Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This should include, but not be limited to, control sites and periodic ecological surveys to be undertaken by a qualified ecologist***

*vii) **a description of the potential risks to successful management against performance criteria, and a description of the contingency measures that would be implemented to mitigate these risks***

*viii) **a process to report, to the department, the progress of management and activities to undertake such improvement***

*ix) **details of the various parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor.***

Leard Forest Mining Precinct Regional Biodiversity Strategy

Condition 20

*The person undertaking the action **must implement the regional biodiversity strategy as required under conditions 40-46 of the NSW state government Project Approval dated 18 July 2012 (application number 09_0182). The required scoping report for the development of the strategy must be submitted to the Minister for approval on or before 31 July 2013. The approved strategy must be implemented.***

Implementation plans were developed for the Box Gum Grassy Woodland ecological community and threatened species listed in Table D1.1. These implementation plans were prepared following an investigation of factors likely

to enhance or impeded the effective long-term restoration of degraded remnants of Box Gum Woodland and the effective long-term provision of suitable habitat for threatened species listed in Table D1.1 (consistent with Condition 12).

For the purposes of providing protection, restoration and long-term maintenance of viable stands of habitat through the BMP, various threatened species have been grouped together (guilds) due to their similarity in habitat requirements and susceptibility to impacts associated with the Project (Table D1.1).

Table D1.1 Targeted Commonwealth listed threatened biodiversity

BIODIVERSITY VALUES	EPBC ACT LISTING	THREATENED SPECIES IMPLEMENTATION PLAN
Threatened ecological communities		
Box Gum Grassy Woodland	Critically Endangered	Section 6
Threatened fauna species identified in CoA 12 of EPBC/2009/5256		
Regent Honeyeater	Critically Endangered	Section 12
Swift Parrot	Critically Endangered	Section 10
Corben's Long-eared Bat ¹	Vulnerable	Section 8
Additional threatened fauna species recorded or predicted to occur		
Painted Honeyeater	Vulnerable	Section 9
Superb Parrot	Vulnerable	Section 11
Spotted-tailed Quoll	Endangered	Section 13
Koala	Vulnerable	Section 14

1) Corben's long-eared Bat (syn. Greater long-eared Bat).

Furthermore, Appendix D has been completed in consideration and in accordance with the Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report (Umwelt (Australia) Pty Limited 2017)) to fulfil COA 20 and to ensure consistency between management actions, monitoring opportunities, performance measures and preliminary completion criteria.

2 INVESTIGATION PLAN FOR THE PROVISION OF BOX GUM WOODLAND AND THREATENED FAUNA HABITAT

Table D2.1 and Table D2.2 detail proposed actions relating to factors that are likely to impede or enhance the provision of Box Gum Woodland and habitat for threatened species of fauna. As many of the threatened fauna species listed in Table D1.1 use Box Gum Woodland as habitat, factors relating to the re-establishment and restoration of Box Gum Woodland are applicable to threatened species of fauna.

The provision of habitat management zones, habitat restoration zones and corridor enhancement zones, together with rehabilitation (re-establishment) of post mine landform, will over time provide a range habitats that can be used by threatened fauna species. Although the provision of suitable habitat does not in itself ensure the presence of any such species, it is possible to seek to optimise the potential habitat for such species to ultimately occupy these landscapes.

Table D2.1 Proposed actions relating to factors likely to impede and enhance the re-establishment and restoration of Box Gum Woodland

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
1. Substrate	1a. Poor soil chemistry – depleted soil nutrients (Eddy, 2002)	Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat restoration and corridor enhancement zones in biodiversity offset areas	<ul style="list-style-type: none"> — Limited and selective use of specific fertilisers to facilitate growth of tube stock (Eddy, 2002). — Placement of woody debris to increase carbon and moisture levels (Goldin and Brookhouse, 2014). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide for soil testing to be undertaken on soils in revegetation areas to identify issues with physical and chemical characteristics as well as determine amelioration requirements and rates. — Provide for selective use of slow-release fertiliser to promote plant growth (if required). — Describe procedures to reuse timber/hollow logs salvaged during vegetation clearance (consistent with Project CoAs).
	1b. Poor soil chemistry - elevated soil nutrients (Prober et al. 2002; Rawlings et al. 2010; DECCW, 2010)	Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat restoration and corridor enhancement zones in biodiversity offset areas	<ul style="list-style-type: none"> — No application of fertilizers on soils with elevated concentrations of the same nutrients (Rawlings et al. 2010). — Nutrient management options to lower soil nitrogen and phosphorus levels: <ul style="list-style-type: none"> — Crash grazing periodically to remove nutrients locked in weeds (Rawlings et al. 2010). — Restriction of livestock access to limit further nutrient enrichment (Rawlings et al. 2010). — Hay cutting (Rawlings et al. 2010) — Controlled burns (Rawlings et al. 2010). — Carbohydrate addition (Rawlings et al. 2010) — Topsoil removal (scalping) (corridor enhancement zone only) (Gibson-Roy <i>et al.</i> 2010; Rawlings <i>et al.</i> 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide for soil testing to be undertaken on soils in revegetation areas to identify issues with physical and chemical characteristics as well as determine amelioration requirements and rates. — Describe the following nutrient reduction options: <ul style="list-style-type: none"> — crash grazing periodically to remove nutrients locked in weeds; — restriction of livestock access to limit further nutrient enrichment; — controlled burns.
	1c. Erosion and sedimentation (Rawlings et al. 2010; DECCW, 2010; Tongway and Ludwig, 2011)	Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat restoration and corridor enhancement zones in biodiversity offset areas	<ul style="list-style-type: none"> — Targeting revegetation along drainage lines. — Remediation of scalded areas. — Restriction of livestock access (particularly along drainage lines) (Rawlings et al. 2010). — Maximised re-use of existing infrastructure (e.g. access roads) instead of creating new infrastructure. — Ecological analysis to identify constraints and requirements for specific management measures (Tongway and Ludwig, 2011). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe restriction of livestock access. — Aim to maximise the re-use of existing infrastructure (e.g. access roads) instead of creating new infrastructure.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
	1d. Soil compaction - inhibits germination of seeds or growth of seedlings (Eddy, 2002; Department of Sustainability and the Environment [DSE], 2005; Rawlings et al. 2010; DECCW, 2010)	Biodiversity offset areas - re-establishment of Box Gum Woodland within corridor enhancement zones	<ul style="list-style-type: none"> — Restriction of vehicle access to avoid compacting soil (Eddy, 2002; DSE, 2005). — Restriction of livestock access (Rawlings et al. 2010). — Options for reducing compaction: <ul style="list-style-type: none"> — Mulching (Rawlings et al. 2010) — Hand aeration (Rawlings et al. 2010) — Deep air-jetting and mulching (Rawlings et al. 2010) — Cultivation followed by mulching (Rawlings <i>et al.</i> 2010). 	The OMP will: <ul style="list-style-type: none"> — Describe that vehicle access will be predominantly restricted to designated tracks to minimise ground disturbance (e.g. compaction). — Describe how livestock will be excluded from areas undergoing active revegetation (i.e. planting or seeding). — Describe site preparation in cleared land (e.g. ripping or use of spiked rollers) and (where relevant) in derived grassland (e.g. use of spiked rollers) to reduce soil compaction impacting the success of the revegetation.
		Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat management and habitat restoration zones	<ul style="list-style-type: none"> — Restriction of vehicle access to avoid compacting soil (Eddy, 2002; DSE, 2005). — Restriction of livestock access (Rawlings et al. 2010). 	
	1e. Ground disturbance (Eddy, 2002; Rawlings et al. 2010)	Biodiversity offset areas - re-establishment of Box Gum Woodland within corridor enhancement zones	<ul style="list-style-type: none"> — Restriction of vehicle access to avoid unnecessary ground disturbance (Eddy, 2002; DSE, 2005). — Fencing and signage. 	The OMP will: <ul style="list-style-type: none"> — Describe that vehicle access will be predominantly restricted to designated tracks to minimise ground disturbance (e.g. compaction). — Describe provision of fencing and signage around the perimeter of the offset areas to manage livestock and avoid accidental clearance. — Restrict the use of revegetation techniques that involve high level of physical disturbance in existing Box Gum Woodland and derived grasslands.
Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat restoration and habitat management zones	<ul style="list-style-type: none"> — Avoidance of revegetation techniques that involve high level of physical disturbance (i.e. cultivation, ripping and excavation) (Eddy, 2002; DECCW, 2010). — Restriction of vehicle access to avoid unnecessary ground disturbance (DSE, 2005; Eddy, 2002). — Fencing and signage. 			
	1f. Depleted soil seed bank (DECCW, 2010)	Biodiversity offset areas - re-establishment of Box Gum Woodland within habitat restoration and corridor enhancement zones in biodiversity offset areas	<ul style="list-style-type: none"> — Supplementary seeding/tube stock planting. 	The OMP will: <ul style="list-style-type: none"> — Favour natural regeneration in the habitat management and habitat restoration zones over seeding or planting in the first instance, followed by seeding or planting where applicable.
2. Clearing	2a. Incidental clearing, fragmentation and fire wood collection	Biodiversity offset area – re-establishment of Box Gum Woodland within corridor enhancement habitat restoration and habitat management zones	<ul style="list-style-type: none"> — Restriction on clearing. — Restriction on fire wood collection. — Fencing and signage. — Maximise re-use of existing infrastructure (e.g. access roads). — Where necessary, new infrastructure should be installed in cleared land (e.g. access roads). — Use of low disturbance methods for site preparation in derived grasslands and existing Box Gum Woodland. 	The OMP will: <ul style="list-style-type: none"> — Describe a restriction of clearing (unless for ecological thinning of density regrowth [i.e. selective removal of regrowth trees or shrubs], maintenance or access for monitoring). — Not permit firewood collection. — Describe provision of fencing and signage around the perimeter of biodiversity offset areas to manage livestock (i.e. exclusion or controlled entry of livestock for specific purposes) and avoid accidental clearance. — Aim to maximise the re-use of existing infrastructure (e.g. access roads) instead of creating new infrastructure. — Aim to locate new offset area management infrastructure (e.g. access roads) preferentially in cleared land.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
3. Livestock	3a. Grazing by cattle – ground disturbance, remove or destroy seeds, seedlings or plantings (DSE, 2005; Rawlings et al. 2010)	Biodiversity offset area – re-establishment of Box Gum Woodland within corridor enhancement zones	<ul style="list-style-type: none"> — Fencing of areas undergoing revegetation to exclude grazing livestock and prevent grazing of seedlings (Eddy, 2002). — Maintenance of fencing used to exclude livestock. 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe how livestock will be excluded from areas undergoing active revegetation (i.e. planting or seeding). — Describe restriction of livestock access to areas not already subject to grazing. — Describe management of livestock to maintain ground cover and diversity of native plants. — Describe restriction of livestock access to protect plants that are known to be sensitive to grazing. — describe the following controlled grazing management options: <ul style="list-style-type: none"> — Rotational grazing system to promote and maintain plant diversity and cover. — Removal of grazing livestock.
		Biodiversity offset areas re-establishment of Box Gum Woodland within habitat restoration zones	<ul style="list-style-type: none"> — Restriction of livestock access (particularly along drainage lines) (Rawlings et al. 2010). — Restriction of livestock access to protect plants that are known to be sensitive to grazing (Rawlings et al. 2010). — Restriction of livestock access to maintain ground cover. — Maintenance of fencing used to exclude livestock. — Controlled grazing management options: <ul style="list-style-type: none"> — Crash grazing periodically to remove nutrients locked in weeds (Rawlings <i>et al.</i> 2010). — High intensity short duration rotational grazing (Rawlings <i>et al.</i> 2010). — Removal of grazing livestock. — Low stocking rates. 	
		Biodiversity offset areas - restoration of habitat management zones	<ul style="list-style-type: none"> — Exclusion of livestock grazing along watercourses (McIvor and McIntyre, 2002). — Exclusion of livestock grazing in areas not already subject to grazing (DECCW, 2010). — Maintenance of fencing used to exclude livestock. — Controlled grazing management (low stocking rates). 	

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
4. Introduced flora species (weeds)	4a. Weed invasion – perennial and annual grasses, perennial herbs, annual and biennial herbs and woody weeds (DSE, 2005; Rawlings et al. 2010; Gibson-Roy et al. 2010; DECCW, 2010)	Biodiversity offset areas – re-establishment of Box Gum Woodland within corridor enhancement zones	<ul style="list-style-type: none"> — Minimal unnecessary ground disturbance that may create opportunities for weeds (Eddy, 2002; DSE, 2005; Rawlings et al. 2010). — Correct spacing for species when planting seedlings to avoid excessive shading (DECCW, 2010). — Weed management options: <ul style="list-style-type: none"> — Crash grazing periodically to reduce annual and perennial grass weeds (Rawlings et al. 2010). — Nutrient management (e.g. exclusion of grazing livestock which add nutrients) (Rawlings et al. 2010). — Controlled burns during spring to reduce annual and perennial grass weeds (not broadleaf exotics) (Rawlings et al. 2010). — Physical Removal (e.g. removing weeds by felling or pulling) (Gibson-Roy et al. 2010; Rawlings et al. 2010). — Herbicide (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods) (DSE, 2005; Rawlings et al. 2010; DECCW, 2010). — Sowing of Kangaroo Grass to outcompete annual grass weeds (Prober et al. 2002; Rawlings et al. 2010). — Scalping to remove weed seed bank (Gibson-Roy et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide application rates for seeds as well as planting densities for tube stock to avoid excessive shading. — Provide the following weed management options: <ul style="list-style-type: none"> — Crash grazing periodically to reduce annual and perennial grass weeds. — Nutrient management (e.g. exclusion of grazing livestock which add nutrients). — Controlled burns (except in revegetation areas) during spring to reduce annual and perennial grass weeds (not broadleaf exotics). — Physical Removal (e.g. removing weeds by felling or pulling). — Targeted and timely herbicide application. — Include sowing of Kangaroo Grass (as this species is known to out-compete annual grass weeds and provide inter tussock spaces for a diversity of ground cover species [e.g. wildflowers]).
		Biodiversity offset areas – re-establishment of Box Gum Woodland within habitat restoration and habitat management zones	<ul style="list-style-type: none"> — Minimal unnecessary ground disturbance that may create opportunities for weeds (Eddy, 2002; DSE, 2005; Rawlings et al. 2010). — Light grazing in autumn and/or winter to reduce vigour of annual grass weeds (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Include provision to lightly graze derived grasslands in times of suitable climatic conditions for weed growth (e.g. autumn and/or winter) to reduce vigour of annual grass weeds.
5. Herbicide	5a. Excessive herbicides – may have a negative effects on native species (Eddy, 2002)	All areas	<ul style="list-style-type: none"> — Use herbicides sparingly (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods) (DSE, 2005; Rawlings et al. 2010; DECCW, 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide methods for the use of herbicides (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods).
6. Impacts from animals	6a. Grazing by feral pigs and goats – remove or destroy seeds, seedlings or plantings (Eddy, 2002; Rawlings et al. 2010; DECCW, 2010; DSE 2005)	All areas	<ul style="list-style-type: none"> — Monitoring and control feral pigs and goats (Eddy, 2002; Rawlings et al. 2010; DSE, 2005). — Use of tree guards to protect young seedlings from browsing or grazing (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe procedures to prevent, monitor and control feral animals (including feral pigs, goats, rabbits and foxes). — Provide an option for using tree guards to protect young seedlings from browsing or grazing native animals.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
	6b. Feral foxes and cats (Eddy, 2002; DECCW, 2010)	All areas	— Monitoring and control of feral foxes and cats (Eddy, 2002; Rawlings et al. 2010).	The OMP will: — Describe procedures to monitor and control feral animals (including feral pigs, goats, rabbits and foxes).
	6c. Other Invasive Fauna	All areas	— Provisions to identify new invasive fauna species (e.g. ecological monitoring).	The OMP will: — Provide provisions to identify new invasive fauna species (e.g. ecological monitoring).
7. Fire	7a. Uncontrolled bushfire (DECCW, 2010)	Biodiversity offset areas – re-establishment of Box Gum Woodland within corridor enhancement and habitat restoration zones	— Not controlled burns whilst vegetation is establishing. — Maintain fire breaks and access. — Controlled grazing to reduce biomass (Rawlings et al. 2010).	The OMP will: — describe measures to prevent fires, such as maintaining fire breaks and access. — provision for maintenance of fire breaks and fire trails. — provide an option for using controlled grazing to reduce biomass.
8. Floristics	8a. Poor diversity in the seed mix or tube stock	Biodiversity offset areas – re-establishment of Box Gum Woodland within habitat restoration zones	— Strategic and long term seed collection, management and storage. — Site preparation and depth of sowing seed. — Supplementary planting or reseedling of absent species.	The OMP will: — Describe procedures for seed collection, management and storage. — Describe procedures for sowing seed. — Favour natural regeneration in the habitat restoration and habitat management zones over seeding or planting in the first instance followed by seeding or planting if required.
		Biodiversity offset areas – re-establishment of Box Gum Woodland within habitat restoration zones	— Favour natural regeneration over seeding or planting in the first instance followed by seeding or planting if required (McIntyre, 2002).	
	8b. Unsuitable species in the seed mix or tube stock	Biodiversity offset areas – re-establishment of Box Gum Woodland within habitat restoration zones	— Favour natural regeneration over seeding or planting in the first instance followed by seeding or planting if required (McIntyre, 2002).	The OMP will — Provide for the preferential use of local endemic (adapted) species. — Favour natural regeneration in habitat restoration and habitat management zones over seeding or planting in the first instance followed by seeding or planting if required.
	8c. Shortage of sufficient seed or tube stock	All areas	— Review commercial seed and tube stock availability.	The OMP will: — Describe a seed and tube stock supply strategy.
	8d. Poor understorey diversity	All areas	— Planting of trees and shrubs at appropriate densities (DECCW, 2010). — Use local endemic (adapted) species (Eddy, 2002; Rawlings et al. 2010). — Restore linkages to existing woodland patches. — Assess whether ecological thinning is necessary (Rawlings et al. 2010). — Consider causing disturbance (e.g. through fire or grazing) (Eddy, 2002). — Include a wide diversity of species in the seed mix (Gibson-Roy et al. 2010).	The OMP will: — Provide for the preferential use of local endemic (adapted) species. — Include provision to assess vegetation density and undertake ecological thinning if necessary. — Provide measures to improve understorey diversity (e.g. replanting, causing disturbance through fire or grazing). — Aim to include a wide diversity of species in the seed mix.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
9. Native plant growth	9a. Poor native plant growth	Biodiversity offset areas – re-establishment of Box Gum Woodland within corridor enhancement and habitat restoration zones	<ul style="list-style-type: none"> — Site preparation and depth of sowing seed. — Fencing of areas undergoing revegetation to exclude grazing livestock. — Correct spacing for species when planting seedlings to avoid excessive shading (Rawlings et al. 2010). — Supplementary seeding or planting. — Preferential use of local endemic (adapted) species (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe procedures for seed collection, management and storage. — Describe how livestock will be excluded from areas undergoing active restoration (i.e. planting or seeding). — Provide application rates for seeds as well as planting densities for tube stock to avoid excessive shading. — Favour natural regeneration in habitat restoration and habitat management over seeding or planting in the first instance followed by seeding or planting if required. — Provide for the preferential use of local endemic (adapted) species.
	9b. Poor seed germination	All areas	<ul style="list-style-type: none"> — Supplementary seeding or planting. — Preferential use of local endemic (adapted) species (Rawlings et al. 2010). — Seed scarification for acacia or heat treatment. 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Favour natural regeneration in habitat restoration and habitat management zones over seeding or planting in the first instance followed by seeding or planting if required. — The OMP will provide for the preferential use of local endemic (adapted) species.
	9c. Dense overstorey and midstorey revegetation (e.g. White Cypress Pine) – sometimes regeneration is too successful and trees may compete with each other for light, water and nutrients (Rawlings et al. 2010; DECCW, 2010)	All areas	<ul style="list-style-type: none"> — Assess whether ecological thinning is necessary (Rawlings et al. 2010). — Thinning with fire or manually (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Include provision to assess vegetation density and undertake ecological thinning (e.g. through selective clearance or fire) if necessary.
	9d. Dense grass cover	All areas	<ul style="list-style-type: none"> — Consider causing disturbance (e.g. through fire or grazing) (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide measures to improve understorey diversity (e.g. replanting, causing disturbance).
	9e. Disease (e.g. <i>Phytophthora cinnamomi</i>) (DECCW, 2010)	All areas	<ul style="list-style-type: none"> — Hygiene protocols to minimise the risk of plant diseases (Rawlings et al. 2010). 	<p>The OMP will:</p> <p>Include hygiene protocols to minimise the risk of plant diseases (i.e. restricting site access).</p>
	9f. Fungi or pathogens – may cause germination failure (seeds) (Rawlings et al. 2010).	All areas	<ul style="list-style-type: none"> — Preferential use of local endemic (adapted) species (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide for the preferential use of local endemic (adapted) species.
10. Fauna habitat	10a. Lack of bush rocks (Michael et al. 2011)	All areas	<ul style="list-style-type: none"> — Maximise salvage and reuse of bush rocks (Condition 13(d) EPBC Act Approval). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe procedures for the reuse of bush rocks salvaged during vegetation clearing activities consistent with Condition 36] Schedule 3 of Project CoA).
	10b. Lack of fallen timber/hollow logs (DECCW, 2010)	All areas	<ul style="list-style-type: none"> — Maximise salvage and reuse of woody debris/ hollow logs (Condition 13(d) EPBC Act Approval). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe procedures for the reuse of woody debris/ hollow logs salvaged during vegetation clearing activities (consistent with Condition 13(d) EPBC Act Approval).

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
	10c. Lack of structural diversity (Manning et al. 2011; Michael et al. 2011; Freudenberger et al. 2004)	All areas	<ul style="list-style-type: none"> — Planting of scattered low shrubs, mid-sized shrubs and tall trees (Freudenberger et al. 2004). — Maximise salvage and reuse timber/hollow logs (Condition 13(d) EPBC Act Approval). — Increase woodland patch size within biodiversity offset areas (Prober et al. 2002). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitat. — Describe procedures to reuse of bush rocks salvaged during vegetation clearance (consistent with Condition 13(d) EPBC Act Approval). — Describe procedures to reuse of timber/hollow logs salvaged during vegetation clearance (consistent with Condition 13(d) EPBC Act Approval). — Focus on increasing woodland patch size within biodiversity offset areas and aim to enhance ecological connectivity.
11. Surrounding land uses	11a. Agriculture -pesticides and herbicides	Offset Areas	<ul style="list-style-type: none"> — Increase woodland patch size within the offset area (Rawlings et al. 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Focus on increasing woodland patch size within biodiversity offset areas and aim to enhance ecological connectivity.
	11b. Agriculture -exotic species (including incursions of stock and feral animals)	Offset Areas	<ul style="list-style-type: none"> — Increase woodland patch size within the offset area (Rawlings et al. 2010). — Fencing and signage. 	
	11c. Agriculture -increased runoff	Offset Areas	<ul style="list-style-type: none"> — Increase woodland patch size within the offset area (Rawlings et al. 2010). 	
	11d. Agriculture -nutrient enrichment	Offset Areas	<ul style="list-style-type: none"> — Increase woodland patch size within the offset area (Rawlings et al. 2010). 	
12. Weather	12a. Drought	Biodiversity offset areas – re-establishment of Box Gum Woodland within corridor enhancement and habitat restoration zones	<ul style="list-style-type: none"> — Monitoring for signs of water stress (dieback). — Limit grazing livestock during drought periods (DECCW, 2011). — Irrigation. — Mulch. 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe how the growth and survival of the vegetation sown or planted will be monitored. — Discuss an adaptive management framework and monitoring program for the management of the Box Gum Woodland EEC. — Provide a mechanism to reduce livestock grazing during drought periods.
	12b. Flood/major rainfall	All areas	<ul style="list-style-type: none"> — Refer to 1d. Erosion and sedimentation. 	
	12c. Wind	All areas	<ul style="list-style-type: none"> — Only use healthy seedlings (Rawlings <i>et al.</i> 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Provide for establishing vegetation cover as soon as practicable following disturbance to minimise the potential for erosion and weeds, using species that are not likely to impede revegetation of the Box Gum Woodland.
	12d. Climate change (DECCW, 2010)	All areas	<ul style="list-style-type: none"> — Restoration of Box Gum Woodland (DECCW, 2010). — Use of genetically diverse collections of seed sourced from large and healthy populations. — Increase woodland patch size within biodiversity offset areas (to provide links for movement of plant propagules and fauna). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Focus on increasing woodland patch size within biodiversity offset areas and aim to enhance ecological connectivity. — Provide for the preferential use of local endemic (adapted) species.
13. Management	13a. Unclear objectives	All areas	<ul style="list-style-type: none"> — Define objectives (Eddy, 2002; Rawlings <i>et al.</i> 2010). — Management for patchiness (diversity) (Rawlings <i>et al.</i> 2010). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Define the objectives for the Box Gum Woodland. — Discuss an adaptive management framework and monitoring program for the management of the Box Gum Woodland.
	13b. Lack of maintenance	All areas	<ul style="list-style-type: none"> — Adaptive management (Rawlings <i>et al.</i> 2010; Tongway and Ludwig, 2011). 	

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
	13c Poor monitoring design (measurement of success)	All areas	<ul style="list-style-type: none"> — Monitor to determine effectiveness (Eddy, 2002; DECCW, 2010). — Monitoring closely linked to objectives. — Use of photo-points to monitor changes over time (Eddy, 2002). 	
	13d. Unqualified personnel	All areas	<ul style="list-style-type: none"> — Engage suitability qualified personnel 	The OMP will: <ul style="list-style-type: none"> — Describe roles for suitability qualified personnel.

Table D2.2 Proposed actions relating to factors likely to impede and enhance the provision of habitat for threatened species of fauna

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
<p>1. Adequate availability of prey species</p> <p>The restoration of native vegetation communities in the biodiversity offset areas and rehabilitation of the post mine landform, together with the salvage and re-use of woody debris and hollows, will over time provide a range of suitable habitats for invertebrates and vertebrates that provide a potential source of food for various threatened fauna species.</p>	<p>1a. Lack of invertebrates as a food source (Painted Honeyeater, Corben's Long-eared Bat) (OEH, 2015)</p>	<p>Primarily relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Maximise salvage and reuse of woody debris and hollow logs from the mine vegetation clearing activities to encourage invertebrate habitation that provide a potential food source (Condition 13(d) EPBC Act Approval). — Mulching to encourage invertebrates that provide a potential food source. 	<ul style="list-style-type: none"> — The OMP will describe procedures to reuse woody debris and hollow logs salvaged during vegetation clearing (consistent with Condition 13(d) EPBC Act Approval).
	<p>1b. Lack of reptiles as a food source (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Maximise salvage and reuse of bush rocks from the mine vegetation clearing activities to encourage reptile habitation that provide a potential food source (Condition 13(d) EPBC Act Approval). — Maximise salvage and reuse of woody debris and hollow logs from the mine vegetation clearing activities to encourage reptiles that provide a potential food source (Condition 13(d) EPBC Act Approval). 	<ul style="list-style-type: none"> — The OMP will describe procedures to reuse bush rocks, woody debris and hollow logs salvaged during vegetation clearing activities (consistent with Condition 13(d) EPBC Act Approval).
	<p>1c. Lack of birds as a food source (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Plant scattered low shrubs, mid-sized shrubs and tall trees to encourage birds that provide a potential food source. — Provision of large areas of suitable woodland within biodiversity offset areas and mine rehabilitation areas to encourage birds that provide a potential food source (Prober et al. 2002). 	<ul style="list-style-type: none"> — The OMP will describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create a structurally diverse habitat.
	<p>1d. Lack of small mammals as a food source (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Maximise salvage and reuse of woody debris and hollow logs from the mine vegetation clearing activities to encourage small mammals that provide a potential food source (Condition 13(d) EPBC Act Approval). — Placement of nest boxes and/or hollow limbs (in young trees without hollows) from the mine vegetation clearing activities to encourage small mammals that would provide a potential food source for predators. 	<ul style="list-style-type: none"> — The OMP will describe procedures to reuse woody debris and hollow logs salvaged during vegetation clearing and/or suitable nest boxes (consistent with Condition 13(d) EPBC Act Approval), including placement of hollow limbs and some select trees without hollows and/or appropriate nest boxes.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
<p>2. Nesting habitat (mainly birds)</p> <p>The restoration of native vegetation communities in the biodiversity offset areas and rehabilitation of the post mine landform will over time provide suitable vegetation in which some threatened fauna species may nest. Additionally, salvage and re-use of logs and hollows could facilitate other threatened fauna species to nest in the short-term.</p>	<p>2a. Lack of suitable vegetation (Regent Honeyeater) (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — As part of a diverse seed mix/tube stock planting list plant: <ul style="list-style-type: none"> — Tall tree species. — Low, dense species (Speckled Warbler). — Eucalypts (Regent Honeyeater, Painted Honeyeater). — Native, tussocky grasses (woodland birds). — <i>Allocasuarina/Casuarina</i> species (Regent Honeyeater, Painted Honeyeater). — <i>Acacia</i> species (Painted Honeyeater). 	<p>The OMP will:</p> <ul style="list-style-type: none"> — Describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitats. — Include the planting (in appropriate soil landscapes) of a variety of eucalypt species. — Include the planting of a variety of native grasses including tussock grass species. — Include the planting of <i>Allocasuarina</i> and <i>Casuarina</i> species. — Include the planting of <i>Acacia</i> species, including both tree and shrub varieties.
	<p>2b. Lack of hollows (Corben’s Long-eared Bat) (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Maximise salvage and reuse of woody debris/hollow logs from the mine vegetation clearing activities (Condition 13(d) EPBC Act Approval), including placement of nest boxes and/or hollow limbs in select trees without hollows. 	<ul style="list-style-type: none"> — The OMP will describe procedures to reuse woody debris and hollow logs salvaged during vegetation clearance (consistent with Condition 13(d) EPBC Act Approval), including placement of hollow limbs or artificial hollows in some select trees without hollows.
	<p>2c. Lack of fallen timber (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Maximise salvage and reuse of fallen timber/hollow logs from the mine vegetation clearance activities (Condition 13(d) EPBC Act Approval). 	<ul style="list-style-type: none"> — The OMP will describe procedures to reuse fallen timber/hollow logs salvaged during vegetation clearance (consistent with Condition 13(d) EPBC Act Approval).
	<p>2d. Lack of suitable vegetation along/near watercourses (OEH, 2015)</p>	<p>Predominantly relevant to watercourses in the biodiversity offset areas.</p>	<ul style="list-style-type: none"> — As part of a diverse seed mix/tube stock planting list, plant trees (particularly eucalypts) along water courses (Koala). 	<ul style="list-style-type: none"> — The OMP will include the planting of eucalypt species along water courses where applicable within the rehabilitation area.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
<p>3. Foraging and roosting habitat</p> <p>The restoration of native vegetation communities in biodiversity offset areas and rehabilitation of the post mine landform will over time provide suitable vegetation in which some threatened fauna species may forage and roost.</p>	<p>3a. Lack of suitable tree species (Superb Parrot, Regent Honeyeater, Painted Honeyeater, Koala, Corben's Long-eared Bat, Large-eared Pied Bat) (Marchant & Higgins, 1993; Garnett & Crowley 2000; Higgins, 1999; Barea, 2008; Churchill, 2008; Department of Environment and Climate Change, 2008a; OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> ▪ Plant eucalypts (Superb Parrot, Painted Honeyeater, Koala, Corben's Long-eared Bat), in particular: <ul style="list-style-type: none"> — box, ironbark and gum species (Painted Honeyeater); — White Box (<i>Eucalyptus albens</i>) (Swift Parrot, Superb Parrot, Regent Honeyeater, Painted Honeyeater, Large-eared Pied Bat); — Yellow Box (<i>E. melliodora</i>) (Superb Parrot, Regent Honeyeater, Painted Honeyeater, Large-eared Pied Bat); — Rough-barked Apple (<i>Angophora floribunda</i>) — Blakely's Red Gum (<i>E. blakelyi</i>) (Superb Parrot, Regent Honeyeater, Painted Honeyeater, Large-eared Pied Bat); — River Red Gum (<i>E. camaldulensis</i>) (Superb Parrot, Corben's Long-eared Bat); — Western Grey Box (<i>E. microcarpa</i>) (Superb Parrot); — Smooth-barked gum species; — Rough-barked species. — Plant <i>Acacia</i> tree species (Painted Honeyeater) — Plant <i>Allocasurina/ Casurina</i> species (Regent Honeyeater, Painted Honeyeater) 	<p>The OMP will:</p> <ul style="list-style-type: none"> — include the planting (in appropriate soil landscapes) of a variety of box, ironbark and gum eucalypt species which are all known to occur in the Leard State Forest and biodiversity offset areas, and may include: <ul style="list-style-type: none"> — White Box (<i>Eucalyptus albens</i>); — Yellow Box (<i>E. melliodora</i>); — Rough-barked Apple (<i>Angophora floribunda</i>); — Blakely's Red Gum (<i>E. blakelyi</i>) — Dwyer's Red Gum (<i>E. dwyeri</i>) — River Red Gum (<i>E. camaldulensis</i>); — Western Grey Box (<i>E. microcarpa</i>) — Include the planting of <i>Acacia</i> species, including both tree and shrub varieties including tree varieties. — Include the planting of <i>Allocasuarina / Casuarina</i> species — Include the planting of <i>Melaleuca</i> species — Describe that seed and tube stock used in revegetation will include a variety of grasses, low shrubs, mid-sized shrubs and tall trees to create structurally diverse habitat.
	<p>3b. Lack of suitable ground cover (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Plant native grasses. — Plant native herbs — Plant native forbs — Correct spacing for species when planting seedlings. 	<ul style="list-style-type: none"> — The OMP will include the planting of a variety of native grasses, herbs and forbs. — The OMP will provide application rates for seeds as well as planting densities for tube stock.
	<p>3c. Dense shrub layer (OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Correct spacing for species when planting seedlings. 	<ul style="list-style-type: none"> — The OMP will provide application rates for seeds as well as planting densities for tube stock.
	<p>3d. Poor floristic diversity (Koala) (Department of Environment and Climate Change, 2008a; OEH, 2015)</p>	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> — re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> — Control for floristic diversity by means of planting a high number of both eucalypt and non-eucalypt species. 	<ul style="list-style-type: none"> — The OMP will aim to include a wide diversity of species in the seed mix.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
<p>4. Remnant Area and Ecological Connectivity</p> <p>The restoration of native vegetation communities in the biodiversity offset areas and rehabilitation of the post mine landform will over time increase the size of the existing vegetation patches.</p>	4a. Small patch area size (OEH, 2015)	<p>Predominantly relevant to:</p> <ul style="list-style-type: none"> re-establishment of habitat in habitat restoration and corridor enhancement zones in biodiversity offset properties 	<ul style="list-style-type: none"> Increase woodland patch area within biodiversity offset areas. Increase woodland patch area in mine rehabilitation area. 	<ul style="list-style-type: none"> The OMP will focus on increasing woodland patch size within the offset area and aim to enhance ecological connectivity.
<p>5. Structural Diversity</p> <p>The restoration of native vegetation communities in the biodiversity offset areas and rehabilitation of the post mine landform, together with the salvage and re-use of woody debris, hollows and bush rock, will over time provide a range of suitable habitats for threatened fauna species.</p>	5a. Lack of dead stumps or fallen timber (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Maximise salvage and reuse of woody debris and hollow logs from the mine vegetation clearing activities (Condition 36 Schedule 3 of Project CoA). Restriction on firewood collection (OEH, 2015). Place nest boxes and/ or hollow limbs in young eucalypt trees without hollows in particular. 	<ul style="list-style-type: none"> The OMP will not permit firewood collection. The OMP will describe procedures to reuse woody debris/ hollow logs salvaged during vegetation clearing activities (consistent with Condition 36 Schedule 3 of Project CoA), including placement of hollow limbs or artificial hollows in some select trees without hollows.
	5b. Lack of tree hollows (Superb Parrot, Corben's Long-eared Bat) (OEH, 2015)	Relevant to biodiversity offset areas.		
<p>6. Feral Animals</p> <p>The BMP will describe procedures to monitor, prevent and control feral animals in the restoration and rehabilitation phase of the project.</p>	6a. Predation by feral animals including foxes, cats and dogs (Koala) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Undertake feral predator control. 	<ul style="list-style-type: none"> The OMP will describe procedures to prevent, monitor and control feral animals including foxes, cats and dogs
	6b. Disturbance to roosting sites by feral goats and pigs (Large-eared Pied Bat) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Monitoring and control feral pigs and goats (Eddy, 2002; Rawlings et al. 2010). 	<ul style="list-style-type: none"> As above.
<p>7. Weeds</p> <p>The RMP and BMP will describe procedures to prevent, monitor and control weeds. They will also describe relevant targets and performance indicators for weed management.</p>	7a. Invasion of weeds, resulting in loss of important food plants (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Weed control (Condition 49 Schedule 3 of Project CoA). 	<ul style="list-style-type: none"> The OMP will detail a weed management strategy, including relevant targets and performance indicators for weed management (Condition 49 Schedule 3 of Project CoA).
	7b. Loss of food sources or indirect poisoning as a result of use of pesticides, insecticides or herbicides (Corben's Long-eared Bat, Large-eared Pied Bat) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Limit use of pesticides used in suitable native habitat (OEH, 2015). Use herbicides sparingly (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods) (DSE, 2005; Rawlings et al. 2010; DECCW, 2010). 	<ul style="list-style-type: none"> The OMP will detail methods for the safe use pesticides and herbicides (minimised through spot-spraying, basal spraying, stem injection or cut and paint application methods).
<p>8. Regeneration</p> <p>The restoration of native vegetation communities in the biodiversity offset areas and rehabilitation of the post mine landform, together with the salvage and re-use of woody debris, hollow logs and bush rock, will over time provide a range of suitable habitats for threatened fauna species.</p>	8a. Poor regeneration of habitat (Swift Parrot, Koala) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> Encourage regeneration by fencing (OEH, 2015). Undertake new plantings (OEH, 2015), Reduce intensity of grazing (OEH, 2015). 	<ul style="list-style-type: none"> Encouraging regeneration of native fauna habitat is an aim of the OMP through measures such as fencing, planting and grazing management.

BROAD FACTOR	FACTORS LIKELY TO IMPEDE	RELEVANT OBJECTIVE	FACTORS LIKELY TO ENHANCE	ACTIONS
9. Management	9a. Too frequent grazing management (Regent Honeyeater, Painted Honeyeater, Large-eared Pied Bat) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> — Fencing of areas undergoing revegetation to exclude grazing livestock and prevent grazing of seedlings (Eddy, 2002). — Maintenance of fencing used to exclude livestock. — Restriction of livestock access to maintain ground cover. — Low stocking rates. 	<ul style="list-style-type: none"> — The OMP will describe how livestock will be excluded from areas undergoing active revegetation (i.e. planting or seeding). — The OMP will describe management of livestock to maintain ground cover and diversity of native plants.
	9b. Too frequent burning management (Koala, Large-eared Pied Bat) (OEH, 2015)	Relevant to biodiversity offset areas.	<ul style="list-style-type: none"> — No controlled burns whilst vegetation is establishing. — Assess fuel loads. — DECCW (2010) suggests fire frequency should be a minimum interval of 5 years and a maximum interval of 40 years. Rawlings et al. (2010) recommends fire frequency in patches should be every 4 to 8 years. — Controlled burns should be undertaken in a mosaic (i.e. retain some unburned areas (DECCW, 2010). 	<ul style="list-style-type: none"> — The OMP will prescribe bushfire management strategies for biodiversity offset areas.

3 PROVISION OF FAUNA HABITATS IN THE BOAS

Table D3.1 outlines the potential habitat quality available in restoration zones and each targeted Matter of National Environmental Significance. Table D3.2 describes predicted threatened species uptake in each BOA based on restoration age.

Table D3.1 Habitat quality for threatened species in habitat restoration and corridor enhancement zones

GENERAL MNES HABITAT FEATURES	RESTORATION AGE				
	5 YEARS	10 YEARS	15 YEARS	20 YEARS	30+ YEARS
Vegetation characteristics					
Canopy Height ¹	4.5 meters	9 meters	13.5 meters	18 meters	>20 meters
Canopy cover ²	10%	20%	30%	30%	30%
Understorey cover	22%	30%	30%	30%	30%
Blossom value ³	Low	Moderate	High	High	High
Mistletoe presence	Absent	Absent	Present	Present	Present
Nest Box provision	0%	50%	50%	100%	100%
Ground timber provision ⁴	0%	50%	50%	100%	100%
Habitat take-up by prey species	30%	50%	75%	100%	100%
Threatened species					
Corben's Long-eared Bat	Foraging opportunities present.	Trunks of planted trees now of sufficient size to maintain nest boxes may be taken up.	Habitat usage established as canopy trees reach sufficient size. Nest box provision offering breeding opportunities	Habitat usage established as canopy trees reach sufficient size. Nest box provision offering breeding opportunities	Foraging and breeding habitat opportunities present
Painted Honeyeater	Limited usage of habitat due to limitations on mistletoe take-up	Seasonal usage occurring due to mistletoes take up on suitable acacia species	Stabilised seasonal habitat usage In line with occurrences in locality with breeding territories established.	Stabilised seasonal habitat usage In line with occurrences in locality with breeding territories established.	Stabilised seasonal habitat usage in line with occurrences in locality with breeding territories established.

GENERAL MNES HABITAT FEATURES	RESTORATION AGE				
	5 YEARS	10 YEARS	15 YEARS	20 YEARS	30+ YEARS
Swift Parrot	Limited habitat opportunities due to limitations on canopy values	Increased habitat opportunities due to increases on canopy values	Foraging opportunities present for seasonal use	Foraging opportunities present for seasonal use	Foraging opportunities present for seasonal use
Superb Parrot	Limited usage of habitat due to limitations on canopy values	Habitat usage increasing as canopy trees increase in size	Habitat usage established as canopy trees reach sufficient size	Habitat usage opportunities	Stabilised habitat usage during seasonal occurrences in locality
Regent Honeyeater	Limited habitat opportunities due to limitations on canopy values	Increased habitat opportunities due to increases on canopy values	Foraging and breeding habitat opportunities present for seasonal use	Foraging and breeding habitat opportunities present for seasonal use	Foraging and breeding habitat opportunities present for seasonal use
Spotted-tailed Quoll	Limited usage of habitat due to limitations on canopy values	Foraging habitat opportunities present	Foraging habitat opportunities present	Foraging habitat opportunities present	Foraging habitat opportunities present
Koala	Limited usage of habitat due to limitations on canopy values	Increased habitat opportunities due to increases on canopy values. Trunks of planted trees now of sufficient size to maintain foraging habitats.	Foraging habitat opportunities present	Foraging habitat opportunities present	Foraging habitat opportunities present

- 1) Estimated height of canopy species
- 2) Estimated canopy cover percentage based on BioBanking method for percentage foliage cover directly overhead
- 3) Blossom value ranking is indicative of the quality of a flowering event to local and nomadic nectarivorous species (i.e. honeyeaters)
- 4) Ground timber provision is calculated as the percentage installation based on hectare amount per relevant fauna habitat type.

Table D3.2 Threatened MNES species predicted in habitat restoration and corridor enhancement zones for each Biodiversity Offsets Area

BOAS	VEGETATION DESCRIPTION	RESTORATION AGE ¹				
		5 YEARS	10 YEARS	15 YEARS	20 YEARS	30+ YEARS
Merriendi, Namoi, Wirrilah and Goonbri	White Box – White Cypress Pine grassy woodland (low condition)	Corben’s Long-eared Bat (foraging only)	Corben’s Long-eared Bat, Painted Honeyeater, Regent Honeyeater, Superb Parrot, Spotted-tailed Quoll and Koala (foraging only)	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Swift Parrot, Spotted-tailed Quoll, Koala and Superb Parrot (foraging only), Painted Honeyeater and Regent Honeyeater	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Swift Parrot, Spotted-tailed Quoll, Superb Parrot and Koala (foraging only), Painted Honeyeater, Regent Honeyeater	Corben’s Long-eared Bat, Painted Honeyeater, Swift Parrot, Regent Honeyeater, Superb Parrot, Spotted-tailed Quoll, Koala
Merriendi	Belah alluvial woodlands (low condition)		Corben’s Long-eared Bat, Painted Honeyeater and Spotted Quoll (foraging only)	Corben’s Long-eared Bat (foraging habitat only), Painted Honeyeater, Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat (foraging habitat only), Painted Honeyeater, Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat, Painted Honeyeater, Spotted-tailed Quoll
Merriendi, Namoi	Pilliga Box – Poplar Box – White Cypress Pine grassy open forest (low condition)		Corben’s Long-eared Bat, Koala, Painted Honeyeater, Regent Honeyeater, Superb Parrot and Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Swift Parrot, Koala, Superb Parrot and Spotted-tailed Quoll (foraging only), Painted Honeyeater, Regent Honeyeater	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Swift Parrot, Spotted-tailed Quoll, Superb Parrot and Koala (foraging only), Painted Honeyeater, Regent Honeyeater	Corben’s Long-eared Bat, Painted Honeyeater, Swift Parrot, Regent Honeyeater, Superb Parrot, Spotted-tailed Quoll, Koala
Namoi, Myall Plains	White Pine/Narrow-leaved Ironbark shrub/grass open forest (low condition)		Corben’s Long-eared Bat, Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat (foraging and breeding habitat if nest boxes present), Spotted-tailed Quoll (foraging only)	Corben’s Long-eared Bat, Spotted-tailed Quoll

BOAS	VEGETATION DESCRIPTION	RESTORATION AGE ¹				
		5 YEARS	10 YEARS	15 YEARS	20 YEARS	30+ YEARS
Namoi	River Red Gum riparian woodland and forest (low condition)		Corben's Long-eared Bat and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present) and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present) and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat, Spotted-tailed Quoll
Myall Plains, Mallee, Wirrilah and Goonbri	White Box – Narrow-leaved Ironbark – White Cypress Pine shrubby open forest (low condition)		Corben's Long-eared Bat and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present) and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present) and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat, Spotted-tailed Quoll
Nioka, Sunshine and Braefield	White Box grassy woodland (low condition)		Corben's Long-eared Bat, Koala, Painted Honeyeater, Superb Parrot, Regent Honeyeater, Superb Parrot and Spotted-tailed Quoll (foraging only)	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present), Painted Honeyeater, Koala, Swift Parrot, Superb Parrot, Spotted-tailed Quoll (foraging only), Regent Honeyeater	Corben's Long-eared Bat (foraging and breeding habitat if nest boxes present), Painted Honeyeater, Koala, Swift Parrot, Spotted-tailed Quoll, Superb Parrot, Regent Honeyeater	Corben's Long-eared Bat, Painted Honeyeater, Swift Parrot, Regent Honeyeater, Superb Parrot, Spotted-tailed Quoll, Koala

1) Threatened species predicted based on habitat attributes estimated for each restoration age in Table D3.1.

4 GENERIC ACTIONS FOR LONG-TERM MAINTENANCE OF SUITABLE HABITAT FOR THREATENED BIODIVERSITY

Most threatened biodiversity values recorded or predicted to occur in the locality of the Project are generally affected by similar threatening processes, including the clearing of woodland resulting in the fragmentation of habitat, modification and destruction of terrestrial microhabitats (i.e. removal of litter and fallen timber) (Department of Environment and Conservation 2006; Reid 1999; Trail & Duncan 2000).

In order for the protection and long-term maintenance of suitable habitat for threatened species and ecological communities, the following briefly describes the relevant steps necessary to ensure their longevity in the locality:

- purchase strategic biodiversity offsets to enable protection, rehabilitation and long-term maintenance of the East-West Wildlife Corridor
- maintain a 500 m corridor between Boggabri Coal and Maules Creek Coal Mine to facilitate adequate corridor (buffer zone) and movement of species between the mines and also along the East-West Wildlife Corridor
- provide protection to areas of existing high quality vegetation (habitat management zones)
- rehabilitate areas of derived native grassland and agricultural land to supplement habitat management areas and form an integral part of providing an adequate East-West Wildlife Corridor
- complement rehabilitation activities with supplementary fauna microhabitats, including fallen timber and nest boxes
- monitor each BOA as part of the annual Biodiversity Monitoring Program (refer to the main BMP document).

The following sections describe how suitable habitat will be protected and restored within each of the offset management zones. The extent of each zone within the BOAs is provided in Table D4.1.

Table D4.1 Extent of offset management zones in each BOA

BOA	MANAGEMENT ZONES (HA)			
	HABITAT MANAGEMENT	HABITAT RESTORATION	CORRIDOR ENHANCEMENT	OTHER LANDS FOR AGRICULTURAL
Mallee	2,025.9	40.3	0.0	0.0
Merriendi	327.0	156.2	0.0	0.0
Myall Plains	367.4	62.0	43.9	0.0
Namoi 1	1,563.4	1,391.4	30.3	229.8
Wirrilah	326.8	371.8	185.6	0.0
Sunshine	353.2	300.1	84.7	0.0
Nioka North	523.1	316.6	17.9	0.0
Goonbri	127.6	88.3	15.1	0.0
Jerralong	222.4	300.8	0.0	46.9
Braefield	1,283.2	117.1	0.4	0.0
Total	7,120.0	3,144.6	377.9	276.7

- 1) The Namoi BOA contains land purchased as a joint venture between Boggabri Coal and the Maules Creek Coal Mine. Boggabri Coal owns 50% of land purchased under the joint venture agreement.

4.1 HABITAT MANAGEMENT ZONE

The habitat management zone is associated with remnant native woodland vegetation in good condition, with limited disturbances and exotic species present. This zone requires some active pest and weed management activities, fencing of areas adjoining lands not managed for biodiversity conservation and the exclusion of livestock grazing. These areas are generally considered to not require any assisted revegetation and provide existing high quality fauna habitats.

Specific management actions within each BOA are provided in the BOA Management Plans (refer to main BMP document).

4.2 HABITAT RESTORATION ZONE

The habitat restoration zone incorporates those areas of good condition native grassland communities with only moderate exotic species present and an existing soil seed bank with the potential for natural revegetation. Management activities within this zone involve fencing, targeted pest and weed management and supplementary canopy planting to facilitate enhanced revegetation of the canopy layer. This zone will also incorporate the provision of supplementary habitat features to further encourage use by local fauna species.

4.3 CORRIDOR ENHANCEMENT ZONE

The corridor enhancement zone incorporates those areas of non-native grasslands that have been significantly disturbed by past land use practices, including clearing, cropping, pasture improvement and heavy grazing. This zone incorporates supplementary canopy planting and some targeted weed and pest management activities to increase woody canopy cover and build on adjoining existing wildlife corridors. This zone is likely to further encourage the use of the proposed wildlife corridors by semi mobile fauna species in the medium to long-term.

5 IMPLEMENTATION PLAN FOR BOX GUM WOODLAND

White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland is listed as a Critically Endangered ecological community under the EPBC Act. White Box Yellow Box Blakely’s Red Gum Woodland is listed as an endangered ecological community under the BC Act.

Several vegetation communities that occur within the Project boundary have been identified as being commensurate with both the federal and state listing of Box Gum Woodlands have/will be directly affected by the Project. These include the following:

- Yellow Box –Blakely’s Red Gum grassy woodland
- White Box – White Cypress Pine grassy woodland
- White Box – Narrow-leaved Ironbark – White Cypress Pine grassy open forest.

This ecological community occurs along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria (Threatened Species Scientific Committee 2006). It is generally found on moderate to highly fertile soils on tablelands and the western slopes of NSW (NSW Scientific Committee 2002). The canopy layer is dominated by one or more of *Eucalyptus albens* (White Box) *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely’s Red Gum). Vegetation communities where the canopy layer of the aforementioned eucalypts has been removed and the grassy native understorey is present are also considered to be included as the threatened community in both the federal and state listings. Therefore, the structure of this community can be variable from grassy woodland to derived grasslands and the structure will often reflect past land use practices.

In western NSW, the community intergrades with *Eucalyptus microcarpa* (Western Grey Box) or *Eucalyptus moluccana* (Grey Box) without the three aforementioned canopy trees present. The federal listing includes these vegetation assemblages as part of the Critically Endangered Community, where they occur within the Nandewar Bioregion only. The dominant understorey species of herbs and grasses vary across the range of the community due to latitudinal and climatic conditions. However, *Themeda australis* (Kangaroo Grass) and *Poa sieberiana* (Snow Grass) were originally dominant across a large part of the community’s range, however these species are sensitive to grazing pressure and have declined in recent years (Cole & Lunt 2005).

5.1 DISTRIBUTION OF BOX GUM WOODLANDS

Box Gum Woodlands have been mapped as occupying an area of approximately 3,214 ha within the Leard State Forest (James B. Croft and Associates 1983) and approximately 633 ha of this ecological community will be cleared for the Project. Box Gum Woodlands are widespread on the fertile flats in the Project Boundary and BOAs (refer **Error! Reference source not found.**).

5.2 THREATS

The main threats that affect Box Gum Woodlands in the Project Boundary and BOAs include:

- clearing, degradation and fragmentation of remnants for agricultural, forestry, infrastructure and residential development
- continuous heavy grazing and trampling of remnants by grazing stock, resulting in losses of plant species (simplification of the understorey and ground layer and suppression of overstorey), soil compaction, erosion and other soil changes (including increased/decreased nutrient status)
- invasion of remnants by non-native plant species, including noxious weeds, pasture species and environmental weeds, including garden escapes, olives and pines
- invasion of remnants by feral animals resulting in the loss or modification of habitat

- disturbance and clearance of remnants during agricultural, road, rail and infrastructure maintenance and upgrades
- harvesting of firewood (either living or standing dead, including material on the ground) and bush rock
- collection of on-ground woody debris in the guise of a 'clean-up'
- instability and poor drainage of the final landform
- poor soil quality – insufficient soil depth, poor water holding capacity, insufficient topsoil depth, lack of soil mycorrhizae
- insufficient seed bank in soil.

5.3 RECOVERY ACTIONS

The following recovery actions have been identified by the DPI&E for Box Gum Woodland EEC across NSW:

- identification of key sites for protection and management
- prepare management plans for top priority sites
- target priority weeds for control
- delineate and protect areas with fencing or signage
- determine optimal management techniques for restoring degraded remnants
- research and utilise techniques where agricultural practices are integrated successfully with conservation
- identify methods for controlling particular introduced species identified as significantly threatening
- develop guidelines for identification and assessment of remnant quality
- collate survey and mapping information and use towards production of integrated and updatable maps
- control Coolatai grass in high-quality remnants of Box Gum Grassy Woodland
- monitor effects of Coolatai Grass invasion in high-quality remnants of Box Gum Grassy Woodland.

5.4 MAINTENANCE OF BOX GUM WOODLANDS

A key element of the monitoring within the BOAs is to determine the condition of White Box Woodland remnants in accordance with the State and Transition model for box gum grassy woodlands. The State and Transition model is a way to think about the condition of woodland, how it got to be that way, and what changes are possible with management actions. The baseline survey will be used to delineate the vegetation within the BOAs into States as follows:

- State 1: Grassy woodland
- State 2: Native pastures and woodland
- State 3: Fertilised pastures
- State 4: Crops and sown pastures
- State 5: Revegetated areas.

Using the State and Transition model during the monitoring of the BOAs, any transition from a state can be detected and hence the effectiveness of management actions can be gauged. Each habitat management zone below is allocated to a state according to the state and transition model for box gum woodlands.

5.4.1 HABITAT MANAGEMENT ZONE

BOAs currently provide approximately 3,487.6 ha of management zones containing Box Gum Woodlands (Table D5.1). Of this, 1,527.9 ha are of high quality State 1 Box Gum Woodland. Box Gum Woodland across the BOAs is illustrated in Figure D.1.

5.4.2 HABITAT RESTORATION ZONE

In the medium to long-term it is estimated that an additional 1,959.7 ha of habitat restoration will supplement the 1,527.9 ha of existing Box Gum Woodland within habitat management zones and effectively contribute to the viability of a local and regional wildlife corridor and maintenance of Box Gum Woodlands in the locality.

In the short-term, early shrub and tree growth, supplemented with fallen timber will likely provide sufficient habitat complexity to afford safe foraging opportunities for a range of species. Over the longer term, structural complexity of mature woodland will provide a full range of foraging and breeding opportunities for fauna.

5.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF BOX GUM WOODLAND

The main threats affecting Box Gum Woodlands involve direct loss. Therefore, the most important management measure in the short-term is the protection of existing habitat management zones in the BOAs, including the restricted access of site personnel and the general public, particularly concerning the removal of standing dead trees for fire wood. Furthermore, the staged clearing of important habitat in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction on the fauna component of the community, by potentially allowing those displaced individuals (from established breeding territories) to relocate to other habitat areas in the immediate vicinity of the Project Boundary. Management measures for Box Gum Woodland include:

- fencing
- grazing management for conservation
- weed and pest control
- fire management for conservation
- management of human access and disturbance
- retention or addition of habitat features
- nutrient management
- erosion control
- thinning
- revegetation.

5.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D5.2 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of Box Gum Woodland.

Table D5.1 Extent of Box Gum Woodland within the Habitat Management and Restoration Zones of each BOA

BOX GUM WOODLAND ¹	HABITAT IN OFFSET PROPERTIES (HA)										COMBINED TOTAL HABITAT IN OFFSET AREAS (HA)
	MERRIENDI	NAMOI	JERRALONG ²	GOONBRI	WIRRILAH	MYALL PLAINS	MALLEE	NIOKA NORTH	SUNSHINE	BRAEFIELD	
Habitat management zone (State 1 Woodland)	176.1	326.4	0	72.3	146.1	66.5	14.2	291.5	240.5	194.3	1,527.9
Habitat restoration zone (State 2: native pastures)	150.5	590.1	0	88.3	517.5	43.9	0	265.2	248.8	55.4	1,959.7
Combined total habitat	326.6	916.5	0	160.6	663.6	110.4	14.2	556.7	489.3	249.7	3,487.6

1) Box Gum Woodland State 4 (crops and sown pastures) and State 5 (revegetated areas) do not occur within the BOAs.

2) Box Gum Woodland does not occur within the Jerralong BOA.

Table D5.2 Management actions and performance criteria for Box Gum Woodland

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat	All management zones ¹	Upgrade boundary fencing of all BOAs Upgrade fencing around land designated as other lands for agriculture Incorporate appropriate signage on boundary fencing	From 2017 Fences installed by year 10 and maintained as required	Appropriate wildlife fencing installed and/or maintained around BOA boundaries, where appropriate. Appropriate locks and signage is maintained in good legible condition and designated access roads and tracks are maintained to prevent unauthorised access. Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with the grazing program, detailed in the main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs Upgrade fencing around land designated as other lands for agriculture	From 2017 Fences installed by year 10 and maintained as required	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, detailed in the main BMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Biodiversity monitoring	Habitat management and habitat restoration	Complete annual biodiversity monitoring, as detailed in main BMP document, to measure success of restoration in the long-term against baseline data and as compared with relevant BBAM 2014 benchmarks and Leard State Forest analogue sites (detailed in main BMP document) If after a rehabilitation age of 5 years canopy regeneration has not significantly taken affect (i.e. not evident or at required density), then supplementary planting would commence at a density approximate to analogue sites.	From 2015, monitoring to be undertaken on an annual basis	Annual biodiversity monitoring undertaken annually across the BOAs in accordance with the methodology detailed in the main OMP document. BOA Monitoring Report to include details of the current health and structure of all management zones across all BOAs against relevant BBAM 2014 benchmarks and analogue sites as required. Additionally, report will provide recommendations on management requirements to fulfil BOA performance and completion criteria detailed in this table. Native vegetation communities within BOAs met at least 80% of lower BBAM 2014 benchmark values for corresponding vegetation types.
Habitat use	Habitat management	Complete annual biodiversity monitoring (refer to main BMP document for biodiversity monitoring program)	From 2015, monitoring to be undertaken on an annual basis	Annual monitoring of diurnal bird and microchiropteran bat species richness and abundance completed as part of the BOA monitoring program. Habitat Management Zones show no observed significant decrease (i.e. greater than 40 % reduction sustained over three consecutive sampling periods) in bird species richness across the BOAs that cannot be attributed to natural variation against baseline monitoring site data.
Medium-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy regrowth	Habitat restoration and corridor enhancement	<p>Actively manage areas of restoration</p> <p>Complete inspections of habitat restoration zones on a five-yearly basis to determine success of naturally regenerating and planted canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>Evidence of canopy growth in Box Gum Woodland restoration zones compared to baseline assessment and milestones nominated in Table D3.1.</p> <p>At least 350 ha of Box Gum Woodland DNG across all BOAs are actively being restored back to Box Gum Woodland (refer to main BMP document) for locations and areas of Box Gum Woodland DNG to be restored).</p> <p>Naturally regenerated areas of Box Gum Woodland conform to condition assessment outlined on page five of the EPBC Policy Statement 3.5 White Box – Yellow Box – Blakely’s Red Gum Grassy Woodlands and Derived Native Grasslands within the Habitat Restoration Zones.</p> <p>100% of Box Gum Woodland BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of Box Gum Woodland BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>100% of Box Gum Woodland BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting for example <i>Eucalyptus albens</i> and/or <i>Eucalyptus melliodora</i>. Given monitoring is undertaken in accordance with BBAM 2014 sampling for natural regeneration is to occur across the entire vegetation zone.</p>
Habitat use	Habitat restoration	Complete annual biodiversity monitoring (refer main OMP document)	From 2015, to be completed annually	<p>Annual monitoring of diurnal bird and microchiropteran bat species richness and abundance completed as part of the BOA monitoring program.</p> <p>Habitat Restoration Zones and Corridor Enhancement Zones show an observed increase in bird species richness and/or abundance across the BOA, to within at least 80% of the benchmark for Leard State Forest analogue reference sites (as described in the main BMP document).</p> <p>Threatened bird species occupancy and habitat usage continues.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of artificial/supplementary habitat suitable for breeding	Habitat restoration and corridor enhancement	Incorporate nest boxes in restoration areas until natural generation of tree hollows predominate	By 10 years By 15 years	<p>Installation of nest boxes as per criteria detailed in Table D3.1:</p> <ul style="list-style-type: none"> — 50% of nest boxes will be installed from a rehabilitation age 10 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1. — Incorporate 100% of nest boxes (remaining 50%) from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1. — 80% of nest boxes installed are being utilised or show signs of use by native species within BOAs. <p>Utilisation of nest boxes by pest species such European Honey Bee, Common Myna, Common Starling and feral rodent species (<i>Rattus</i> and <i>Mus</i> spp.) should be recorded.</p> <p>Nest boxes structurally in good condition and functioning in the landscape. Where nest boxes are no longer in structurally good condition they are replaced within a year of being identified.</p>
Provision of supplementary habitat	Habitat restoration and corridor enhancement	Incorporation of ground timber in restoration areas	By 10 years By 15 years	<p>Provision of ground timber as per criteria detailed in Table D3.1:</p> <ul style="list-style-type: none"> — 50 % of ground timber to be incorporated from a rehabilitation age of 10 years, or when regenerating canopy species are commensurate within criteria detailed in Table D3.1. — 100 % of ground timber to be incorporated from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1.
Long-term				

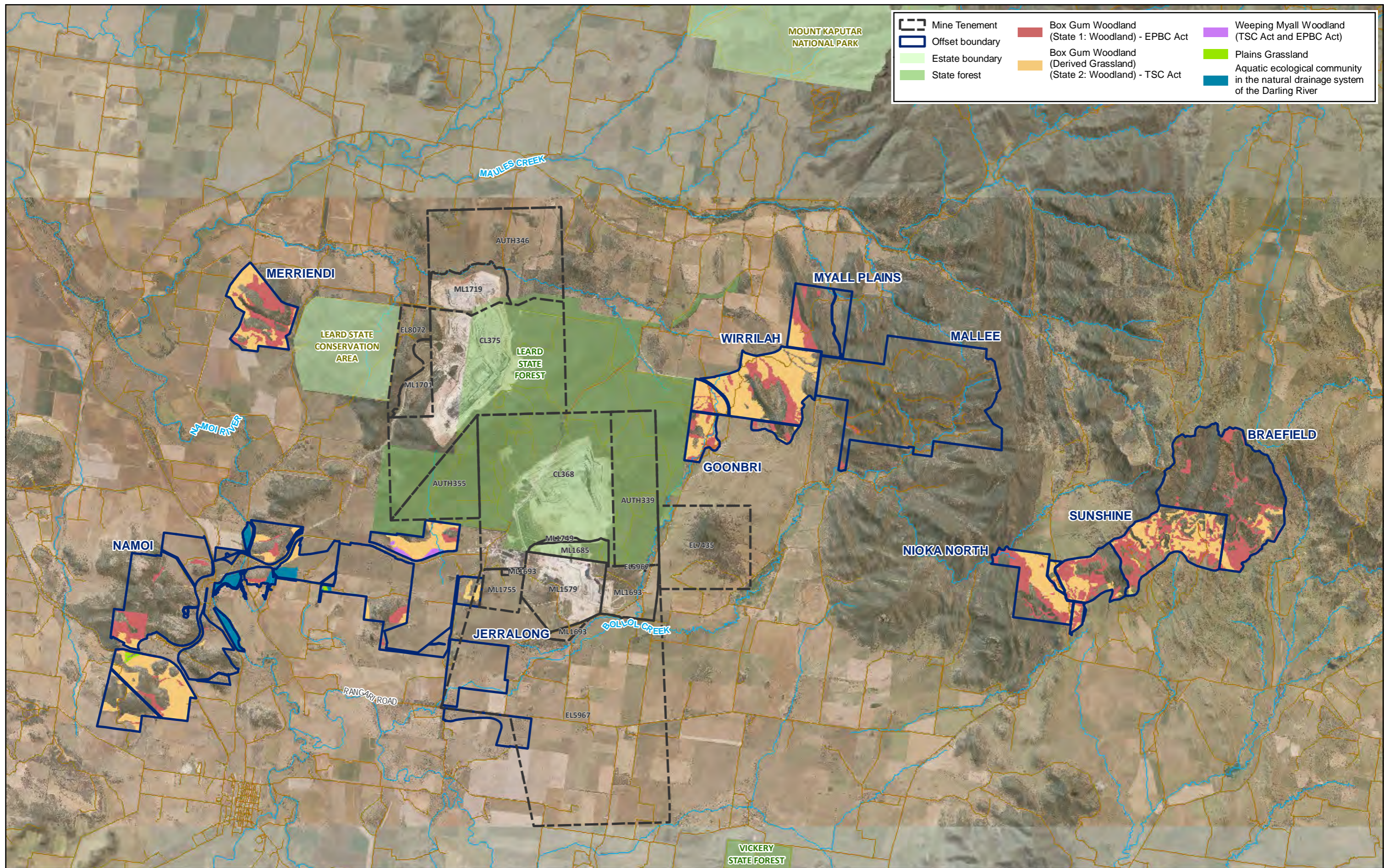
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Ecosystem health	Habitat restoration and corridor enhancement	Actively manage areas of restoration	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of Box Gum Woodland BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>100% of Box Gum Woodland at BOA monitoring locations within the Habitat Restoration Zones show locally occurring canopy species recruiting for example <i>Eucalyptus albens</i> and/or <i>Eucalyptus melliodora</i>. Given monitoring is undertaken in accordance with BBAM 2014 sampling for natural regeneration is to occur across the entire vegetation zone.</p>
Ecosystem structure	Habitat restoration and corridor enhancement	Actively manage areas of restoration	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>Annual biodiversity monitoring undertaken in accordance with the methodology described in the main OMP document to measure the success of restoration and maintenance of Box Gum Woodland against BBAM 2014 benchmark data and analogue sites within Habitat Management Zones. Monitoring to include photograph point monitoring.</p> <p>100% of Box Gum Woodland BOA monitoring sites within Habitat Restoration Zones area within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark following active revegetation.</p> <p>Salvaged resources are reused and relocated to rehabilitated areas and BOA Habitat Restoration Zones and are in structurally good condition.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring	From 2015, thereafter annually (1-20 yrs)	<p>Annual monitoring of diurnal bird and microchiropteran bat species richness and abundance completed as part of the BOA monitoring program.</p> <p>Habitat Restoration Zones and Corridor Enhancement Zones show an observed increase in bird species richness and/or abundance across the BOA, to within at least 80% of the benchmark for Leard State Forest analogue reference sites (as described in the main BMP document).</p> <p>Threatened bird species occupancy and habitat usage.</p>
Control of weed species	All management zones ¹	Implement integrated weed management	From 2017, thereafter completed annually or as deemed necessary based on annual monitoring reports	<p>Annual BOA Biodiversity Monitoring Report shows an overall reduction in exotic plant cover following implementation of control measures across all BOAs.</p> <p>Weed species within native vegetation communities comprise less than 20% of any strata across the BOAs within 10 years of control measures being implemented.</p> <p>Cypress Pine and Shiny Bush thinning undertaken across BOAs. Endeavour to achieve the following targets:</p> <ul style="list-style-type: none"> — Reduced to less than 80% of original distribution by end of year 5 — Reduced to less than 50% of original distribution by end of year 10 — Reduced to less than 30% of original distribution by end of year 15 — Maintenance thinning to occur in years following initial thinning events. <p>Weed control undertaken in accordance with the relevant practises and guidelines specified in the Weed and Pest Management Strategy (refer to Appendix B).</p> <p>Where significant or new weed infestations are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification, where applicable.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Fire control	All management zones ¹	Access tracks and fire breaks maintained in accordance with the main OMP document and in consultation with NSW Rural Fire Service, as required. Periodic use of crash grazing to reduce (biomass) fuel loads.	As required, to be determined on an annual basis based on results of annual inspection	Schedule of maintenance for access tracks and fire breaks Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)
Control of pest species, particularly foxes, cats and goats	All management zones ¹	Complete strategic culling events or baiting programs as necessary	Commencement in 2017. Thereafter, as required based on results of annual inspections and results of pest control reports.	Documentation detailing the use of any pest control activity, required efficacy and the results of any program instigated Annual BOA Biodiversity Monitoring Report shows an overall reduction in pest animal species and population sizes targeted by control measures implemented across all management zones across all BOAs (taking into consideration potential drought conditions and seasonal trends). Pest animal control is undertaken in accordance with relevant Codes of Practise and Standard Operating Procedures as detailed in the Weed and Pest Management Strategy (refer to Appendix B). Where significant or new pest occurrences are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification, where applicable.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Implement fire regime for conservation	Habitat management	Undertake strategic burns in a fire regime aimed at promoting patchiness to promote diversity	Autumn Commencement to be determined in consultation with Rural Fire Service - every 4 to 8 years in each patch or as determined necessary during annual inspections	Reduction in weed species in BOAs Promotion of species diversity in BOAs
Nutrient management	Habitat restoration	Restrict stock access (crash grazing) Change, reduce or eliminate fertiliser use in adjacent or upslope paddocks Create buffers that capture nutrients before they enter the patch Hay cutting Topsoil removal (scalping) Seeding (Kangaroo Grass, Snow Tussock, Red Grass)	From 2015, (following end of existing grazing leases) and prior to revegetation. Refer to preliminary revegetation plan for indicative timeframe for each BOA.	Nutrient loads are reduced across all BOAs i.e. all fertilisers and other soil amelioration measures associated with agriculture have ceased and livestock grazing excluded. Only soil improvement measures and crash grazing required for revegetation/regeneration as well as fuel load and weed management of native vegetation communities to occur. Annual BOA Biodiversity Monitoring Report shows an overall reduction in weed species (such as broadleaf weeds and annual pasture grasses) following reduction of fertiliser use across all BOAs. Weed species within native vegetation communities comprise less than 20% of any strata across the BOAs.

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



0 0.5 1 1.5 2 2.5 3 3.5 KM

Scale 1:125,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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APPENDIX **D.1**

TITLE: **BOX GUM WOODLAND**

6 LARGE-EARED PIED BAT (*CHALINOLOBUS DWYERI*)

The Large-eared Pied Bat is listed as Vulnerable under both the EPBC Act and BC Act.

This species has been recorded in scattered localities from near Rockhampton in central coastal Queensland to Bungonia in Southern NSW. It can be found in a variety of dry habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. "Isolated records from subalpine woodland above 1500 m and at the edge of rainforest and moist eucalypt forest, suggest it may tolerate a greater range of habitats than has so far been recorded" (Strahan 1995).

During the daytime, its roosts include caves, mine tunnels and the abandoned, mud-shaped nests of Fairy Martins. While roosting in the caves it often selects positions close to the entrance where individuals huddle together. The Large-eared Pied Bat is thought to be quite manoeuvrable due to a relatively short, broad wing and a low weight per unit area of wing. It is most likely to forage for small flying insects below the forest canopy (Duncan *et al.* 1999).

A group of females and a few males assemble deep inside a roosting site during early spring. Young are born between November and December and are weaned until late January. The colony will disperse from the site during autumn. Females become reproductively mature after one year. During autumn and winter males have enlarged testes and both sexes have swollen glands on the muzzle.

6.1 DISTRIBUTION

The Large-eared Pied Bat was captured within the Eastern Offsets (Nioka North BOA) while undertaking targeted harp trapping for Corben's Long-eared Bat. Additionally, Large-eared Pied Bat was potentially recorded via an Anabat recording in the Project boundary. While the recording was relatively poor in quality, suitable roosting requirements for this species have been observed in the BOAs (refer **Error! Reference source not found.** and Figure D.2).

6.2 THREATS

The main threats affecting cave-dependent microchiropteran bats (combined for all species) include:

- loss or modification of habitat (including feeding habitat) near roosting and maternity sites
- clearing and isolation of dry eucalypt forest and woodland, particularly about cliffs and other areas containing suitable roosting and maternity sites, mainly as a result of agriculture or development
- loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities, vegetation and too-frequent burning
- disturbance to roosting areas by goats
- predation by cats and foxes
- introduction of exotic pathogens such as white-nose fungus
- application of pesticides in or adjacent to foraging areas may reduce the availability of invertebrates, or result in the accumulation of toxic residues in individuals' fat stores
- damage to or disturbance of roosting and maternity caves, particularly during winter or when breeding
- Mining operations and recreational activities (such as caving) being examples.

6.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for the Large-eared Pied Bat:

- Protect known and potential habitat from burning at too-frequent intervals.
- Reduce the use of pesticides and consider alternatives where available.

- Protect known and potential forest and woodland habitat around cliffs, rock overhangs and old mine workings from clearing and isolation.
- Control goats to reduce disturbance to roosting sites.

6.4 MAINTENANCE OF SUITABLE HABITAT

6.4.1 HABITAT MANAGEMENT ZONE

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for these species (refer Table D4.1). Habitat of particular importance to these species includes the Eastern Offsets, Namoi Offsets and Central Offsets. Rocky plateaus and small escarpments contain roosting and potentially breeding habitat for the species. The Nioka North BOA and Mallee BOA are situated along the Nandewar Range and contains large areas of rocky outcrops, escarpments and cliff lines, all of which are likely to contain potential roosting and maternity locations for these species. Indeed, The Large-eared Pied Bat was captured in the Nioka North BOA during targeted Corben's Long-eared Bat trapping in 2017. Together these properties represent important habitat for the maintenance of this species in the locality.

6.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

In the medium to long-term it is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (refer Table D4.1), which will supplement existing habitat management zones in providing important foraging habitat in the locality. Although the Large-eared pied Bat may not necessarily be affected by the effects of localised habitat fragmentation (i.e. relatively high mobility), they are susceptible to the effects of habitat loss and degradation, particularly concerning the removal of foraging habitat near roosting and maternity sites. Therefore, the establishment of a regional wildlife corridor is envisaged to provide suitable movement pathways from roost sites to foraging locations in an otherwise largely cleared landscape.

6.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

The main threats affecting the species include the loss and modification of habitat (including foraging habitat) near roosting and maternity sites, clearing and isolation of dry eucalypt woodland/ forest, particularly around cliff lines and areas containing suitable roosting and breeding habitat, and damage or disturbance to roosting and maternity caves, particularly during winter or when breeding.

Therefore, the most important management measure in the short-term is the protection of known and potential habitat located in the BOAs; particularly concerning suitable habitat in surrounding rocky outcrops, escarpments and cliff lines that likely provide suitable roosting and maternity sites for this species and other threatened cave-dependent microchiropteran bats such as the Eastern Cave Bat.

Furthermore, due to extensive clearing of woodland and forest habitats in the locality and wider region, smaller fragments and linear riparian strips of remnant trees effectively occur as the last inhabitable areas for foraging. Therefore, in the long-term, an important management measure for the maintenance of suitable habitat includes the restoration of a regional wildlife corridor effectively connecting the Namoi Offsets with the Eastern Offsets. In the long-term, it is envisaged that the restoration of regional wildlife corridor will likely form important foraging habitat for these species in the locality.

Another important management measure will be the appropriate use of any pesticide or herbicide within the BOAs. Such chemicals may reduce the availability of invertebrates in nearby foraging areas or result in the accumulation of toxic residues in individuals. Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the species and will be implemented within each BOA:

- active and passive revegetation
- weed and pest control, including the control of feral cats
- management of unauthorised access and disturbance.

6.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D6.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the large-eared pied Bat.

Table D6.1 Management actions and performance criteria for Large-eared pied Bat

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of known and potential roosting/ maternity sites	All management zones ¹	Upgrade boundary fencing of all BOAs Upgrade fencing around land designated as other lands for agriculture zone Incorporate appropriate signage on boundary fencing	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in the main OMP document Upgrade fencing around land designated as other lands for agriculture zone	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, details in the main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Biodiversity monitoring	All management zones	Complete annual biodiversity monitoring, as detailed in the main OMP document, to measure success of restoration in the long-term against baseline data and as compared with relevant BBAM 2014 benchmarks and Leard State Forest analogue sites (described in the main OMP document).	Annual	<p>Biodiversity monitoring undertaken annually across the BOAs in accordance with the methodology detailed in the main BMP document.</p> <p>BOA Biodiversity Monitoring Report to include details of the current health and structure of all management zones across all BOAs against relevant BBAM 2014 benchmarks and analogue sites as required. Additionally, report will provide recommendations on management requirements to fulfil BOA performance and completion criteria detailed in this table.</p> <p>Native vegetation communities within BOAs meet at least 80% of lower BBAM 2014 benchmark values for corresponding vegetation types.</p>
Minimise application of pesticides/herbicides	All management zones ¹	Limit use of pesticides/insecticides to that absolutely necessary for effective use of agricultural lands	Annual	Document all use of pesticides/insecticides on agricultural lands that occur immediately adjacent to the wildlife corridor (i.e. those areas where excess use may affect insect abundance or availability for foraging microchiropteran bats).
Habitat use	Habitat management	Annual biodiversity monitoring targeting the Large-eared Pied Bat (refer main BMP document).	Annual	<p>Monitoring of microchiropteran bat species richness and abundance completed as part of the BOA monitoring program.</p> <p>Provision of annual biodiversity offset monitoring report detailing threatened species recorded.</p>
Medium-term				

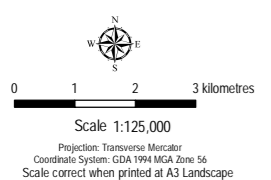
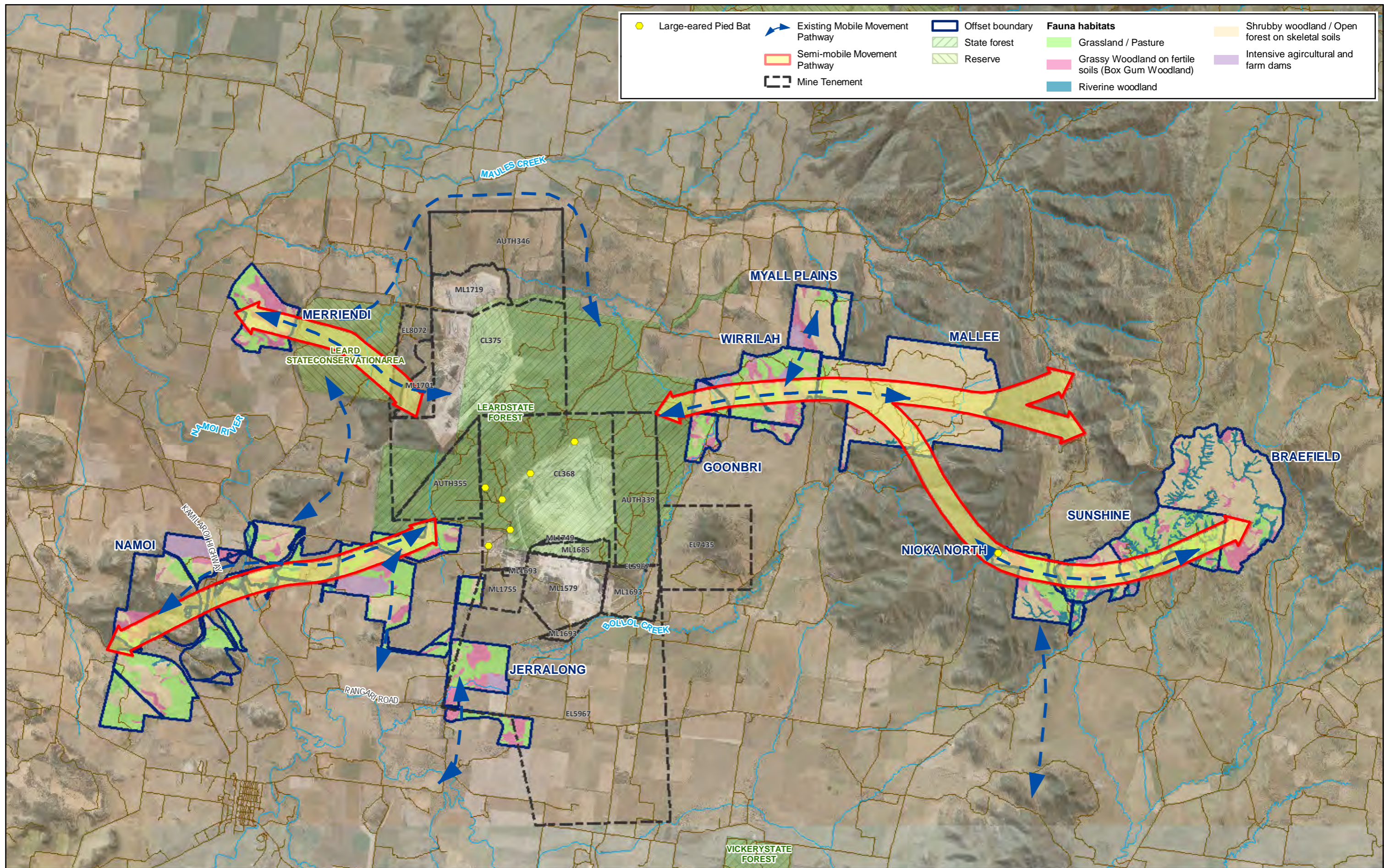
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration. Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p> <p>Planting and regrowth to be managed to encourage areas of open woodland and clearings to serve as ecotonal foraging habitat for microchiropteran bats.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement zones	<p>Actively manage areas of restoration (including corridor enhancement zones). Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p> <p>Planting and regrowth to be managed to encourage areas of open woodland and clearings to serve as ecotonal foraging habitat for microchiropteran bats.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in the main OMP document).</p>
Provision of suitable habitat for cave-dependent microchiropter an bats	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Fire control	All management zones ¹	<p>Access tracks and fire breaks maintained in accordance with the main BMP document and in consultation with NSW Rural Fire Service, as required.</p> <p>Periodic use of crash grazing to reduce (biomass) fuel loads</p>	As required	<p>Schedule of maintenance for access tracks and fire breaks</p> <p>Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)</p>

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



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7 CORBEN'S LONG-EARED BAT (*NYCTOPHILUS CORBENI*)

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

Corben's Long-eared Bats inhabit a variety of vegetation types, including mallee and box eucalypt dominated communities, but they are distinctly more common in box/ironbark/cypress-pine vegetation, which occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. They roost in tree hollows, crevices and under loose bark. It is a slow flying, agile bat using the understorey to hunt non-flying prey — especially caterpillars and beetles — and will even hunt on the ground. Mating takes place in autumn, with one or two young born in late spring to early summer (Churchill 2008).

This species has previously been recorded in Leard State Forest (Pennay, Michael 2001) with suitable habitat existing therein (Figure D.3). It has also been recorded during targeted surveys in the Namoi Offsets (Victoria Park Property), Central Offsets (Goonbri BOA and Myall Plains BOA) and Eastern Offsets (Nioka North BOA). Multiple individuals have now been captured in the Namoi BOA and Myall Plains BOA by harp trapping methodology during targeted surveys.

The main threats affecting hollow-dependent microchiropteran bats (combined for all species) include:

- loss and fragmentation of foraging habitat, particularly extensive areas of continuous forest and areas of high productivity and mallee habitat
- loss of hollow-bearing trees
- disturbance and loss of roosting and breeding sites.
- application of pesticides/ herbicides in or adjacent to foraging areas, reducing the availability or abundance of insects, or result in the accumulation of toxic residues in individuals.

7.1 RECOVERY ACTIONS

The following applicable recovery actions have been identified for Corben's Long-eared Bat by the NSW DPI&E:

- Protect and maintain areas of high quality habitat, particularly areas of extensive tall forest (dominated by trees more than 20m in height), which include areas of high productivity foraging habitat around creeks, rivers and wetlands.
- Retain and protect hollow-bearing trees in suitable habitat. Ensure long-term hollow availability by protecting recruit trees, that is, trees that will be able to provide hollows when current hollow-bearing trees have died and fallen.
- Undertake revegetation, using a locally appropriate mix of native species, in areas that will develop into tall forest. Revegetation should focus on expanding existing smaller areas of suitable habitat, and areas of high productivity such as riparian areas and wetlands. Maintain and improve travelling stock reserves used by the species. A diversity of local native species should be planted.
- Ensure roosting bats are not present before removing or disturbing hollow-bearing trees in winter.
- Control or remove exotic weeds, particularly in riparian zones, that degrade habitat and alter the structure of the vegetation community in areas of the species' distribution. Ensure that such weed control work be undertaken in a staged manner and minimises disturbance to the habitat of the species and prey species (insects). Develop and implement a bush regeneration strategy (which includes monitoring and reporting requirements) targeting the removal of weeds significantly compromising habitat values such as the repression of future hollow-bearing trees. Care should be taken to avoid widespread removal of vegetation without replacement. Manual weed removal is preferable and the use of herbicides should avoid non-target impacts. Leave dead trees standing.
- Ensure that areas immediately surrounding maternity and roost sites are identified as an important biodiversity asset in any relevant fire planning and have a 100m buffer zone applied. Planned fires near maternity or

roosting sites should not be undertaken during the breeding season, i.e. October to January, or during winter when bats are in residence. Hazard reduction burns in box/ironbark/cypress pine vegetation communities where the bats are known or suspected of using should not occur more than once every 20-50 years. Liaise with the Rural Fire Service, National Parks and Wildlife Service, or relevant land manager, to ensure that prescribed burns that may affect habitat are cool burns and/or do not kill hollow-bearing trees.

7.2 MAINTENANCE OF SUITABLE HABITAT

7.2.1 HABITAT MANAGEMENT ZONE

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for these species (refer Table D4.1). Habitat of particular importance for these species include Grassy Woodland on Fertile Soils and Riverine Woodland, which approximate 1,676.1 ha and 596.3 ha respectively in habitat management zones, as they contain large trees that generally provide an abundance of tree hollows of varying size classes. Furthermore, large areas of existing habitat (habitat management zones), such as that located in the Myall Plains, Wirrilah, Mallee, and the western portion of the Namoi BOAs, are likely to provide important habitat attributes for these species.

7.2.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

In the medium to long-term it is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (refer Table D4.1), which will supplement existing habitat management zones and effectively contribute to the viability of a local and regional wildlife corridor. Although, these species are not necessarily affected by the localised small-scale fragmentation of habitat, they are all susceptible to the effects of habitat loss, particularly concerning the loss of critical resources (i.e. hollow-bearing trees). Furthermore, hollow-dependent microchiropteran bats such as Corben's Long-eared Bat are more readily associated with large remnants of suitable habitat, often due to the provision of necessary roosting, breeding and foraging habitat.

Therefore, the effective restoration of areas of derived native grassland and agricultural land (Habitat restoration and corridor enhancement zones) will likely provide suitable habitat (including potential breeding habitat) and movement pathways for these species in the locality. A mosaic of habitats in the wildlife corridor will necessarily provide important microhabitat characteristics important for invertebrates, which comprise important prey species.

7.2.3 MANAGEMENT MEASURES OF MAINTENANCE OF SUITABLE HABITAT

The main threats affecting hollow-dependent microchiropteran bats such as Corben's Long-eared Bat, include the loss and fragmentation of habitat; loss of critically limiting resources (tree hollows); disturbance of roosting and breeding habitat; and application of pesticides and herbicides that may reduce the availability and/ or abundance of invertebrate prey.

Therefore, the most important management measure in the short-term is the protection of existing habitat (habitat management zones) in BOAs. Furthermore, the staged clearing of important habitat in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction, by potentially allowing those displaced individuals to relocate to other habitat areas in the immediate vicinity of the clearing footprint.

Due to extensive habitat destruction in the locality and wider catchment area, smaller fragments and riparian strips of remnant trees effectively occur as the last inhabitable areas for these species. Therefore, in the long-term, an important management measure for the maintenance of suitable habitat includes the restoration of a regional wildlife corridor effectively connecting larger areas of remnant woodland/ forest to the west of the Namoi River to the Eastern Offsets. It is envisaged that the restoration of the regional wildlife corridor will likely form important roosting, breeding and foraging habitat for these species in the locality. As these species are reliant on critically limiting resources (i.e. tree hollows), which will not naturally occur in areas of restoration (Habitat restoration and corridor enhancement zones) for a period greater than 50 years, and more likely greater than 100 years, restoration

areas will need to be supplemented with appropriately sized nest boxes that may offer potential roosting and breeding habitat in the short to medium-term.

Another important management measure will be the appropriate use of any pesticide or herbicide. Such chemicals may reduce the availability of invertebrates in nearby foraging areas or result in the accumulation of toxic residues in individuals.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to threatened hollow-dependent microchiropteran bats and will be implemented within each BOA:

- active and passive revegetation
- retention and addition of habitat features, including natural hollows and nest boxes.

7.3 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D7.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for Corben’s long-eared Bat.

Table D7.1 Management actions and performance criteria for Corben’s Long-eared bat

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat and trees capable of providing suitable roost/ breeding locations	All management zones ¹	Upgrade boundary fencing of all BOAs Upgrade fencing around land designated as other lands for agriculture zone Incorporate appropriate signage on boundary fencing	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document Upgrade fencing around land designated as other lands for agriculture zone	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, detailed in main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Biodiversity monitoring	All management zones ¹	Complete annual biodiversity monitoring, as detailed in main BMP document, to measure success of restoration in the long-term against baseline data and as compared with relevant BBAM 2014 benchmarks and Leard State Forest analogue sites (detailed in main OMP document).	Annual	<p>Biodiversity monitoring undertaken annually across the BOAs in accordance with the methodology detailed in main OMP document.</p> <p>BOA Biodiversity Monitoring Report to include details of the current health and structure of all management zones across all BOAs against relevant BBAM 2014 benchmarks and analogue sites as required. Additionally, report will provide recommendations on management requirements to fulfil BOA performance and completion criteria detailed in this table.</p> <p>Native vegetation communities within BOAs meet at least 80% of lower BBAM 2014 benchmark values for corresponding vegetation types.</p>
Habitat use	Habitat management	Annual biodiversity monitoring targeting Corben's Long-eared Bat (refer to main OMP document).	Annual	<p>Monitoring of Corben's Long-eared Bat completed as part of the BOA monitoring program.</p> <p>Continued records for Corben's Long-eared Bat within the BOAs.</p> <p>Provision of annual biodiversity offset monitoring report detailing threatened species records.</p>
Medium-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration. Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p> <p>Planting and regrowth to be managed to encourage woodlands to contain areas of mid-storey shrubby trees and low shrubs to provide cover for Corben's Long-eared Bat.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.

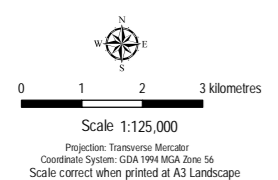
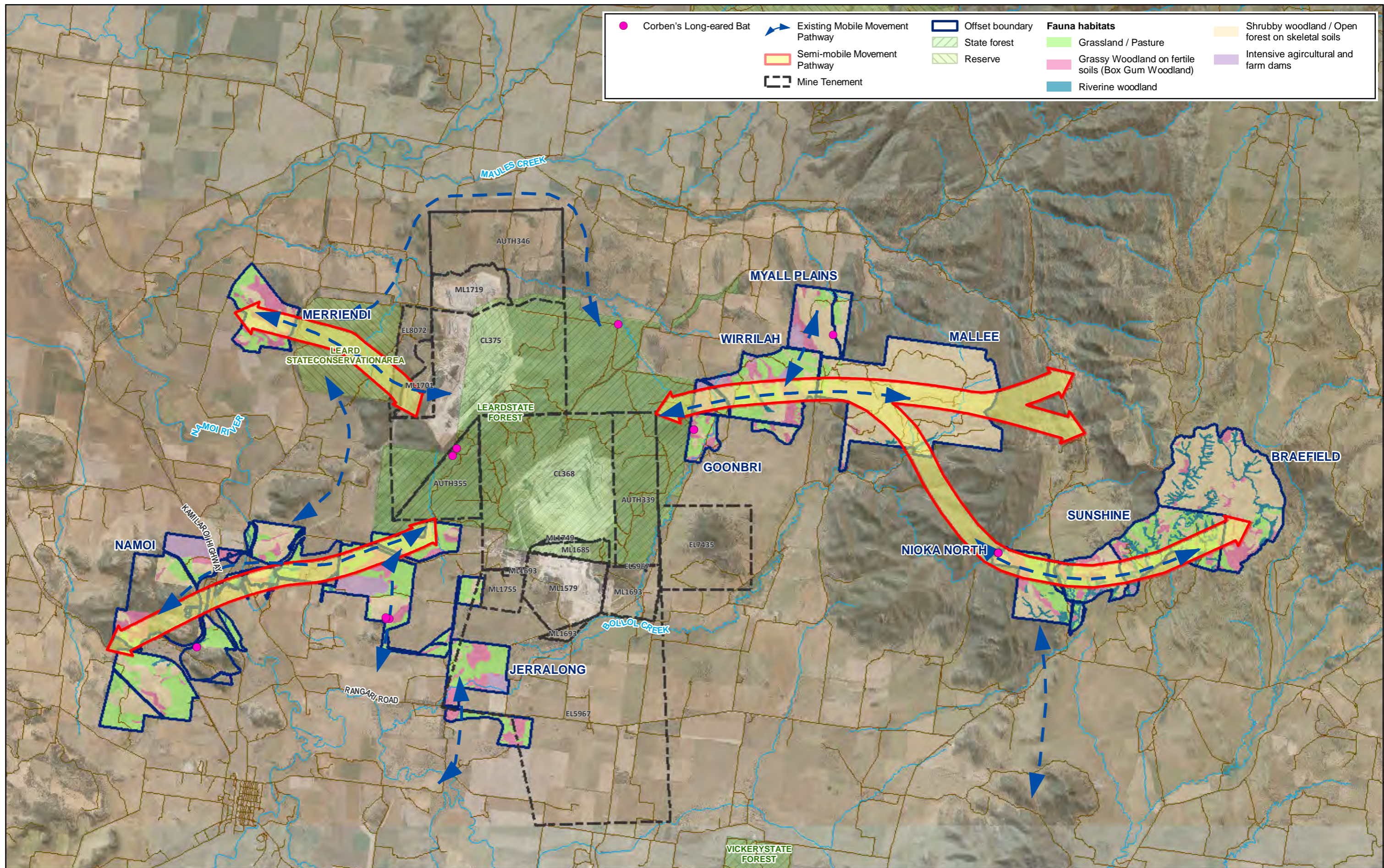
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement zones	<p>Actively manage areas of restoration. Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p> <p>Planting and regrowth to be managed to encourage woodlands to contain areas of mid-storey shrubby trees and low shrubs to provide cover for Corben’s Long-eared Bat.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of artificial/ supplementary habitat suitable for roosting and breeding	Habitat restoration and corridor enhancement zones	Incorporate nest boxes in habitat restoration zones areas until natural generation of tree hollows predominates	10 years 15 years	<p>Installation of nest boxes as per criteria detailed in Table D3.1:</p> <ul style="list-style-type: none"> — 50% of nest boxes will be installed from a rehabilitation age of 10 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1 — Incorporate 100% of nest boxes (remaining 50%) from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1. — 80% of nest boxes installed are being utilised or show signs of use by native species within BOAs. <p>Utilisation of nest boxes by pest species such European Honey Bee, Common Myna, Common Starling and feral rodent species (<i>Rattus</i> and <i>Mus</i> spp.) should be recorded.</p> <p>Nest boxes structurally in good condition and functioning in the landscape. Where nest boxes are no longer in structurally good condition they are replaced within a year of being identified.</p>
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in main BMP document).</p>
Provision of suitable habitat for hollow-dependent microchiropter an bats	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting microchiropteran bats (refer to main OMP document).	From 2015, to be monitored annually	<p>Annual monitoring of Corben’s Long-eared Bat completed as part of the BOA monitoring program.</p> <p>Habitat restoration zones and corridor enhancement zones show an observed increase in microchiropteran bat species richness and/or abundance across the BOA, to within at least 80% of the benchmark for Leard State Forest analogue reference sites (as described in main OMP document).</p> <p>Records of Corben’s Long-eared Bat, utilising areas of restoration where canopy species are commensurate with milestones detailed in Table D3.1.</p> <p>Provision of annual biodiversity offset monitoring report detailing threatened species records.</p>
Fire control	All management zones ¹	<p>Access tracks and fire breaks maintained in accordance with relevant sections in main BMP document and in consultation with NSW Rural Fire Service, as required.</p> <p>Periodic use of crash grazing to reduce (biomass) fuel loads</p>	As required	<p>Schedule of maintenance for access tracks and fire breaks.</p> <p>Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period).</p>

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



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8 PAINTED HONEYEATER (*GRANTIELLA PICTA*)

Painted Honeyeaters occur in dry forests and woodlands. The primary food is mistletoes in the genus *Amyema*, although they will take some nectar and insects (Department of Environment and Conservation 2006). The breeding distribution is dictated by the presence of mistletoes, which are largely restricted to older eucalypts. In many areas they particularly favour mistletoes such as *Amyema quandang* (Grey Mistletoe), which favour *Acacia* sp., and mistletoes such as *A. cambagei* and *A. linophylla*, which favour she-oak species. The species is less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).

8.1 DISTRIBUTION

The Painted Honeyeater has been recorded within the Namoi BOA within Weeping Myall Woodland. The species is also predicted to occur within the remaining BOAs (Figure D.4).

8.2 THREATS

The primary threats identified by NSW DPI&E that affect threatened woodland birds (all species) include:

- Clearing of woodlands and open forests.
- Removal of large, old trees with heavy mistletoe infestations.
- Degradation of open forest and woodland remnants, including thinning of trees bearing mistletoe.
- Heavy grazing of grassy woodlands.
- Habitat infestation by weeds such as African boxthorn, *Gazania* and invasive grasses.
- Inappropriate fire regimes.
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners
- Degradation and simplification of habitat due to overgrazing.

8.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for Painted Honeyeater:

- Manage grazing on sites where Painted Honeyeater habitat occurs.
- Encourage regeneration of habitat by fencing remnant stands and undertaking new plantings.
- Protect remnant woodland and open forest throughout the range of the species.
- Regenerate and replant local flora species to maintain breeding and foraging habitat.
- Conduct further research to increase understanding of habitat selection and nomadic movements of the Painted Honeyeater.

8.4 MAINTENANCE OF SUITABLE HABITAT

8.4.1 HABITAT MANAGEMENT AREA

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for these species (refer Table D4.1). Such areas likely represent important foraging and breeding habitat in the locality. Habitat types of importance for this species include the Riverine Woodland and Grassy Woodland on Fertile Soils, which approximate 596.3 ha and 1,676.1 ha respectively in habitat management zones.

8.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

It is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (refer Table D4.1), which will supplement existing areas of habitat management and effectively contribute to the viability of a regional wildlife corridor. The species is susceptible to the effects of habitat loss and degradation. In the medium to long-term, 3,522.5 ha of Habitat restoration and corridor enhancement will likely provide important foraging and breeding habitat in the locality. Although these species all inhabit similar woodland and open forest habitats, they all have individual niches and micro-habitat preferences that must be catered for during restoration works.

8.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

The main threats affecting the woodland birds involve the loss and degradation of habitat, through clearing for agriculture, mining and urban development.

Therefore, the most important management measure in the short-term is the protection of existing habitat management zones in BOAs, including the restricted access of site personnel and the general public. Furthermore, the staged clearing in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction, by potentially allowing those displaced individuals to relocate to other habitat areas in the immediate vicinity of the clearing footprint.

In the long-term, an important management measure for the maintenance of suitable habitat for the species includes the restoration of a regional wildlife corridor effectively connecting larger areas of remnant woodland/ forest to the west of the Namoi River to the Eastern Offsets. It is envisaged that the successful restoration of a regional wildlife corridor will likely form important foraging and breeding habitat in the locality.

Another important management measure will be the appropriate planting of habitat restoration and corridor enhancement zones, as to provide a mosaic of habitats in the regional wildlife corridor.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the Painted honeyeater and will be implemented within each BOA:

- active and passive revegetation
- selective thinning
- weed and pest control, including the control of foxes and feral cats
- management of unauthorised access and disturbance.

8.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D8.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for Painted Honeyeater.

Table D8.1 Management actions and performance criteria for Painted honeyeater

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat and trees capable of providing suitable shelter and/ or breeding locations	All management zones ¹	Upgrade boundary fencing of all BOAs. Upgrade boundary fencing around land designated as other land for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main BMP document. Upgrade fencing around land designated as other lands for agriculture zone.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, as detailed in main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Biodiversity monitoring	All management zones ¹	Complete annual biodiversity monitoring, as detailed in main OMP document, to measure success of restoration in the long-term against baseline data and as compared with relevant BBAM 2014 benchmarks and Leard State Forest analogue sites (detailed in main OMP document).	Annual	<p>Biodiversity monitoring undertaken annually across the BOAs in accordance with the methodology detailed in main OMP document.</p> <p>BOA Biodiversity Monitoring Report to include details of the current health and structure of all management zones across all BOAs against relevant BBAM 2014 benchmarks and analogue sites as required. Additionally, report will provide recommendations on management requirements to fulfil BOA performance and completion criteria detailed in this table.</p> <p>Native vegetation communities within BOAs meet at least 80% of lower BBAM 2014 benchmark values for corresponding vegetation types.</p>
Habitat use	Habitat management zone	Annual biodiversity monitoring targeting threatened woodland birds (refer to main OMP document).	Annual	<p>Monitoring of diurnal bird species richness and abundance completed as part of the BOA monitoring program.</p> <p>Habitat Management Zones show no observed significant decrease (i.e. greater than 40 % reduction sustained over three consecutive sampling periods) in bird species richness across the BOAs that cannot be attributed to natural variation against baseline monitoring site data.</p> <p>Continued records of threatened the species.</p> <p>Provision of annual biodiversity offset monitoring report detailing threatened species records.</p>
Minimise application of pesticides/herbicides	All management zones ¹	Limit use of pesticides/herbicides to that necessary for effective use of agricultural lands	Annual	Document all use of pesticides/insecticides on agricultural lands that occur immediately adjacent to the wildlife corridor (i.e. those areas were excess use may affect insect abundance or availability for foraging insectivorous birds).
Medium-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration. Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p> <p>Planting and regrowth to be managed to encourage areas of open woodland and clearings to serve as foraging habitat for threatened grassland birds. Woodlands to contain areas of mid-storey shrubby trees and low shrubs to provide cover for small threatened passerines.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p> <p>Planting and regrowth to be managed to encourage areas of open woodland and clearings to serve as foraging habitat for threatened grassland birds. Woodlands to contain areas of mid-storey shrubby trees and low shrubs to provide cover for small threatened passerines.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.
Provision of supplementary habitat	Habitat restoration and corridor enhancement	Incorporation of ground timber in habitat restoration zones	<p>10 years</p> <p>15 years</p>	<p>Salvaged resources are reused and relocated to BOA habitat restoration zones and are in structurally good condition.</p> <p>Provision of ground timber as per criteria detailed in Table D3.1:</p> <ul style="list-style-type: none"> — 50 % of ground timber to be incorporated from a rehabilitation age of 10 years, or when regenerating canopy species are commensurate within criteria detailed in Table D3.1. — 100 % of ground timber to be incorporated from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1.

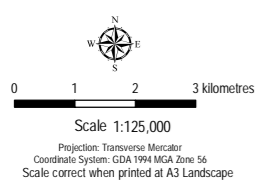
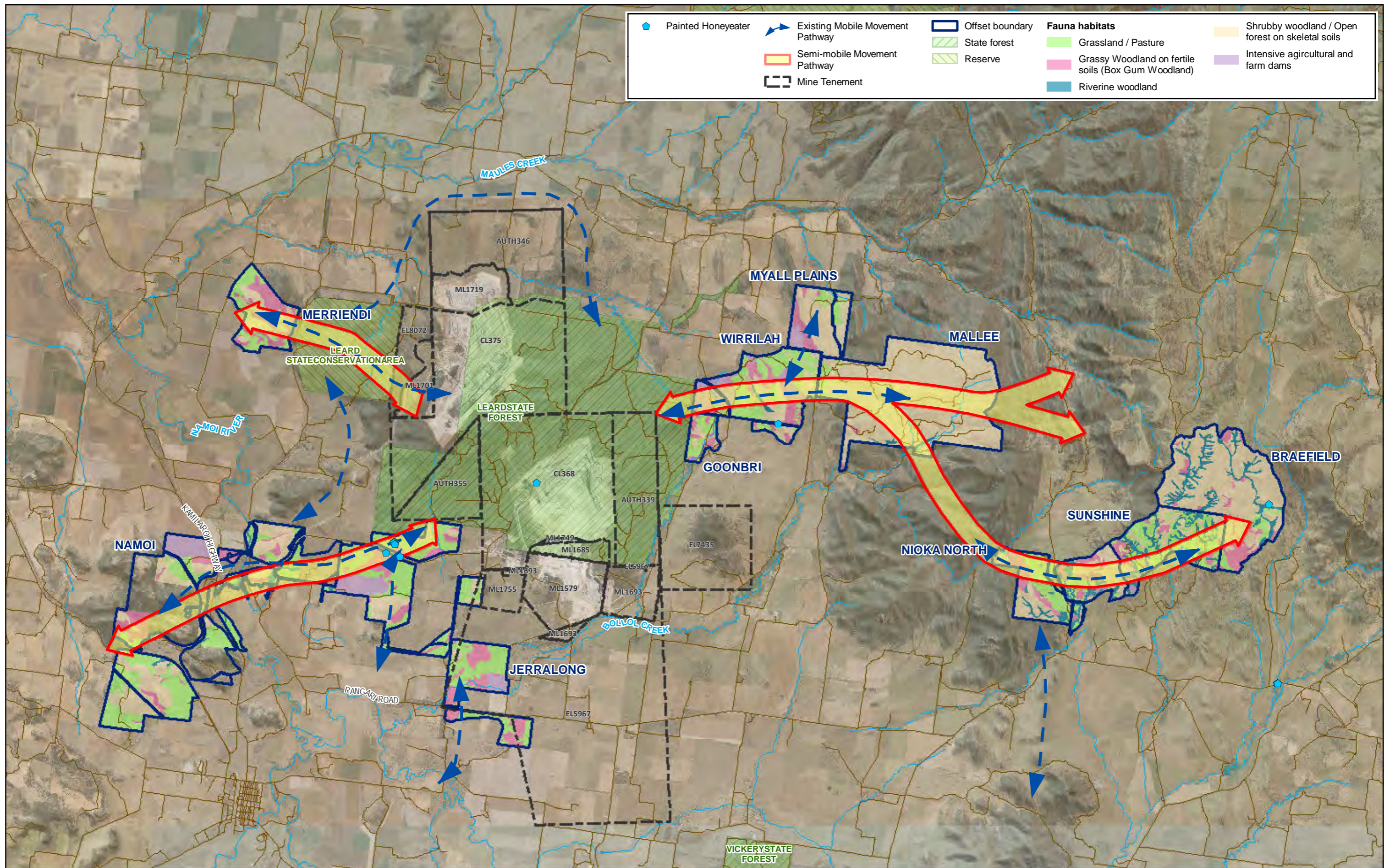
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Inclusion of supplementary habitat features suitable for breeding	Habitat restoration and corridor enhancement zones	Incorporate nest boxes in habitat restoration zones until natural generation of tree hollows	10 years 15 years	<p>Installation of nest boxes as per criteria detailed in Table D3.1:</p> <ul style="list-style-type: none"> — 50% of nest boxes will be installed from a rehabilitation age of 10 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1. — Incorporate 100% of nest boxes (remaining 50%) from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1. — 80% of nest boxes installed are being utilised or show signs of use by native species within BOAs. <p>Utilisation of nest boxes by pest species such European Honey Bee, Common Myna, Common Starling and feral rodent species (<i>Rattus</i> and <i>Mus</i> spp.) should be recorded.</p> <p>Nest boxes structurally in good condition and functioning in the landscape. Where nest boxes are no longer in structurally good condition they are replaced within a year of being identified.</p>
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark. Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in main OMP document).
Provision of suitable habitat for threatened woodland birds	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative active restoration timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting diurnal birds (refer Section 7.1 of the main OMP document).	From 2015, to be completed annually	<p>Annual monitoring of diurnal bird species richness and abundance completed as part of the BOA monitoring program.</p> <p>Habitat restoration zones and corridor enhancement zones show an observed increase in diurnal bird species richness and/or abundance across the BOA, to within at least 80% of the benchmark for Leard State Forest analogue reference sites (as described in main OMP document).</p> <p>Records for threatened woodland birds utilising areas of restoration where canopy species are commensurate with milestones detailed in Table D3.1.</p> <p>Provision of annual biodiversity offset monitoring report detailing threatened species records.</p>
Control of pest species, particularly foxes and cats	All management zones ¹	Complete strategic culling events or baiting programs as necessary	From 2016, as required and deemed necessary by annual inspections and pest control reports	<p>Annual BOA Biodiversity Monitoring Report shows an overall reduction in pest animal species (particularly foxes and cats) and population sizes targeted by control measures implemented across all management zones across all BOAs (taking into consideration potential drought conditions and seasonal trends).</p> <p>Pest animal control is undertaken in accordance with relevant Codes of Practise and Standard Operating Procedures as detailed in the Weed and Pest Management Strategy (refer to Appendix B).</p> <p>Where significant or new pest occurrences are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Fire control	All management zones ¹	<p>Access tracks and fire breaks maintained in accordance with relevant sections in main BMP document and in consultation with NSW Rural Fire Service, as required.</p> <p>Periodic use of crash grazing to reduce (biomass) fuel loads</p>	As required	<p>Schedule of maintenance for access tracks and fire breaks</p> <p>Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)</p>

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



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APPENDIX	D.4
TITLE:	PAINTED HONEYEATER

9 SWIFT PARROT (*LATHAMUS DISCOLOUR*)

The Swift Parrot is listed as Critically Endangered under the EPBC Act and Endangered under the BC Act.

Swift Parrots migrate to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations (Department of Environment and Conservation 2006). Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark) and *E. albens* (White Box) (Higgins 1999). The parrots return to foraging sites on a cyclic basis depending on food availability (Department of Environment and Conservation 2006). Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by *Tasmanian E. globulus* (Blue Gum) (Webster 1988).

On mainland Australia, the main threat affecting this species is the loss of habitat through clearing for agriculture and urban and industrial development. During the breeding season and winter migration, collisions with wire netting fences, windows and cars, threaten this species, particularly where such obstacles are in close proximity to suitable habitat (Department of Environment and Conservation 2006).

9.1 DISTRIBUTION

Targeted surveys for threatened winter migrating birds completed in the Project Boundary to inform the continuation of mining biodiversity impact assessment failed to record this species, which was potentially attributable to a lack of flowering resources.

However, Swift Parrot was recorded in Leard State Forest and the Wirrilah BOA during surveys informing annual biological monitoring and this OMP, which coincided with *E. albens* (White Box) flowering profusely in the Project locality. Figure D.5 shows the spatial distribution of WSP observations in the Project boundary and BOAs.

9.2 THREATS

The following threats have been identified by the NSW OEH for the Swift Parrot:

- Habitat loss and degradation.
- Changes in spatial and temporal distribution of habitat due to climate change.
- Reduction in food resources due to drought.
- Competition for food resources.
- Collision mortality.
- Psittacine Beak and Feather Disease (Pbfd).
- Fragmentation of woodland habitat.
- Infestation by invasive weeds.
- Inappropriate fire regimes.
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.

The main threat affecting this species on mainland Australia is the continued destruction of habitat through clearing for agriculture, mining and urban development. Large trees on fertile soil provide abundant nectar, which is an important foraging resource for the Swift Parrot during their winter migration.

9.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for the Swift Parrot:

- Protect large old trees, including from the effects of fire. Ensure the recruitment of large old trees by retaining medium-sized trees, facilitating regeneration, and undertaking replanting.
- Include locally occurring species that provide important food resources in revegetation programs where appropriate. Ensure that fuel reduction burns do not result in canopy scorch, which can reduce flowering in subsequent years. Manage aggressive honeyeater impacts through habitat modification (e.g. reduce the amount of edge and establish a structurally complex understorey).
- Monitor swift parrot distribution, abundance, and habitat use. Investigate knowledge gaps to improve the effectiveness of management actions, including understanding the phenology of key food species, determining movement strategies, patterns and pathways between regions, and modelling the impacts of climate change projections on the distribution and abundance of foraging habitat and resources.

9.4 MAINTENANCE OF SUITABLE HABITAT

9.4.1 HABITAT MANAGEMENT ZONE

While habitat management zones reflect areas of existing high quality fauna habitat that require little management in order for species uptake, the Swift Parrot is generally limited in its foraging opportunities to those eucalypt species that flower during their period of residence or areas with abundant lerp. Therefore, Swift Parrot is essentially limited to grassy woodland on fertile soil habitat, which is dominated by *E. albens*, as indicated by the spatial distribution of recent sightings. The apparent absence of this species in periods of low flowering abundance and their presence during a profuse flowering event highlights the cyclic nature of their migration to those areas that provide abundant foraging opportunities.

While *E. crebra* (Thin-leaved Ironbark) flowers from winter through to September, coinciding with Swift Parrots potential presence in the locality, its blossom is seldom of sufficient quantities to be considered an important foraging resource for this species.

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for the Swift Parrot on at least a cyclic basis (refer Table D4.1).

9.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

It is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (Table D4.1). This will supplement existing areas of habitat management and over the mid to long-term will provide winter foraging sources for the Swift Parrot on at least a cyclic basis.

9.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

Swift Parrots migrate to the Australian south-east mainland from March to October occurring in areas where eucalypts are flowering profusely or where there are abundant lerp infestations (Department of Environment and Conservation 2006). Further, it is known that local sightings can be cyclic and based on the presence of heavily flowering eucalypts. Therefore, in the long-term a mature canopy (equivalent to analogue sites) of specific food trees, particularly *E. albens* (White Box), will provide an important foraging resource for this species in the locality.

As Swift Parrots are non-breeding migrants to the mainland, the main management measures include the staged clearing of existing habitat (to minimise the extent of habitat loss in the locality in any one year) and successful restoration of Habitat restoration and corridor enhancement zones.

The restoration of derived native grassland areas through regeneration of the existing soil seed bank is likely to provide limited habitat opportunities in the short to medium term (e.g. 5-15 years), with increased usage thereafter as canopy tree species increase in size and maturity. Structural elements for the continued survival of this species in the locality should be sufficient for potential occurrence from a rehabilitation age of 10 to 15 years (e.g. potential foraging opportunities).

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the Swift Parrot and will be implemented within each BOA:

- Active and passive revegetation
- Selective thinning
- Management of unauthorised access and disturbance.

9.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D9.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the Swift Parrot.

Table D9.1 Management actions and performance criteria for Swift Parrot

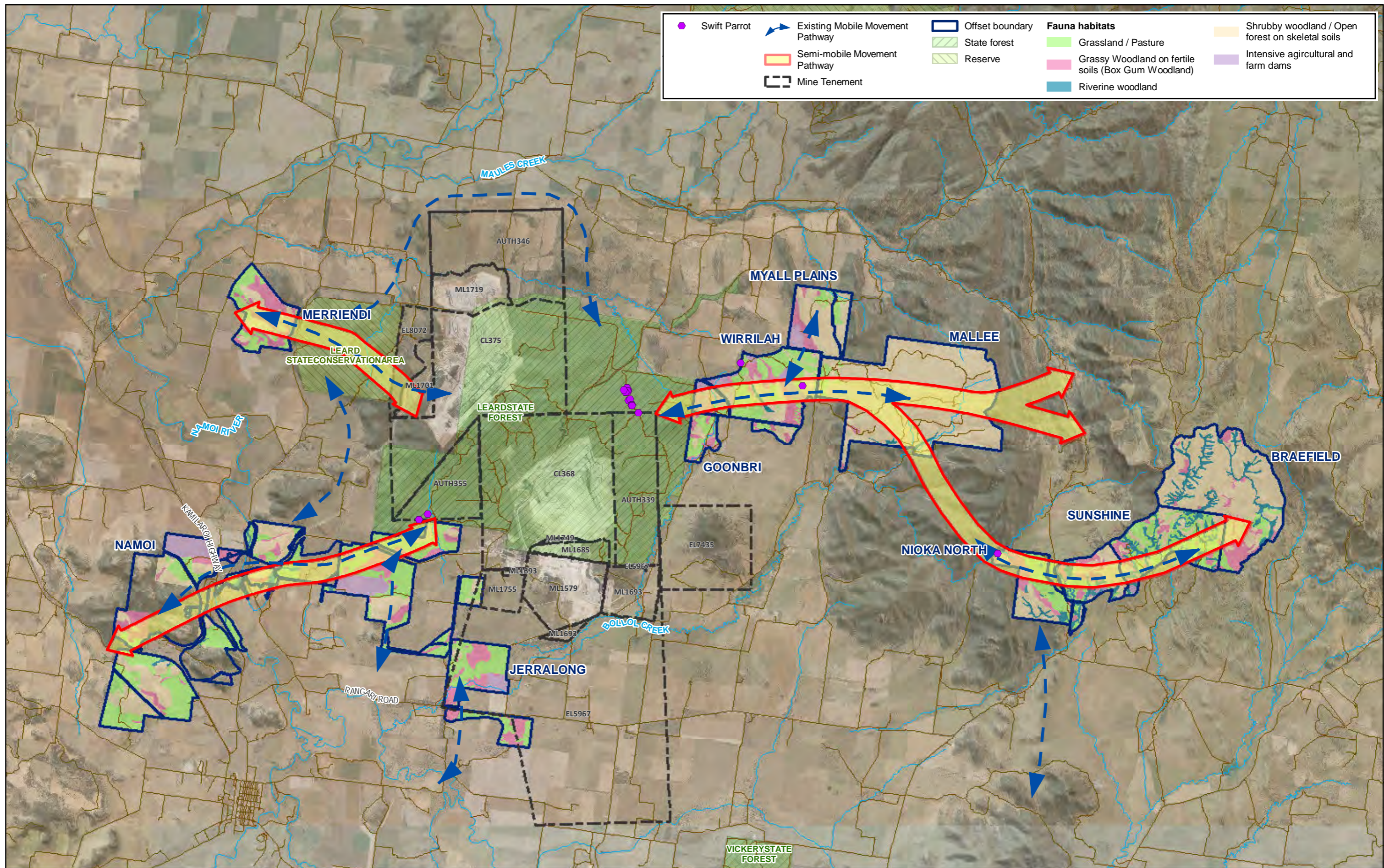
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade boundary fencing around land designated as other land for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other lands for agriculture.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, detailed in main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Habitat use ²	Habitat management	Annual biodiversity monitoring targeting threatened winter blossom nomads (refer to main BMP document).	Annual	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter blossom nomad surveys and any threatened species recorded therein.
Medium-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones.</p> <p>Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.
Canopy growth	Habitat restoration and corridor enhancement	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Long-term				
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in main OMP document).</p>
Provision of suitable habitat for Swift Parrot	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Habitat use ²	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting threatened winter blossom nomads (refer to main OMP document).	From 2015, to be completed annually	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter blossom nomad surveys and any threatened species recorded therein.
Fire control	All management zones ¹	Access tracks and fire breaks maintained in accordance with the main OMP document and in consultation with NSW Rural Fire Service, as required. Periodic use of crash grazing to reduce (biomass) fuel loads	As required	Schedule of maintenance for access tracks and fire breaks Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)

- 1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.
- 2) Due to the cyclic nature of the Swift Parrots migration patterns, observations of this species are not likely to occur every season. Rather this may be observed locally during periods when *E. albens* is flowering profusely in the locality.



● Swift Parrot	➔ Existing Mobile Movement Pathway	▭ Offset boundary	Fauna habitats	▭ Shrubby woodland / Open forest on skeletal soils
➔ Semi-mobile Movement Pathway	▭ State forest	▭ Reserve	▭ Grassland / Pasture	▭ Intensive agricultural and farm dams
▭ Mine Tenement			▭ Grassy Woodland on fertile soils (Box Gum Woodland)	▭ Riverine woodland

0 1 2 3 kilometres

Scale 1:125,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

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APPENDIX **D.5**

TITLE: **SWIFT PARROT**

10 SUPERB PARROT (*POLYTELIS SWAINSONII*)

The Superb Parrot is listed as Vulnerable under the EPBC Act and BC Act.

This species is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild.

The species Inhabits Box Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. It nests in small colonies and is known to forage up to 10 km from nesting sites, primarily in Box Gum Woodland. The species feeds in trees and understorey shrubs and on the ground, with a diet consisting grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain (Office of Environment and Heritage, 2012).

10.1 DISTRIBUTION

The Superb Parrot has not been recorded within the Project Boundary or BOAs, however these areas provide potential habitat for this species (Figure D.6).

10.2 THREATS

The following threats have been identified by the NSW OEH for the Superb Parrot:

- Loss of living and dead hollow bearing trees
- Loss of breeding and foraging habitat
- Loss of breeding and foraging habitat
- Poor regeneration of nesting trees and food resources
- Loss of habitat from private native forestry activities
- Feeding on grain spills and subsequently being struck by vehicles
- Loss of hollows to feral bees and native and exotic hollow-nesting birds
- Illegal trapping which can also result in the destruction of hollows
- Illegal shooting of birds in orchards
- Lack of knowledge of population trends in the Superb Parrot
- Lack of knowledge of key flight paths and corridors of the Superb Parrot
- Loss of habitat trees from fire damage during hazard reduction and stubble burns
- Lack of knowledge of breeding ecology and success of the Superb Parrot
- Competition with Noisy Miners for breeding and foraging habitat and resources.

10.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for the Superb Parrot:

- Retain living and dead paddock trees and plant or direct seed appropriate local eucalypt species, particularly white box, yellow box, Blakely's red gum and river red gum, to replace these trees in the long-term. Ideally, planted paddock trees should be spaced no more than 50m apart to provide connectivity for other fauna species.
- Report illegal shooting or trapping of Superb Parrots to Environment Line (131 555).

- Protect living and dead hollow-bearing trees from fire.
- Supplement the number of natural hollows with artificial hollows. These may be created in living or dead eucalypts without natural hollows using a chainsaw. Alternatively, appropriate nest boxes may also be used, provided that they are monitored for use by Superb Parrots and not exotic fauna and they are maintained in the long-term.
- Protect paddock trees and ensure their replacement over the long term through planting and direct seeding
- Protect known and potential remnant superb parrot habitat, particularly Box Gum, box-ironbark and weeping myall woodland and river red gum riparian gallery forest, with large hollow-bearing trees, native shrubs such as wattles, hop bushes and saltbushes and native grasses and manage to allow ongoing regeneration of local native trees, shrubs and groundcover plants.
- Restore superb parrot habitat in strategic locations close to known habitat and movement corridors, including riparian areas, using appropriate local tree, shrub and ground cover species. The planting of wattles, hopbush, saltbush and native grasses will provide important foraging habitat.
- Erect warning signs on roads where superb parrot road kill events are known to occur.

10.4 MAINTENANCE OF SUITABLE HABITAT

10.4.1 HABITAT MANAGEMENT ZONE

BOAs currently provide approximately 7,120.0 ha of habitat management zones that provide habitat attributes important for this species including, hollow-bearing trees, fallen timber and high native species diversity (refer Table D4.1). Habitat of particular importance includes areas dominated by White Box due to the generally high abundance of tree hollows.

10.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

In the medium to long-term it is estimated that an additional 3,522.5 ha of habitat restoration and corridor enhancement will supplement existing habitat management zones and effectively contribute to the viability of a local and regional wildlife corridor. Although the Superb Parrot is not necessarily affected by localised small-scale fragmentation of habitat, the species is susceptible to the effects of habitat loss, particularly concerning the loss of critical resources (i.e. hollow-bearing trees) and degradation of habitat through agricultural practices.

The restoration of areas of derived native grassland and agricultural land (habitat restoration and corridor enhancement zones) will likely provide suitable habitat (including potential breeding habitat) and movement pathways for this species in the locality. Furthermore, as the Superb Parrot typically feeds on grass seeds and herbaceous plants, and is often associated with ecotone or edge habitat (i.e. edges of eucalypt woodland and adjoining clearings), a mosaic of habitats in the wildlife corridor will provide important microhabitat characteristics for this species.

In the short-term, early shrub and tree growth, supplemented with fallen timber will likely provide sufficient habitat complexity to afford safe foraging opportunities. Initial careful plant spacing is required to provide open foraging areas with increased shelter offered by maturing canopy species. It is estimated that following 15 years of restoration, stabilised habitat usage will occur as open foraging areas continue to exist in a mosaic structure, potentially with established breeding territories, where nest boxes are provided as a supplementary habitat feature.

10.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

The main threats affecting the Superb Parrot involve the loss of habitat, including critical resources such as hollow-bearing trees and the degradation of habitat. Therefore, the most important management measure in the short-term is the protection of existing habitat management zones in the BOAs, including restricting access of site personnel and the general public, particularly concerning the removal of standing dead trees for fire wood. Furthermore, the staged

clearing of important habitat in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction, by potentially allowing any displaced individuals (from established breeding territories) to relocate to other habitat areas in the immediate vicinity of the clearing footprint.

Due to extensive habitat destruction in the locality and wider catchment area, smaller fragments and riparian strips of remnant trees effectively occur as the last inhabitable areas for the Superb Parrot. Therefore, in the long-term, an important management measure for the maintenance of suitable habitat includes the restoration of a regional wildlife corridor effectively connecting larger areas of remnant woodland/ forest to the west of the Namoi River to the Eastern Offsets. It is envisaged that the successful restoration of a regional wildlife corridor will likely form important foraging and breeding habitat in the locality. As the Superb Parrot is critically limited by the availability of tree hollows, which will not naturally occur in areas of restoration (Habitat restoration and corridor enhancement zones) for a period greater than 50 years, and more likely greater than 100 years, restoration areas will require the provision of appropriately sized nest boxes that may offer potential breeding habitat in the short to medium-term.

Another important management measure will be the appropriate planting of habitat restoration and corridor enhancement zones, as to provide a mosaic of habitats in the regional wildlife corridor.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the Superb Parrot and will be implemented within each BOA:

- Active and passive revegetation
- Retention and addition of habitat features, including natural hollows and nest boxes
- Selective thinning
- Weed and pest control, including the control of foxes and feral cats
- Grazing management
- Management of unauthorised access and disturbance.

10.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D10.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the Superb Parrot.

Table D10.1 Management actions and performance criteria for Superb Parrot

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other land for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other land for agriculture.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with Section 6.2 (of the main OMP document) as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Habitat use	Habitat management and habitat restoration	Annual biodiversity monitoring targeting threatened winter birds (refer main OMP document).	Annual	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter bird surveys and any threatened species recorded therein.
Medium-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2015, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.</p>

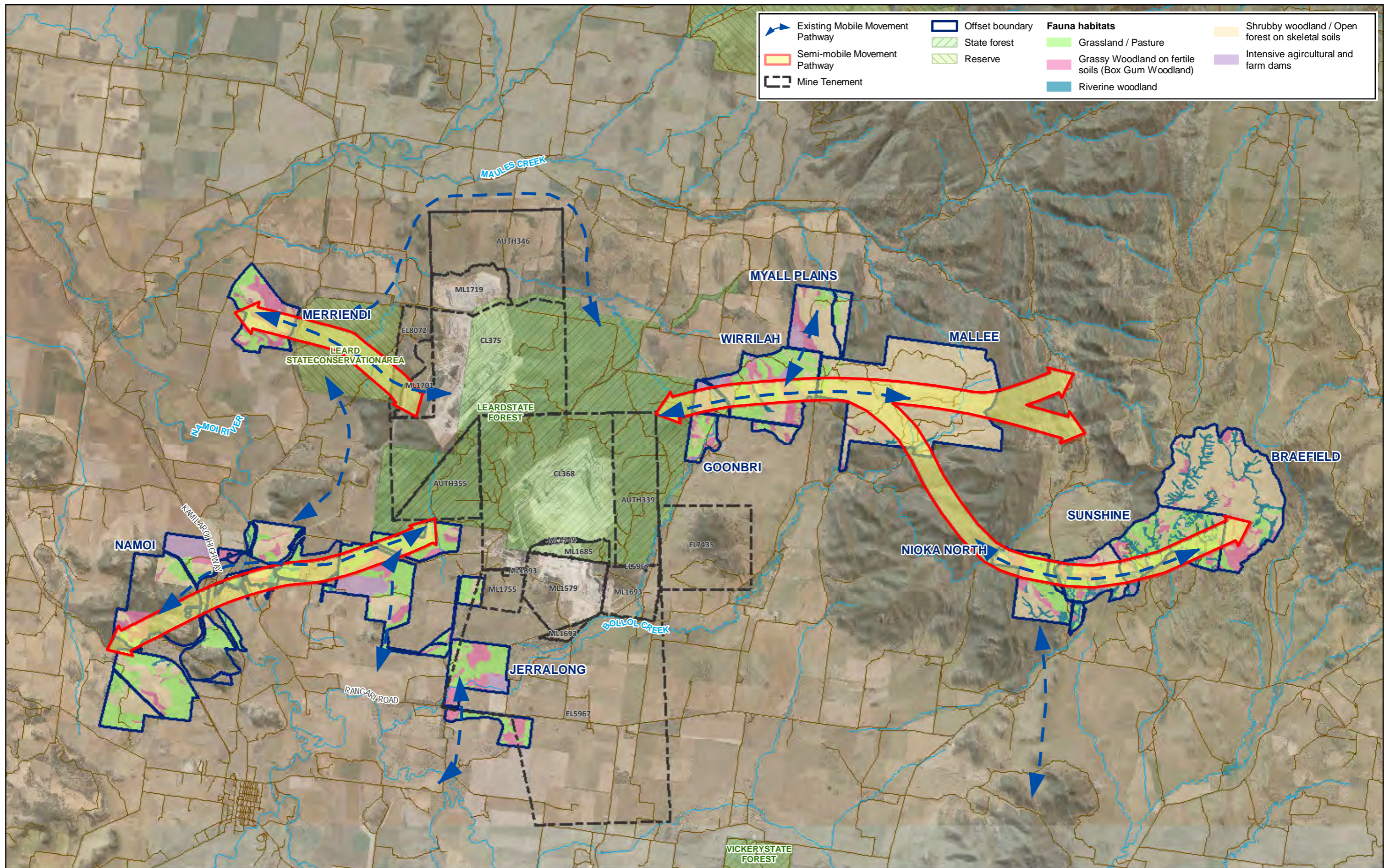
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement zones	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p>	<p>From 2015, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in main OMP document).</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of suitable habitat for Superb Parrot	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting threatened winter blossom nomads (refer main OMP document).	From 2015, to be completed annually	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter bird surveys and any threatened species recorded therein.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Control of pest species, particularly foxes and cats	All management zones ¹	Complete strategic culling events or baiting programs as necessary	From 2016, thereafter as required based on results of annual inspections and pest control reports	<p>Annual BOA Biodiversity Monitoring Report shows an overall reduction in pest animal species (particularly foxes and cats) and population sizes targeted by control measures implemented across all management zones across all BOAs (taking into consideration potential drought conditions and seasonal trends).</p> <p>Pest animal control is undertaken in accordance with relevant Codes of Practice and Standard Operating Procedures as detailed in the Weed and Pest Management Strategy (refer to Appendix B).</p> <p>Where significant or new pest occurrences are identified, a review has been undertaken and appropriate control measures are implemented within one year of identification.</p>
Fire control	All management zones ¹	<p>Access tracks and fire breaks maintained in accordance with main OMP document and in consultation with NSW Rural Fire Service, as required.</p> <p>Periodic use of crash grazing to reduce (biomass) fuel loads</p>	As required	<p>Schedule of maintenance for access tracks and fire breaks</p> <p>Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)</p>

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



0 1 2 3 kilometres

Scale 1:125,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

Imagery:
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APPENDIX **D.6**

TITLE: **SUPERB PARROT**

11 REGENT HONEYEATER (*ANTHOCHAERA PHRYGIA*)

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act and Critically Endangered under the BC Act.

This species mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years, flocks converge on flowering coastal woodlands and forests.

The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.

The Regent Honeyeater is a generalist forager, feeding on the nectar from a wide range of eucalypts and mistletoes. During breeding between July and January, the female constructs an open cup-shaped nest of bark, grass, twigs and wool. Two or three eggs are laid and incubated by the female for 14 days. Nestlings are brooded and fed by both parents at an average rate of 23 times per hour and fledge after 16 days. Fledglings fed by both parents 29 times per hour (Office of Environment and Heritage, 2012).

11.1 DISTRIBUTION

The Regent Honeyeater has not been recorded within the Project Boundary or BOAs, but is considered likely to occur based on the suitability of habitat and proximity to Bundarra-Barraba, which is an important location where this species is concentrated in NSW (NSW Department of Environment and Climate Change 2009e).

11.2 THREATS

The following threats have been identified by the NSW DPI&E for the Regent Honeyeater:

- Historical loss, fragmentation and degradation of habitat from clearing for agricultural and residential development, particularly fertile Yellow Box-White Box-Blakely's Red Gum woodlands.
- Continuing loss of key habitat tree species and remnant woodlands from strategic agricultural developments, timber gathering and residential developments.
- Suppression of natural regeneration of overstorey tree species and shrub species from overgrazing. Riparian gallery forests have been particularly impacted by overgrazing.
- Inappropriate forestry management practices that remove large mature resource-abundant trees. Firewood harvesting in Box-Ironbark woodlands can also remove important habitat components.
- Competition from larger aggressive honeyeaters, particularly Noisy Miners, Noisy Friarbirds and Red Wattlebirds.
- The small population size and restricted habitat availability make the species highly vulnerable to extinction via stochastic processes.
- Egg and nest predation by native birds.

11.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW OEH for the Regent Honeyeater in the Bundarra-Barraba management area (Gunnedah/Gwydir/Tamworth Region):

- Ensure grazing regime is appropriate for the species.
- Ensure land management is sympathetic to the long-term requirements of the species.
- Track species abundance/condition over time.
- Conservation and restoration of key habitat for the Regent Honeyeater is a priority recovery action for this species.

11.4 MAINTENANCE OF SUITABLE HABITAT

11.4.1 HABITAT MANAGEMENT ZONE

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for these species (refer Table D4.1). Of importance for this species are the Riverine Woodland and Grassy Woodland on Fertile Soils habitat types, which approximate 596.3 ha and 1,676.1 ha respectively in habitat management zones and are dominated by tree species known to be associated with the Regent Honeyeater, including *E. albens*, *E. crebra* and *Callitris glaucophylla*.

11.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

It is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (refer Table D4.1), which will supplement existing areas of habitat management and effectively contribute to the viability of a regional wildlife corridor. The Regent Honeyeater is susceptible to the effects of habitat loss and degradation. In the medium to long-term, 3,522.5 ha of habitat restoration and corridor enhancement will likely provide important foraging and breeding habitat in the locality.

Habitat opportunities for this species within restoration zones (habitat restoration and corridor enhancement zones) will be limited due to a lack of canopy values for at least 15 years from the commencement of active and passive regeneration. Following the establishment of sufficient canopy cover, these areas will provide foraging and breeding habitat opportunities for seasonal use by the Regent Honeyeater.

11.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

The main threats affecting the Regent Honeyeater involve the loss and degradation of habitat for agriculture and residential development. Therefore, the most important management measure in the short-term is the protection of existing habitat management zones in BOAs, including restricting the access of site personnel and the general public. Furthermore, the staged clearing in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction, by potentially allowing any displaced individuals to relocate to other habitat areas in the immediate vicinity of the clearing footprint.

In the long-term, an important management measure for the maintenance of suitable habitat for the Regent Honeyeater includes the restoration of a regional wildlife corridor effectively connecting larger areas of remnant woodland/ forest to the west of the Namoi River to the Eastern Offsets and beyond. It is envisaged that the successful restoration of a regional wildlife corridor will likely form important foraging and breeding habitat in the locality. Another important management measure will be the appropriate planting of habitat restoration and corridor enhancement zones, as to provide a mosaic of habitats in the regional wildlife corridor.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the Regent Honeyeater and will be implemented within each BOA:

- Active and passive revegetation
- Selective thinning
- Weed and pest control, including the control of foxes and feral cat
- Management of unauthorised access and disturbance.

11.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D11.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the Regent Honeyeater.

Table D11.1 Management actions and performance criteria for Regent Honeyeater

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of potential habitat	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade boundary fencing around other land for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other land for agriculture.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with the grazing program, detailed in the main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Habitat use ²	Habitat management	Annual biodiversity monitoring targeting threatened winter blossom nomads (refer main OMP document).	Annual	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter blossom nomad surveys and any threatened species recorded therein.
Minimise application of pesticides/herbicides	All management zones ¹	Limit use of pesticides/herbicides to that necessary for effective use of agricultural lands	Annual	Document all use of pesticides/insecticides on agricultural lands that occur immediately adjacent to the wildlife corridor (i.e. those areas where excess use may affect insect abundance or availability for foraging insectivorous birds).
Medium-term				

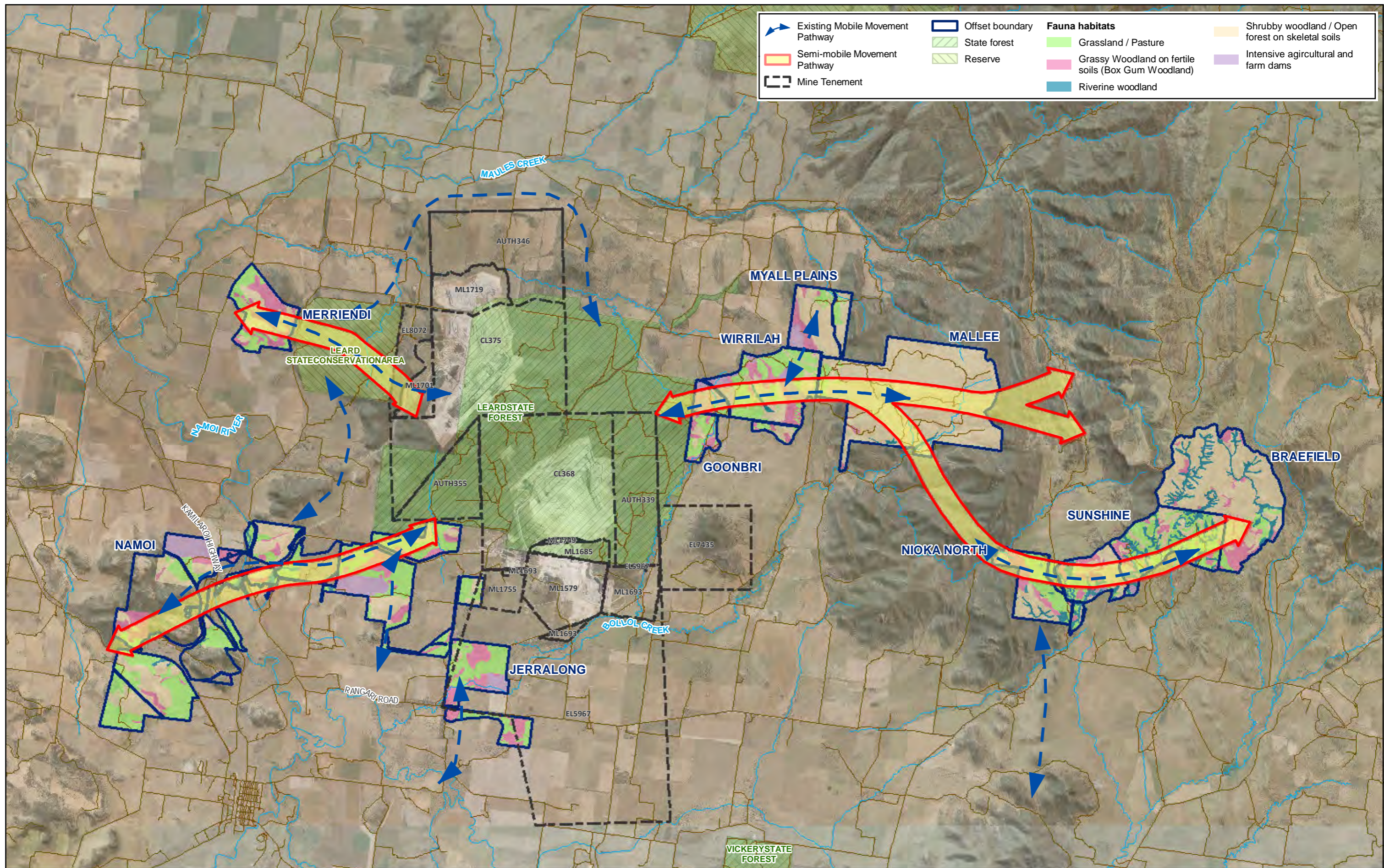
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement zones	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.</p> <p>Planting and regrowth to be managed to encourage areas of open woodland and clearings to allow for greater uptake of mistletoe (<i>Amyema</i> sp.)</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as described in main OMP document).</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of suitable habitat for Regent Honeyeater	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of the main OMP document) for indicative timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting threatened winter blossom nomads (refer to main OMP document).	From 2015, to be monitoring annually	Provision of annual biodiversity offset monitoring report detailing targeted threatened winter blossom nomad surveys and any threatened species recorded therein.
Fire control	All management zones ¹	Access tracks and fire breaks maintained in accordance with main OMP document and in consultation with NSW Rural Fire Service, as required. Periodic use of crash grazing to reduce (biomass) fuel loads	As required	Schedule of maintenance for access tracks and fire breaks. Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period).

- 1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.
- 2) Although the Regent Honeyeater is a generalist forager, it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. They can undertake large-scale nomadic movements in the order of hundreds of kilometres in response to spatial and temporal flowering patterns. Accordingly, observations of Regent Honeyeater may be observed locally during periods when *E. albens* is flowering profusely in the locality.



0 1 2 3 kilometres

Scale 1:125,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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APPENDIX **D.7**

TITLE: **REGENT HONEYEATER**

12 SPOTTED-TAILED QUOLL (*DASYURUS MACULATUS*)

The Spotted-tailed Quoll is listed as Endangered under the EPBC Act and Vulnerable under the BC Act.

Spotted-tailed Quoll occurs in a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline (Belcher 2003). Preferred habitat for Spotted-tailed Quoll includes dry and moist sclerophyll forests where they nest in hollow-bearing trees, fallen logs, burrows, small caves, rock crevices, boulder-fields and rocky-cliff faces and will feed in nearby cleared areas (Edgar & Belcher 1998). Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (Triggs 2004), although individuals require large areas of relatively intact vegetation through which to forage.

Spotted-tailed Quoll is mostly nocturnal although it will hunt during the day. On cold winter days they often bask in the sun. It spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds. This species consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, reptiles, bandicoots, rabbits and insects. It also eats carrion and takes domestic fowl (Edgar & Belcher 1998).

Females breed only once a year unless they fail to find a mate or lose their litter early, at which time they will try to breed again. Breeding occurs in early winter with females giving birth to up to six young after a gestation period of 21 days. The young leave the pouch at seven weeks and are left in the den when too large to carry on the mothers back (Gibbons & Lindenmayer 2000). They are independent at five months, with sexual maturity reached at one year of age (Kortner *et al.* 2004). Dens are shared by family groups and are aggressively defended by both males and females. Females occupy large home ranges up to about 750 ha and males up to 3,500 ha and they usually traverse their ranges along densely vegetated creeklines. This species has been recorded moving more than two kilometres overnight (Claridge *et al.* 2005).

Spotted-tailed Quolls use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; these may be visited by a number of individuals. Latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals (Triggs 1996).

The Spotted-tailed Quoll is found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common (NSW National Parks and Wildlife Service 1999).

12.1 DISTRIBUTION

The Spotted-tailed Quoll has not been recorded within the Project Boundary or BOAs; however these areas provide potential habitat for this species.

12.2 THREATS

The following threats have been identified by the NSW DPI&E for the Spotted-tailed Quoll:

- Loss, fragmentation and degradation of habitat.
- Competition with introduced predators such as cats and foxes.
- Deliberate poisoning, shooting and trapping, primarily in response to chicken predation.
- Roadkill.

12.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for the Spotted-tailed Quoll:

- Conserve old-growth forest stands and other areas of known habitat.
- Identify and target restoration and revegetation projects at areas where connectivity between large areas of known habitat is compromised, with the aim of increasing the width, condition and security of critical landscape links.

- Implement (or augment coordinated), cross-tenure, landscape scale predator control programs in areas where significant populations of spotted-tailed quoll are known to occur, and monitor populations of the target introduced predator.
- Monitor significant spotted-tailed quoll populations to investigate the impact of fox and wild dog baiting.

12.4 MAINTENANCE OF SUITABLE HABITAT

12.4.1 HABITAT MANAGEMENT ZONE

Approximately 7,120.0 ha of habitat are currently dedicated to habitat management within the BOAs, representing known and potential habitat for these species (refer Table D4.1). Such areas likely represent important foraging and breeding habitat in the locality. Habitat types of importance for this species include the Riverine Woodland and Grassy Woodland on Fertile Soils, which approximate 596.3 ha and 1,676.1 ha respectively in habitat management zones.

12.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

It is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement within the BOAs (refer Table D4.1), which will supplement existing areas of habitat management and effectively contribute to the viability of a regional wildlife corridor.

The restoration of derived native grassland areas through active revegetation and regeneration of the existing soil seed bank is likely to provide limited habitat opportunities in the short to medium term (e.g. 5-10 years), with increased usage thereafter as canopy tree species increase in size and maturity. Structural elements for the continued survival of this species in the locality should be sufficient for potential occurrence from a rehabilitation age of 10 to 15 years (e.g. potential foraging opportunities).

12.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

As the principle threat to this species comprises the loss, fragmentation and degradation of habitat, the main management measures include the staged clearing of existing habitat (to minimise the extent of habitat loss in the locality in any one year) and successful restoration of Habitat restoration and corridor enhancement zones.

Habitat restoration and corridor enhancement zones will be planted appropriately to provide a mosaic of habitats in the regional wildlife corridor. This would establish potential breeding territories and home ranges and provide areas of sufficient cover to escape predators such as foxes and cats. The wildlife corridor will be facilitated by the maintenance of a 500 m corridor between Boggabri Coal and Maules Creek Coal Mine.

Habitat features potentially used by this species, including hollow-bearing trees, fallen logs and bush rocks, will be retained within all offset managements zones throughout the BOAs. Following approved thinning or clearing, habitat resources will be relocated to BOAs to create additional nesting opportunities for Spotted-tailed Quoll.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to the Spotted-tailed Quoll and will be implemented within each BOA:

- Active and passive revegetation
- Selective thinning
- Addition and retention of habitat features, including hollow logs
- Weed and pest control, including the control of foxes and feral cats
- Grazing management
- Management of unauthorised access and disturbance.

12.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D12.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the Spotted-tailed Quoll.

Table D12.1 Management actions and performance criteria for Spotted-tailed Quoll

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of suitable habitat for the Spotted-tailed Quoll and prey species	All management zones 1	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other lands for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones 1	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other lands of agriculture.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, detailed in the main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Habitat use	Habitat management	Annual biodiversity monitoring targeting threatened mammals and opportunistic sightings (refer to the main OMP document).	Annual	Provision of annual biodiversity offset monitoring report detailing threatened mammal surveys and any threatened species recorded therein.
Medium-term				

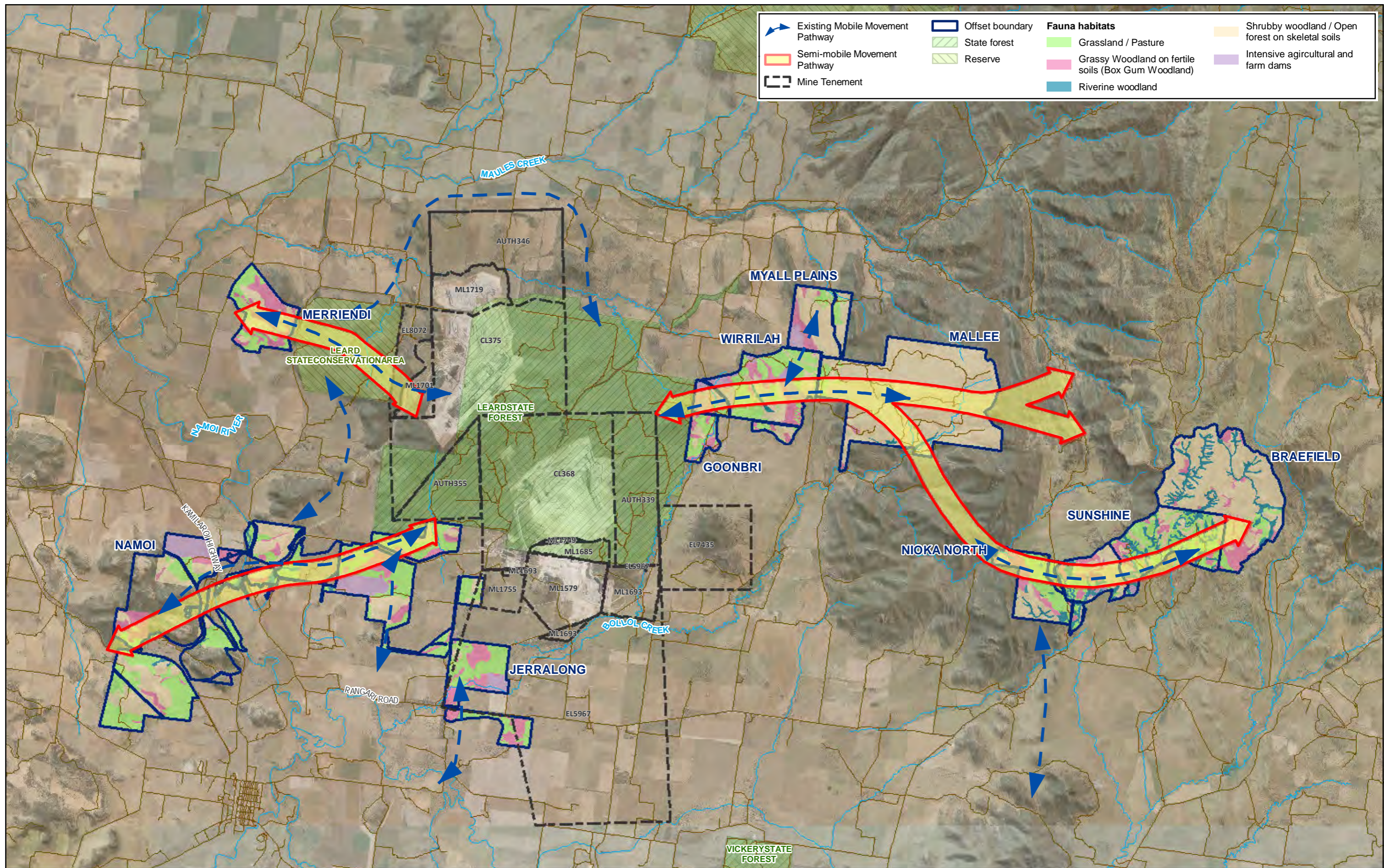
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of BOA monitoring sites within the habitat restoration zone show locally occurring canopy species recruiting.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement	Actively manage areas of restoration. Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted species.	From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA. To be monitored every 5 years, following commencement of management.	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated Table D3.1.
Inclusion of supplementary habitat features	Habitat restoration and corridor enhancement	Incorporation of ground timber in restoration areas	10 years 15 years	Salvaged resources are reused and relocated to BOA habitat restoration zones and are in structurally good condition. Provision of ground timber as per criteria detailed in Table D3.1: <ul style="list-style-type: none"> — 50 % of ground timber to be incorporated from a rehabilitation age of 10 years, or when regenerating canopy species are commensurate within criteria detailed in Table D3.1. — 100 % of ground timber to be incorporated from a rehabilitation age of 15 years, or when regenerating canopy species are commensurate with criteria detailed in Table D3.1.

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as detailed in the main OMP document).</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of suitable habitat for Spotted-tailed Quoll	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting threatened mammals and opportunistic sightings (refer to main OMP document).	From 2015, to be monitored annually	Provision of annual biodiversity offset monitoring report detailing targeted threatened mammal surveys and any threatened species recorded therein.
Fire control	All management zones ¹	Access tracks and fire breaks maintained in accordance with the relevant sections of the main OMP document and in consultation with NSW Rural Fire Service, as required. Periodic use of crash grazing to reduce (biomass) fuel loads	As required	Schedule of maintenance for access tracks and fire breaks Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



0 1 2 3 kilometres

Scale 1:125,000

Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
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13 KOALA (*PHASCOLARCTOS CINEREUS*)

The Koala is listed as Vulnerable under both the EPBC Act and BC Act.

The Koala occurs along the east coast of Australia and extends into Woodland, Mulga and River Red Gum forests west of the Great Dividing Range (Department of Environment and Climate Change 2008a). The range of the Koala covers all such suitable areas of NSW. The diet is generally restricted to Eucalypt leaves (Department of Environment and Climate Change 2008a), although on occasion, non-Eucalypt foliage is eaten. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. melliodora* (Yellow Box), *E. albens* (White Box), *E. blakelyi* (Blakely's Red Gum) and *E. microcarpa* (Western Grey Box) are some of the preferred and secondary food tree species for Koalas occurring on the Western Slopes and Plains (Department of Environment and Climate Change 2008b). Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted or nutrient deprived. Individual home ranges range from one to two ha in high quality habitat, to around 100 ha in more arid country where territories are usually discrete (Strahan and Van Dyck 2008).

Conservation status of the Koala in western NSW is variable (Department of Environment and Climate Change 2008b). Most records for this species during detailed vertebrate fauna surveys for the Brigalow Belt South Western Regional Assessments (Pennay 2002) came from the Pilliga forests. Moreover, during recent surveys of the Pilliga forests, this species was found to be widespread and common in some areas with these forests reported as supporting a large Koala population (Department of Environment and Climate Change 2008b). Furthermore, the Koala population situated around Gunnedah has also been reported as increasing (Smith 1992).

13.1 DISTRIBUTION

As a result of this observation, a systematic grid based Koala habitat survey was undertaken throughout the Project Boundary and remaining Leard State Forest. One Koala was observed during this survey and five sites of 166 surveyed (3%) indicated Koala activity through the presence of Koala scats (refer Figure D.9).

The Koala has also been recorded in the Myall Plains and Namoi BOAs, with the remaining BOAs containing potential habitat for this species (refer Figure D.9).

13.2 THREATS

The following threats have been identified by the NSW DPI&E for the Koala:

- Loss, modification and fragmentation of habitat
- Predation by feral and domestic dogs
- Intense fires that scorch or kill the tree canopy
- Road-kills
- Human-induced climate change, especially drought.

13.3 RECOVERY ACTIONS

The following applicable recovery actions have been identified by the NSW DPI&E for the Koala:

- Identify and conserve habitat important for Koala conservation, particularly those areas containing Koala freed tree species.
- Undertake pest management for feral cats and dogs
- Liaise with relevant land and fire managers where known populations or habitat occurs, to ensure that prescribed burns that may affect riparian or floodplain habitat are cool burns and do not kill hollow-bearing trees or remove cohorts of smaller hollow-bearing species over large areas.

- Undertake revegetation and rehabilitate of identified potential Koala habitat areas utilising locally occurring Koala feed tree species.
- Erect suitable signage on roadsides known for Koala crossings to warn drivers.

13.4 MAINTENANCE OF SUITABLE HABITAT

13.4.1 HABITAT MANAGEMENT ZONE

The habitat management zone supports known and potential habitat for the Koala, including areas of Riverine Woodland that contain *E. camaldulensis*, which is listed as a primary food tree species for the western slopes and plains Koala management area (Department of Environment and Climate Change 2008a).

Furthermore, seven species listed as secondary food trees are present throughout the BOAs. Such species include *E. populnea*, *E. pilligaensis*, *E. melliodora*, *E. albens*, *E. dwyeri*, *E. dealbata* and *E. blakelyi*.

Approximately 7,120.0 ha of habitat is currently dedicated to habitat management within the BOAs, representing known and potential habitat for this species (refer Table D4.1). Such areas likely represent important foraging and breeding habitat in the locality.

13.4.2 HABITAT RESTORATION AND CORRIDOR ENHANCEMENT ZONES

It is estimated that an additional 3,522.5 ha are dedicated to habitat restoration and corridor enhancement, which will supplement existing areas of habitat management and effectively contribute to the viability of a regional wildlife corridor. In the medium to long-term, 3,522.5 ha of habitat restoration and corridor enhancement will likely provide important foraging and potentially breeding in the locality. Moreover, the effective establishment of a regional wildlife corridor is envisaged to provide suitable habitat and movement pathways for all species in the locality. Therefore, a mosaic of habitats in the wildlife corridor, will necessarily provide microhabitat characteristics for this species and potentially provide movement pathways and importantly, breeding habitat. The restoration of the four broad vegetation types within the BOAs will include the planting of both primary and secondary food tree species for the western slopes and plains Koala management area.

Restoration within the BOAs through active revegetation and passive regeneration of the existing soil seed bank is likely to provide limited habitat opportunities in the short to medium term (e.g. 5-10 years), with increased usage thereafter as canopy values increase and planted trees develop trunks of sufficient size to maintain foraging habitats. Structural elements for the continued survival of this species in the locality should be sufficient for potential occurrence from a rehabilitation age of 10 to 15 years (e.g. potential foraging opportunities).

13.4.3 MANAGEMENT MEASURES FOR MAINTENANCE OF SUITABLE HABITAT

A primary threat to the Koala is the loss, fragmentation and modification of habitat. Therefore, the most important management measure in the short-term is the protection of existing habitat (habitat management zones) in BOAs. Furthermore, the staged clearing of important habitat in the Project Boundary and implementation of the Clearing and Fauna Management Procedure will help ameliorate the effects of habitat destruction, by potentially allowing any displaced individuals to relocate to other habitat areas in the immediate vicinity of the clearing footprint. The Clearing and Fauna Management Plan provides specific controls to be implemented if this species is encountered during clearing operations and pre-clearing surveys.

In the long-term, an important management measure for the maintenance of suitable habitat includes the restoration of a regional wildlife corridor effectively connecting larger areas of remnant woodland/ forest to the west of the Namoi River to the Eastern Offsets. It is envisaged that the restoration of the regional wildlife corridor will likely form important breeding and foraging habitat for this species in the locality.

Measures developed for the management of all native fauna and habitats in each BOA are detailed in specific management plans provided in Section 6.3 of the main OMP document. The following management measures address known threats to Koala populations and will be implemented within each BOA:

- Active and passive revegetation
- Selective thinning
- Weed and pest control, including the control of wild dogs
- Grazing management
- Management of unauthorised access and disturbance.

13.5 MANAGEMENT ACTIONS AND PERFORMANCE CRITERIA

Table D13.1 outlines performance criteria associated with specific management actions for the long-term maintenance of viable stands of suitable habitat for the Koala.

Table D13.1 Management actions and performance criteria for Koala

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Short-term				
Protection of existing habitat and hollow-bearing trees	All management zones ¹	Upgrade boundary fencing of all BOAs. Upgrade fencing around land designated as other land for agriculture. Incorporate appropriate signage on boundary fencing.	<5 years	All BOA boundary fences and fences for other lands for agriculture have been installed/upgraded with appropriate signage, gates and locks to protect existing vegetation, exclude unwanted livestock grazing and prevent unauthorised access by year five.
Grazing exclusion	All management zones ¹	Upgrade boundary fencing of all BOAs, as detailed in main OMP document. Upgrade fencing around land designated as other land for agriculture.	<5 years	Livestock are excluded from all management zones following planting events at each BOA. Note: conservational grazing may occur from time to time in accordance with grazing program, detailed in main OMP document, as required. Temporary fences may be used during crash grazing events to prevent livestock from entering sensitive areas.
Habitat use	All management zones ¹	Annual biodiversity monitoring targeting threatened mammals and opportunistic sightings (refer to main OMP document).	Annual	Provision of annual biodiversity offset monitoring report detailing threatened mammal surveys and any threatened species recorded therein.
Medium-term				

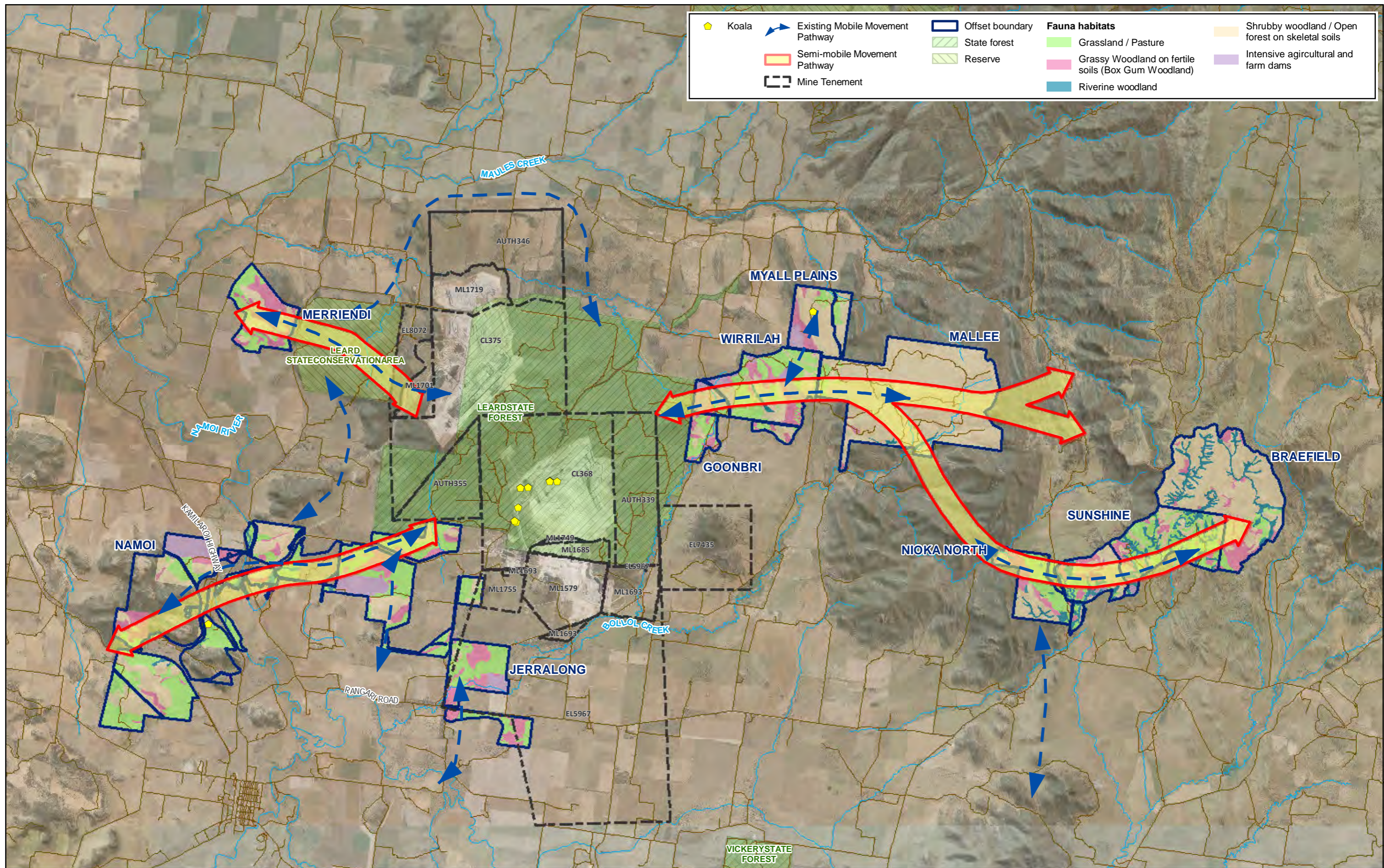
OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy recruitment	Habitat restoration	<p>Actively manage areas of restoration.</p> <p>Inspections are to be completed on a five-yearly basis to determine success of naturally regenerating canopy species.</p> <p>Further management actions may be required if regeneration significantly misses expected milestones. Alternatively, milestones may require adjustment to account for natural variation in succession. If regeneration is not evident in habitat restoration zones after 5 years, supplementary planting of canopy species would commence at a density approximate to analogue sites.</p>	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored every 5 years, following commencement of management.</p>	<p>100% of BOA monitoring sites within the Habitat Restoration Zone show locally occurring canopy species recruiting.</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Canopy growth	Habitat restoration and corridor enhancement zones	Actively manage areas of restoration Inspections are to be completed on a five-yearly basis to determine growth in naturally regenerating or planted canopy species.	From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA. To be monitored every 5 years, following commencement of management.	Evidence of canopy growth in restoration zones compared to baseline assessment and milestones nominated in Table D3.1.
Long-term				

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Maintenance, enhancement and restoration of fauna habitat	All management zones ¹	Actively manage areas of restoration and annual biodiversity monitoring	<p>From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA.</p> <p>To be monitored annually, following commencement of management.</p>	<p>100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.</p> <p>Habitat Restoration Zones at each BOA show evidence of occupation or presence of at least 80% of native fauna species comparative to Leard State Forest analogue reference sites (as detailed in main OMP document).</p>

OBJECTIVE	MANAGEMENT ZONE	MANAGEMENT ACTION	TIMING	PERFORMANCE CRITERIA
Provision of suitable habitat for Koala	Habitat restoration and corridor enhancement	Actively manage areas of restoration and annual biodiversity monitoring	From 2016, refer to preliminary revegetation plan (Figure 6.6 of main OMP document) for indicative timeframes for each BOA. To be monitored annually, following commencement of management.	100% of BOA monitoring sites within Habitat Restoration Zones are within or above BBAM 2014 benchmark ranges for vegetation cover (i.e. overstorey, midstorey and groundcovers). Additionally, species richness at least 80% of native species richness BBAM 2014 benchmark.
Habitat use	Habitat restoration and corridor enhancement	Annual biodiversity monitoring targeting threatened mammals and opportunistic sightings (refer main OMP document).	From 2015, to be monitored annually	Provision of annual biodiversity offset monitoring report detailing targeted threatened mammal surveys and any threatened species recorded therein.
Fire control	All management zones ¹	Access tracks and fire breaks maintained in accordance with main OMP document and in consultation with NSW Rural Fire Service, as required. Periodic use of crash grazing to reduce (biomass) fuel loads	As required	Schedule of maintenance for access tracks and fire breaks Documentation detailing any use crash grazing (i.e. BOA, management zone, time-period)

1) Habitat management zone, habitat restoration zone, corridor enhancement zone and other land for agriculture zone.



Koala	Existing Mobile Movement Pathway	Offset boundary	Fauna habitats	Shrubby woodland / Open forest on skeletal soils
Semi-mobile Movement Pathway	State forest	Reserve	Grassland / Pasture	Intensive agricultural and farm dams
Mine Tenement			Grassy Woodland on fertile soils (Box Gum Woodland)	Riverine woodland

Scale 1:125,000
 Projection: Transverse Mercator
 Coordinate System: GDA 1994 MGA Zone 56
 Scale correct when printed at A3 Landscape

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APPENDIX **D.9**

KOALA

TITLE

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APPENDIX E

2018 BOA MONITORING REPORT



BOGGABRI COAL OPERATIONS PTY LTD

MARCH 2019

CONFIDENTIAL

BOGGABRI COAL MINE

2018 BIODIVERSITY OFFSET AREA MONITORING

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GLOSSARY

BC Act	NSW <i>Biodiversity Conservation Act 2016</i> . Replaced former TSC Act.
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: <ul style="list-style-type: none">— Genetic diversity — the variety of genes (or units of heredity) in any population— Species diversity — the variety of species— Ecosystem diversity — the variety of communities or ecosystems.
Biodiversity Offset Strategy	Continuation of Boggabri Coal Biodiversity Offset Strategy
BMP	Biodiversity Management Plan
BOAs	Biodiversity Offset Areas
BOS	Biodiversity Offset Strategy
Boggabri Coal	Boggabri Coal Pty Limited
Central Offset Area	Referring to the Myall Plains, Mallee, Wirrilah and Goonbri biodiversity offset properties.
CoA	Condition of Approval
DoEE	Department of the Environment and Energy formerly known as: <ul style="list-style-type: none">— Department of Environment— Department of Environment, Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC).
Eastern Offset Area	Referring to the Nioka North, Sunshine and Braefield biodiversity offset properties.
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Microbat	This report uses the term microbat (microchiropteran bats) to refer to small mostly insectivorous bats that use echolocation to navigate and find food.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include the Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term ‘Migratory’ in this report refers to those species listed as Migratory under the EPBC Act.
MNES	Matters of National Environmental Significance
Namoi Offset Area	Referring to the Namoi and Jerralong biodiversity offset properties.

Noxious weed	An introduced species listed under the <i>Noxious Weeds Act 1993</i> . Under the Act, noxious weeds have specific control measures and reporting requirements. <i>Noxious Weed Act 1993</i> has been repealed and was replaced by the <i>Biosecurity Act 2015</i> on 1 July 2017.
OEH	Office of the Environment and Heritage
Priority weed	An introduced species listed under the <i>Biosecurity Act 2015</i> . Under the Act, priority weeds have specific control measures and reporting requirements.
The Project	Boggabri Coal Project
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as vulnerable, endangered or critically endangered (collectively referred to as threat-listed) under the EPBC Act, TSC Act or the FM Act.
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i> (repealed)
Western Offset Area	Refers to the Merriendi biodiversity offset property

DRAFT

1 INTRODUCTION

This report presents the findings of the fourth biodiversity monitoring event completed on all ten of the Biodiversity Offset Areas (BOAs) associated with the Boggabri Coal Project (the Project). The BOAs are managed by Boggabri Coal Pty Limited (Boggabri Coal) to compensate for impacts associated with the Project.

The 2018 monitoring event follows the 2012 and 2014 baseline monitoring surveys conducted by (Parsons Brinckerhoff 2014), which highlighted the baseline biodiversity values associated with the five BOAs outlined in the original Biodiversity Offset Strategy (Parsons Brinckerhoff 2010). Since these monitoring sessions the Continuation of Boggabri Coal Biodiversity Offset Strategy (WSP | Parsons Brinckerhoff 2016) has outlined five distinct additional BOAs that create direct linkages or key stepping stones for a Regional East-West Wildlife Corridor (Figure 1.1). The ten BOAs contain large patches of remnant vegetation and high quality habitats adjoining existing vegetated lands (Figure 1.1).

The 2018 biodiversity offset monitoring event represents the fourth year of monitoring to encapsulate all ten BOAs that form part of the Project's Biodiversity Offset Strategy (first year undertaken in 2015). Given that no habitat management or vegetation restoration works had been completed within any of the BOAs prior to the 2015 monitoring event, the 2015 monitoring event has been treated as a baseline monitoring session for the ten Boggabri Coal's BOAs. This will provide a more ecologically and statistically robust ecological monitoring program for future comparison.

Each BOA has been divided into the four management zones as outlined in Table 1.1.

Table 1.1 Biodiversity offset area and restoration zones

BIODIVERSITY OFFSET AREA	HABITAT MANAGEMENT ZONE (AREA HA)	HABITATION RESTORATION ZONE (AREA HA)	CORRIDOR ENHANCEMENT ZONE (AREA HA)	AGRICULTURAL LANDS (AREA HA)	TOTAL AREA (HA)
Eastern offsets					
Nioka North	523.1	316.6	17.9	–	857.6
Sunshine	353.2	300.1	84.7	–	738
Braefield	1,283.2	117.1	0.4	–	1,400.7
Central offsets					
Mallee	2,025.9	40.3	–	–	2,066.2
Myall Plains	367.4	62	43.9	–	473.3
Wirrilah	326.8	371.8	185.6	–	884.2
Goonbri ¹	127.6	88.3	15.1	–	231
Namoi offsets					
Namoi ¹	1,563.4	1,391.4	30.3	229.8	3,214.9
Jerralong	222.4	300.8	–	46.9	570.1
Western offsets					
Merrendi	327.0	156.2	–	–	483.3
Totals	7,120.0	3,144.6	377.9	276.7	10,919.2

- (1) The Namoi BOA contains land purchased as a joint venture between Boggabri Coal and the Maules Creek Coal Mine. The Namoi BOA totalling 3,214.9 ha, encompasses properties wholly owned by Boggabri Coal and Boggabri Coal's 50 % liability (i.e. 50 % of credits generated) of land purchased under the joint venture agreement.

Specific management measures will be implemented for each management zone to achieve the overall objective of meeting an ‘*improve or maintain*’ outcome (as defined in the *Native Vegetation Regulation 2005* and the BioBanking Assessment Methodology (BBAM) (Department of Environment and Climate Change 2008)). The aim of monitoring biodiversity within the BOAs is to assess the outcomes of management measures employed by Boggabri Coal and to measure progress towards, and achievement of, the completion criteria outlined in the Biodiversity Offset Strategy (WSP 2017) (BOS), Biodiversity Management Plan (WSP 2017, WSP 2018) (BMP) and Stage 2 of the Leard Forest Regional Strategy (Umwelt (Australia) Pty Limited 2017).

The specific management measures and regulatory approvals are outlined below:

- Specific management measures will be implemented for each management zone in order to achieve the overall objective of meeting an ‘*improve or maintain*’ outcome (as defined in the *Native Vegetation Regulation 2005* and the BBAM (Department of Environment and Climate Change 2008). The aim of monitoring biodiversity within the BOAs is to assess the outcomes of management measures employed by Boggabri Coal and to measure progress towards, and achievement of, the completion criteria outlined in the BOS.
- Furthermore, following the granting of approval for the Boggabri Coal Mine Extension (EPBC 2009/5256) on 11 February 2013 under Section 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), several conditions were imposed by the (then) Minister for Sustainability, Environment, Water, Populations and Communities (SEWPaC), now known as the Department of the Environment and Environment (DoEE). Conditions specifically relating to biodiversity surveys for Matters of National Environmental Significance (MNES) included:
 - 13(c): a detailed survey and description (prior to management activities, hence a baseline) of the current condition of the extant vegetation of each offset area, which must be consistent with the State and Transition Model. And surveys for the Regent Honeyeater, Swift Parrot and Greater Long-eared Bat.
 - 14: Baseline surveys (identified in the surveys required by condition 13(c)) must be conducted in accordance with the department’s *Survey Guidelines for Australia’s Threatened Birds and the Survey Guidelines for Australia’s Threatened Bats* (Department of Environment Water Heritage and the Arts 2010).

1.1 BACKGROUND TO MONITORING AND MANAGEMENT

As part of the Project’s CoA Boggabri Coal are required to monitor the biodiversity values associated with the ten BOAs outlined in the BOS (WSP 2017, WSP 2018). Specifically, Boggabri Coal are required to monitor biodiversity within the BOAs to ensure that the biodiversity management measures employed are progressively working towards and/or achieving the criteria outlined in the BMP (WSP | Parsons Brinckerhoff 2015, WSP 2018) and Leard State Forest Regional Biodiversity Strategy: Stage 2 – Strategy Report (Umwelt 2017).

The baseline monitoring session for the five original BOAs (Mallee, Merriendi, Myall Plains, Namoi and Wirrilah) was undertaken in 2012 and 2014 by (Parsons Brinckerhoff 2014). These surveys involved the establishment of 38 replicate monitoring sites across the original BOAs. The location of the 38 monitoring sites were selected to represent the main vegetation communities, condition class and each management zone. It was anticipated that the results of the 2012 monitoring event would provide the baseline biodiversity benchmark from which successive monitoring sessions would be compared. However, to meet the project’s residual offset requirements under CoA 43, Boggabri Coal acquired five additional BOAs (Jerralong, Goonbri, Nioka North, Sunshine and Braefield) that were added to the Boggabri Coal BOS in 2015.

The five additional BOAs were formally included in Boggabri Coal’s BMP in 2015 and consequently included in the 2015 biodiversity offset area monitoring event. The 2015 biodiversity offset monitoring event represented the first year of monitoring that encapsulated all 10 BOAs that form part of the BOS, and included 55 replicate monitoring sites. Given that the 2015 monitoring event represented baseline monitoring for five of the ten BOAs (and that no active restoration works had been completed across the biodiversity offsets), it has been treated as the baseline monitoring event for all ten

BOAs. This will provide a more ecologically and statistically robust ecological monitoring program from which successive monitoring events will be compared.

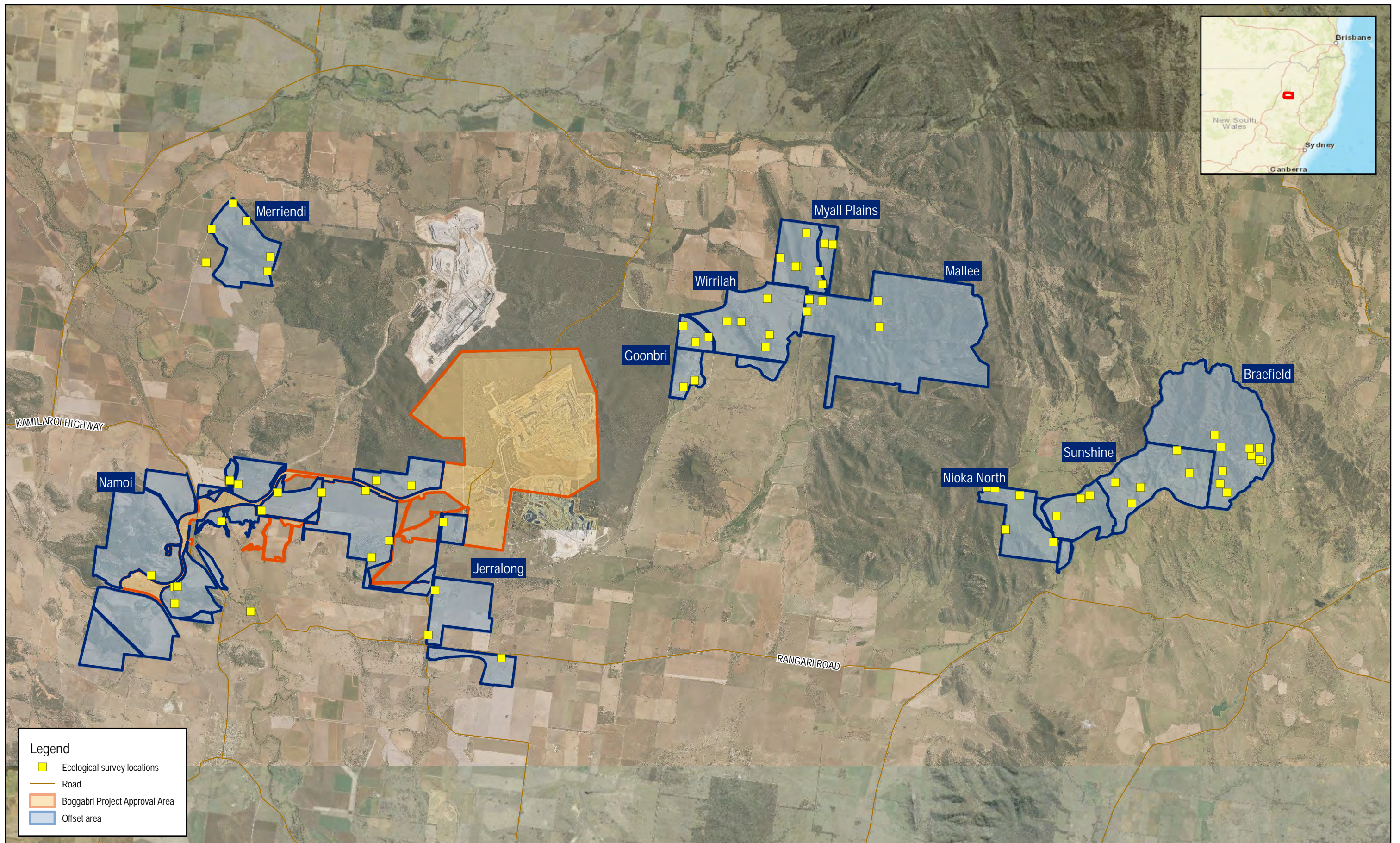
Habitat restoration works completed to date in the BOAs include:

- 2016: a trial revegetation area was established within the Namoi Offset Area (area south west of the Project, east of Leard State Forest Road and north of Goonbri Road).
- 2017: revegetation works commenced in habitat restoration zones of the Central Offset Area (Wirrilah BOA) and Namoi BOA (section north of the rail corridor and immediately south of Leard State Forest in vicinity of Merriown Mountain).
- 2018: revegetation works continued within the Namoi BOA, with approximately 651.6 ha of habitat restoration zones planted along the Namoi and Nagero Creek floodplain either side of the haul road from Merriown Mountain to the Kamilaroi Highway. A relatively small area was also revegetated west of the Kamilaroi Highway, in association with Ginns Leap. The 2018 restoration works included approximately 103.7 ha of State 2 Box Gum Woodland (native pastures).

1.2 AIMS OF THIS REPORT



The aims of this report are outlined below:

- Outline the monitoring results for the ten BOAs that form part of Boggabri Coal's BOS
- Outline the results of targeted surveys for Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat
- Provide results of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Community against BBAM vegetation type benchmark values, the State and Transition Model and EPBC Act Policy Statement 3.5.
- Provide a comparison of the 2018 monitoring results against biodiversity benchmark data collected during the 2015 baseline monitoring event and subsequent monitoring sessions.
- Provide a comparison of fauna attribute data against Leard State Forest analogue benchmarks in accordance with the Leard Forest Regional Biodiversity Strategy (Stage 2 Strategy Report) (Umwelt (Australia) Pty Limited 2017) and Boggabri Coal's 2018 BMP, which is currently under agency review for approval.
- Recommend potential mitigation or management actions that may be required based on the results of the 2018 (fourth year) biodiversity monitoring event.



Legend

- Ecological survey locations
- Road
- Boggabri Project Approval Area
- Offset area

Map: PS110420_GIS_BOA002_A1	Author: SuansriR		 1:125,000 Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3
Date: 7/03/2019	Approved by: - N. Cooper		
<small>Data source: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community</small>			



BIODIVERSITY OFFSET MONITORING

Figure 1.1
Locality plan

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2 METHODOLOGY

This section details the field methodologies used to completed the 2018 monitoring event, which represents the fourth successive year of monitoring all ten BOAs. This section also describes methods for data analysis used to derive results and trends.

2.1 CONTRIBUTORS AND QUALIFICATIONS

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2.1.

Table 2.1 Contributors and their roles

NAME	QUALIFICATON	ROLE
Alex Cockerill	BSc (Hons)	Lead Ecologist – technical lead
Nathan Cooper	BEnvSc, Grad Dip Ornith	Senior Ecologist – project management, field surveys, reporting and technical review
Tanya Bangel	BSc (Hons), DipConsLdMgt	Senior Ecologist – field surveys and reporting
Julia Wyllie	BSc	Ecologist – field surveys
Allan Richardson	BSc (Hons)	Senior Ecologist – field surveys and reporting
Clementine Watson	BEnvScMgt	Ecologist – field surveys and reporting
Troy Jennings	BSc, Dip Wildlife Mgt	Ecologist – field surveys
Lauren Smith	BSc	Graduate Ecologist – field surveys
Robert Suansari	BSc (GIS)	GIS Consultant – spatial data management and figure preparation

All work was carried out under the appropriate licences, including a Scientific Licence granted under Part 2 of the *Biodiversity Conservation Act 2016* (and as required under Clause 23 of the National Parks and Wildlife Regulation 2009), as well as Animal Research Authority issued by the NSW Department of Industry (NSW Department of Primary Industries).

2.2 FIELD SURVEY

The fourth year biodiversity monitoring of Boggabri Coal’s ten BOAs was completed over a single monitoring session. This monitoring session involved six WSP Ecologists completing flora and vertebrate fauna surveys over an 11 day and 10 night period between 15–25 October 2018. This field survey encompassed the survey methodologies outlined in between Section 2.2.2 and Section 2.2.4.4.

Targeted seasonal surveys for Swift Parrot, Regent Honeyeater and Corben’s Long-eared Bat were undertaken independently through the year as detailed in Section 2.2.4.5 and Section 2.2.4.6. A summary of the monitoring sites for each BOA is provided in Appendix A.

2.2.1 WEATHER CONDITIONS

Weather conditions during the 2018 monitoring event were typical of local conditions for October. Weather conditions were generally warm to hot with maximum temperatures reaching between 25°C and 34°C during the day; generally, with a minimum temperature between 12°C and 17°C. Rainfall was recorded on five survey days with a total of 50.2 mm received (Boggabri Post Office, Station 55007). Detailed weather conditions for the survey period sourced from the Gunnedah Airport AWS weather station (station 055202) (Bureau of Meteorology 2018) are provided in Appendix B.

Multiple storm systems were experienced during the survey period between Wednesday 17 October and Sunday 21 October, which affected the delivery of the monitoring program (refer to limitations in Section 10).

2.2.2 BASELINE MONITORING AND SITE SELECTION

The baseline methodology adopted a 'Beyond BACI' style experimental design (Underwood 1992) to measure environmental change in response to various biodiversity management measures. This design utilises multiple control sites to account for natural spatial and temporal variability, with BACI referring to Before/After Control/Impact and the 'beyond' element relating to the use of multiple control sites instead of just one.

The use of a 'Beyond BACI' style experimental design allows for the quantification of changes to biological assemblages through time. The detection of change is measured as an interaction between spatial and temporal components of variation against a variable background. To determine baseline conditions replicate monitoring sites were surveyed in each vegetation community and condition class (vegetation zone); including representation of each management zone.

Following successive monitoring events, it is anticipated that replicate monitoring sites in habitat management zones and values within the BBAM Vegetation Benchmarks Database (Office of Environment and Heritage 2014) will be adopted as a benchmark for the performance criteria detailed in the Boggabri Coal BMP (WSP | Parsons Brinckerhoff 2017) and Leard State Forest Regional Biodiversity Strategy: Stage 2 – Strategy Report (Umwelt 2017).

Importantly, the location of replicate monitoring sites and subsequent discussion of 2015 baseline monitoring results followed vegetation mapping and community descriptions for BOAs outlined in Boggabri Coal's BOS (WSP 2017). An outcome of an audit completed on Boggabri Coal's BOAs was a modified vegetation community map; a corollary of which included some modification to the occurrence of Box Gum Woodland and respectively assessments against the State and Transition model. Discussion of vegetation attributes and the location and state of Box Gum Woodland are reflected in the modified figures provided in this document.

2.2.2.1 MONITORING LOCATIONS

The location of each replicate monitoring site is illustrated in Section 3 to Section 6. Within each vegetation zone, monitoring sites were placed randomly by marking points on satellite imagery. In the field, transects/plots were established at the predetermined locations or where necessary repositioned to achieve a representative sample of the vegetation. Due to safety and access restrictions, not all vegetation types were able to be sampled. Replicate monitoring sites were marked with a metal stake from which sampling occurs.

MONITORING OF EXISTING BOA PROPERTIES

Biodiversity monitoring of Boggabri Coal's BOAs began in 2012 within each of the five original BOAs (Mallee, Merriendi, Myall Plains, Namoi and Wirrilah). During the 2012 baseline monitoring surveys 38 monitoring sites were established across these BOAs using the methodology detailed below.

During the 2014 monitoring session two replicate monitoring sites were relocated:

- Namoi Site 15 – stake removed and relocated immediately adjacent within similar Yellow Box – Blakely's Red Gum grassy woodland.
- Wirrilah Site 2 – removed by Goonbri Road Upgrade and relocated immediately to adjacent paddock within similar grassland vegetation.

During the 2015 monitoring session (representing new baseline data), an additional five BOAs were introduced into Boggabri Coal’s BOS and BMP (Nioka North, Sunshine, Braefield, Jerralong and Goonbri). Subsequently, 17 new replicate monitoring sites were established in the new BOAs, whilst three existing monitoring sites from the Namoi BOA were relocated into the new Jerralong BOA:

- Nioka North BOA – six new replicate monitoring sites established (Figure 3.1)
- Sunshine BOA – five new replicate monitoring sites established (Figure 3.2)
- Braefield BOA – six new replicate monitoring sites established (Figure 3.3)
- Jerralong BOA – three existing Namoi BOA monitoring sites relocated (Figure 5.1) to within the Jerralong BOA (i.e. Na1, Na2 and Na7 and now identified as Na1a, Na2a and Na7a).

During the 2016 monitoring session, a single monitoring location Namoi BOA (Na15) was not sampled as its location no longer formed part of the project’s BOS. This replicate monitoring site (Na15) was subsequently repositioned within the Namoi BOA in the same vegetation community during the 2017 monitoring event.

Due to modifications to the Western BOA (Merriendi property) boundary, replicate monitoring site Merriendi 5 (Me5) was relocated to ensure it was situated within the BOA boundary during the 2017 monitoring event (now identified as Me5a).

During the 2018 monitoring session, five new monitoring sites were established within the Namoi (Na16 and Na17), Wirrilah (W7) and Goonbri (G1 and G2) BOAs. These sites were established to provide further data on the success (or otherwise) of restoration efforts on improving connectivity and fauna usage within the landscape.

2.2.3 FLORA SURVEY

2.2.3.1 VEGETATION PLOT/TRANSECT

The flora monitoring involved the completion of 60 quantitative transect/plot surveys in accordance with a modified version of the methodology contained within the BBAM (Office of Environment and Heritage 2014). The methodology completed at each monitoring location is summarised below in Table 2.2 and Figure 2.1.

Table 2.2 Attributed measures in each transect/plot

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
Canopy	Species richness	20 x 20 m plot	A count of the total number of canopy species.
	Percentage canopy cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the canopy.
	Number of trees with hollows	50 x 20 m plot	A count of the total number of living and dead trees with at least one hollow.
	Regeneration	50 x 20 m plot	The proportion of canopy species regenerating (i.e. seedlings/saplings).
	Stem classes	50 x 20 m plot	Total stem count of canopy species within specific DBH classes (i.e. <5 cm, 5-9 cm, 10-19 cm, 20-29 cm, 30-49 cm, 50-79 cm, >80 cm).

VARIABLE	ATTRIBUTE	PLOT OR TRANSECT TYPE	DESCRIPTION
Midstorey	Species richness	20 x 20 m plot	A count of the total number of midstorey species.
	Percentage Midstorey cover	Measured at 10 points along 50 m line transect (i.e. every 5 m)	An estimate of percent foliage cover for the midstorey.
Ground layer	Species richness	20 x 20 m plot	A count of the total number of ground cover species.
	Percentage native ground cover (grasses)	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	Records of whether native grass intersects defined points along the transect to derive percentage cover.
	Percentage native ground cover (shrubs)		Records of whether native shrubs intersect defined points along the transect to derive percentage cover.
	Percentage native ground cover (other)		Records of whether native other (forbs, ferns, etc.) intersects defined points along the transect to derive percentage cover.
	Coarse woody debris (fallen logs)	50 x 20 m plot	Total number and combined length of all sections of dead fallen timber ≥ 10 cm diameter, ≥ 0.5 m in length, and completely detached from living or dead standing trees.
Weed species	Species richness	20 x 20 m plot	Total number of weed species.
	Percentage cover	Measured at 50 points along a 50 m line transect (i.e. every 1 m)	An estimate of percent foliage cover for weed species in the canopy and midstorey. Records of whether ground cover weeds intersect defined points along the transect to derive percentage cover.
Callitris regrowth	Density	20 x 20 m plot	Total number of Callitris stems based on height classes (i.e. <1 m, 1–2 m, 2–5 m, 5–10 m, 10–15 m and 20–25 m).

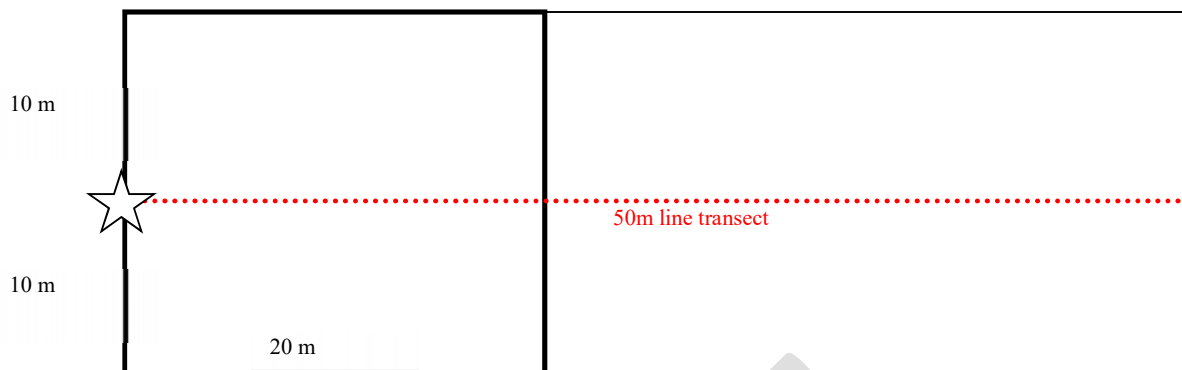


Figure 2.1 Transect/plot design

2.2.3.2 ASSESSMENT OF BOX GUM WOODLAND

A key element of the monitoring within the BOAs was to determine the condition of Box Gum Woodland remnants in accordance with the State and Transition model for box gum grassy woodlands. The box gum woodland vegetation within the BOAs was delineated into States as follows:

- State 1: Grassy woodland
- State 2: Native pastures and woodland
- State 3: Fertilised pastures
- State 4: Crops and sown pastures
- State 5: Revegetated areas.

The State and Transition model was used during the monitoring of the BOAs to develop a baseline for Box Gum Woodland patches to enable identification of any transition from a state to be detected in the future after management actions have begun. The indicators outlined in Table 2.3 were used to determine the current state of the vegetation within the BOAs (for States 1–3) and will be used to determine any transition between states as monitoring progresses. The current states of Box Gum Woodland within each BOA is mapped in Section 3 to Section 6 for each BOA.

Table 2.3 Indicator species to be used for State 1-3 within BOAs

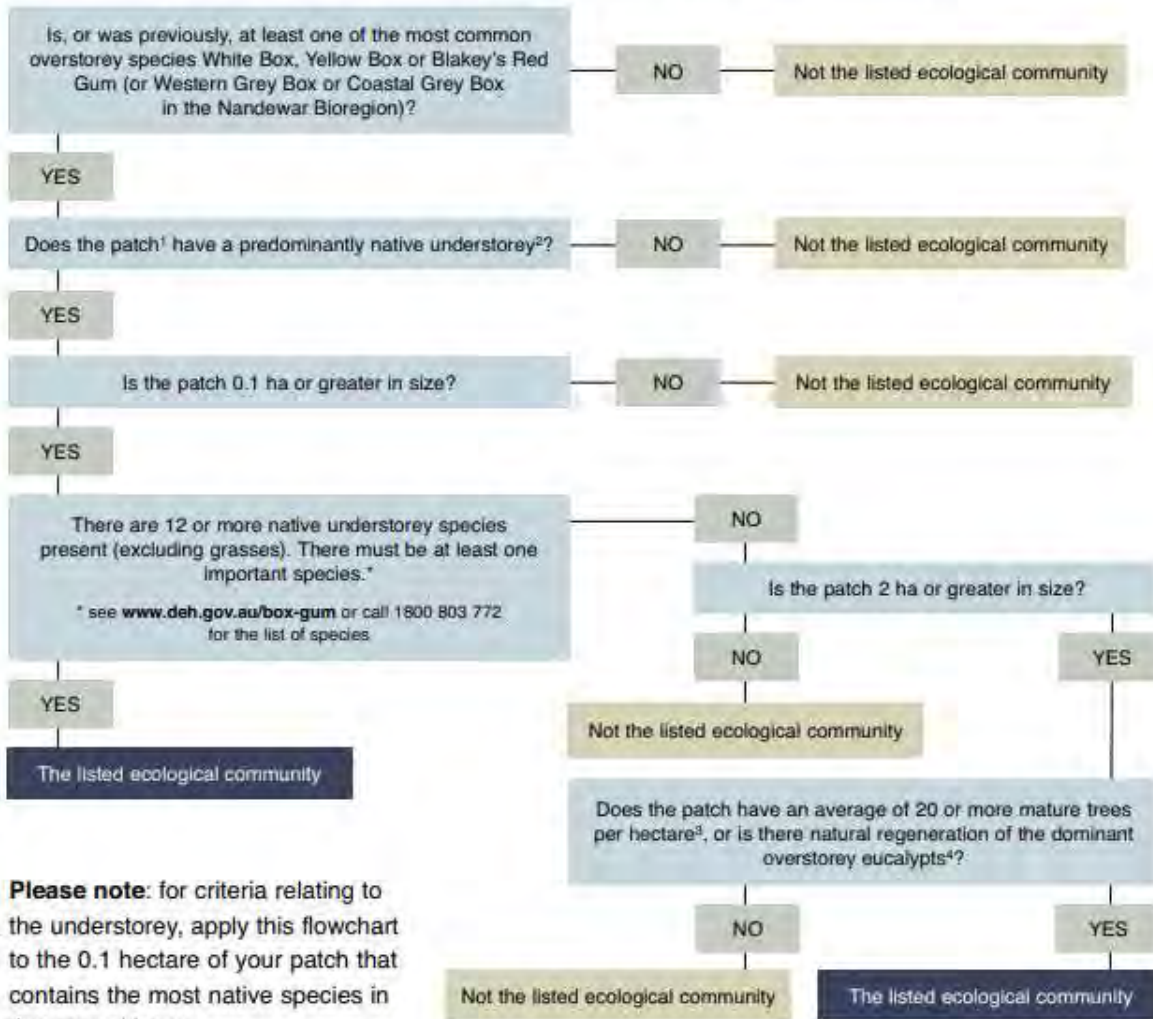
VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Canopy	A range of ages, from mature trees with hollows to seedlings.	The dominant canopy species are present, with a good representation of tree ages (excludes derived grasslands).	Canopy species are still present in woodlands though there are few young trees and seedlings.

VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Shrubs	<p>Many of the leguminous (pod-bearing) shrubs are found only in State 1. Due to their high nutritional value, young plants are quickly grazed out in other states.</p> <p>Examples include Wattles (<i>Acacia</i> spp.), Indigos (<i>Indigofera</i> spp.), Common fringe-myrtle (<i>Calytrix tetragona</i>), Bush-peas (e.g. <i>Pultenaea</i> spp., <i>Daviesia</i> spp., <i>Dillwynia</i> spp.), and Cryptandras (<i>Cryptandra</i> spp.).</p>	<p>While many shrubs are still present in State 2, they are likely to be mostly the colonising species like Cassinias. Grazing-sensitive shrubs such as most of the wattles, the indigos and cryptandras are probably no longer present unless protected. Examples include some heaths, such as urn heath (<i>Melichrus urceolatus</i>) and peach heath (<i>Lissanthe strigosa</i>) persist where protected, and Grey Guinea-flower (<i>Hibbertia obtusifolia</i>).</p>	<p>Most shrubs in State 3 will be exotic. Native shrubs that persist in State 3 are those that are highly unpalatable due to thorns or other features.</p> <p>Examples include Blackthorn (<i>Bursaria spinosa</i>), and Cassinias, Chinese shrub, sifton bush, etc. (<i>Cassinia</i> spp.).</p>
Groundcover – forbs (wildflowers)	<p>Plants with tall, flowering stems which are sensitive to grazing may only be found in State 1 including many lilies, orchids and daisies.</p> <p>Examples include Native flax (<i>Linum marginale</i>), Donkey orchids (<i>Diuris</i> spp.) and sun orchids (<i>Thelymitra</i> spp.), and Yam daisy/murrnong (<i>Microseris lanceolata</i>).</p>	<p>Forbs are transitional in form, between the tall, fleshy plants found in State 1 and those of shorter stature that are often found in State 3. State 2 forbs will often have persistent root stock, tough, rough or hairy leaves, which makes them more resistant to grazing.</p> <p>Examples include Sedges (<i>Carex</i> spp.), Mat-rushes (<i>Lomandra</i> spp.), Early Nancy (<i>Wurmbea dioica</i>), Chocolate lilies (<i>Dichopogon</i> spp.), Common buttons (<i>Chrysocephalum apiculatum</i>), Native plantains (<i>Plantago</i> spp.), Common raspwort (<i>Gonocarpus tetragynus</i>).</p>	<p>In general, the groundcover in State 3 will have traits adapted to elevated nutrients, competition and grazing. These plants will be annuals (a), short-lived perennials (spp.), short-flowering (sf), rosette forming (r) or stoloniferous (st).</p> <p>Examples include Bluebells (<i>Wahlenbergia</i> spp.) (spp.), New Holland daisies (<i>Vittadinia</i> spp.), Austral sunray (<i>Triptilodiscus pygmaeus</i>) (a), Blue heron's-bill (<i>Erodium crinitum</i>) (a), Austral bear's-ear (<i>Cymbonotus lawsonianus</i>) (r), Solenogyne (<i>Solenogyne</i> spp.) (r), Kidneyweed (<i>Dichondra repens</i>) (st).</p>

VARIABLE	INDICATORS		
	STATE 1	STATE 2	STATE 3
Groundcover — grasses	<p>Grasses that are typically sensitive to grazing will only persist in State 1.</p> <p>These include Kangaroo grass, Barbed-wire grass (<i>Cymbopogon refractus</i>), Wild sorghum (<i>Sorghum leiocladum</i>).</p>	<p>Many of the warm-season and highly grazing sensitive grasses found in State 1 are no longer present in State 2.</p> <p>Common State 2 grasses include Nine-awn grass (<i>Enneapogon nigricans</i>), Plume-grasses (<i>Dichelachne spp.</i>) and Common wheat-grass (<i>Elymus scaber</i>).</p>	<p>There are many native grasses that become more common with grazing. In State 3, these species will move towards co-dominance with the exotics that are present.</p> <p>Some examples include Weeping grass (<i>Microlaena stipoides</i>), Red grass (<i>Bothriochloa macra</i> or <i>B. decipiens</i>), Wallaby grasses (<i>Austrodanthonia spp.</i>), Purple wire-grass (<i>Aristida ramosa</i>).</p>
Exotic species	<p>Occasional woody weeds from seeds carried in bird droppings.</p>	<p>Shrubs including Blackberry (<i>Rubus fruticosus</i>), Briar rose (<i>Rosa rubiginosa</i>), and African box-thorn (<i>Lycium ferocissimum</i>).</p> <p>Groundcovers including Paterson’s curse (<i>Echium plantagineum</i>), Capeweed (<i>Arctotheca calendula</i>), Fescues (<i>Vulpia spp.</i>), Bromes (<i>Bromus spp.</i>), Coolatai grass (<i>Hyparrhenia hirta</i>), African love-grass (<i>Eragrostis curvula</i>), and Thistles (various species).</p>	<p>Exotic species commonly found in State 3 are similar to those in State 2 but more abundant.</p>

Box Gum Woodland monitoring sites were further assessed against the EPBC Act Policy Statement Statement 3.5 for the EPBC Act listed White Box – Yellow Box – Blakey’s Red Gum grassy woodlands and derived native grasslands (5.2). This assessment was used to determine whether Box Gum Woodland monitoring sites within the BOAs meet the EPBC Act condition thresholds and therefore whether they are consistent with the critically endangered ecological community.

Determining if your land has an area of the listed ecological community



Please note: for criteria relating to the understorey, apply this flowchart to the 0.1 hectare of your patch that contains the most native species in the ground layer.

- ¹ Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:
 - an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
 - the area over which the understorey is predominantly native.
 Patches must be assessed at a scale of 0.1 ha (1000m²) or greater.
- ² A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)
- ³ Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.
- ⁴ Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Figure 2.2 EPBC Act Box Gum Woodland assessment

2.2.3.3 CYPRESS PINE DENSITY ASSESSMENT

White Cypress Pine (*Callitris glaucophylla*) regeneration can be prolific in certain circumstances sometimes forming dense monospecies stands which are characterised by a bare understorey and a lack of other native species recruitment. Cypress Pine inhibits the recruitment and establishment of species via outcompeting other species for resources such as light and space by shading and layering of pine needles. Where Cypress Pine density is high, active management to reduce the number of stems per hectare is sometimes required to encourage the successful germination and establishment of other native species.

There are many previous studies which have investigated different criteria to define density thresholds for Cypress Pine. In considering these studies, the Natural Royal Commission (2014) has developed a framework for ecological thinning based on density thresholds as identified below in Table 2.4. A mean of Treatment 1 and Treatment 2 (i.e. 650 stems per/hectare) was used as a density threshold in this report to determine whether ecological thinning of Cypress Pine may be required at each monitoring location.

Following this assessment, a review of other vegetation attributes collected (i.e. data collected in Table 2.2) and BBAM vegetation type benchmarks was completed to identify whether the high densities of Cypress Pine were likely to be inhibiting the recruitment of canopy species and percentage cover of groundcover species.

Table 2.4 Framework for ecological thinning and potential treatment levels

TYPE OF ECOLOGICAL THINNING	POTENTIAL TREATMENT LEVELS		
	Treatment 1	Treatment 2	Treatment 3
Thinning vegetation regrowth to a uniform, predetermined level	1,000 stems per ha (3 m tree spacing)	300 stems per ha (6 m tree spacing)	150 stems per hectare (8 m tree spacing)
Thinning of trees to open dense stands (in some cases around specified features such as habitat trees)	10 m squared basal area per ha	8 m squared basal area per ha	6 m squared basal area per hectare
Comment	<ul style="list-style-type: none"> — Promotes successful seed germination and abundant grasses — Promotes understorey growth and a positive biodiversity response 		<ul style="list-style-type: none"> — Trending towards pre-European density levels — Higher than nominated stem densities for dry sclerophyll forest (200 per hectare) and white/black cypress pine (20 per hectare).

Source: Table 24 from Brigalow and Nandewar State Conservation Areas: Actively managing for better ecological outcomes (Natural Resources Commission 2014).

Bold indicates values used to determine density threshold used in this report.

2.2.4 VERTEBRATE SURVEY

Vertebrate fauna monitoring focused on diurnal bird surveys and microbat surveys (Anabat recordings). Spotlighting and call playback for nocturnal birds and mammals was also completed, however they were typically completed at replicate monitoring sites associated with habitat management zones. This reduced effort for spotlighting and call playback is a result of time constraints, fatigue management and the remote access of some BOAs. Each method employed is described in the following sections. Table 2.5 provides an overview of fauna survey methods used.

Table 2.5 Variables measured during fauna monitoring

SPECIES/GROUP	METHODS	EFFORT PER SITE	FREQUENCY	SEASON
Diurnal birds	2 ha area search	20 minutes each for two mornings/afternoons per monitoring site	Annual	Spring – Summer
Nocturnal birds	Call playback	5 minutes of call broadcast, 10 minutes listening in habitat management zone per BOA	Annual	Spring – Summer
Microchiropteran bats	Ultrasonic call detection (Anabat)	2 consecutive nights of passive recording per monitoring site	Annual	Spring – Summer
Nocturnal Mammals	Spotlighting	20 min in habitat management zones per BOA	Biennial	Spring – Summer
Targeted Regent Honeyeater and Swift Parrot survey	Area searches targeting <i>Eucalyptus albens</i> blossom	Refer Section 2.2.4.5	Annual	Winter
Targeted Corben's Long-eared Bat survey	Harp trapping	2 trap nights per site	Annual	Summer

2.2.4.1 DIURNAL BIRDS

The diversity and abundance of birds was recorded at each replicate monitoring site using 20 minute, 2 ha census methodology. Surveys were generally completed within an 80 m radius of the fixed monitoring site, with sampling occurring within the same vegetation type and habitat management zone. As far as practicable, bird surveys were completed during periods of high bird activity; predominately early morning or late afternoon. Surveys were completed at each sample site twice on separate days by an experienced ecologist, with birds identified to species level on call recognition and/or observation. Opportunistic records were collected within each BOA during the entire monitoring period.

2.2.4.2 MICROCHIROPTERAN BATS

Passive Ultrasonic Anabat Bat detection (Anabat SD1/SD2 or Anabat Express unit – Titley Scientific, Brendal QLD) was used to record and identify the echolocation calls of microchiropteran bats foraging at each replicate monitoring site. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night over two consecutive nights.

Anabat Bat detectors recorded bat vocalisations throughout the full night, with the recording starting before dusk. Bat activity throughout the night does vary (Taylor and Oneill 1988, Department of Environment and Conservation 2004), but the peak in activity is usually within a few hours of dusk. For this study the sampled population was defined as those active up to two hours after last light. Bat activity is used as a substitute for abundance, and is based on the number of

microchiropteran bat calls recorded during the survey period, including those calls assigned to a species complex (i.e. not positively attributable to an individual species). Calls were analysed using Analook (Version 4.7) software with reference to ‘Bat Calls of NSW: Region Based Guide to the Echolocation Calls of Microchiropteran Bats’ (Pennay, Law et al. 2004).

2.2.4.3 CALL PLAYBACK

Call playback was used to survey for the Barking Owl, Powerful Owl, Masked Owl, Squirrel Glider and Koala considering the methods of Kavanagh and Debus (1994) and Debus (1995). Call playback surveys involved broadcasting recordings of the vocalisations of animals to elicit a response, either vocal or behavioural. At each call playback site an initial ten minute listening period was undertaken followed by a five minute call broadcast and then a five minute listening and spotlighting period. A final listening period of ten minutes was undertaken after call broadcasting was concluded. Calls were broadcast using a portable MP3 player and amplified through a megaphone. Call playback was completed in conjunction with spotlighting surveys by two Ecologists.

2.2.4.4 SPOTLIGHTING

Spotlighting was completed at each monitoring site associated with habitat management zones (Table 2.6). Survey were completed on foot by two ecologists, targeting arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. At least one person hour of survey effort was completed per monitoring site.

Table 2.6 Nocturnal survey completed during 2018 monitoring event

BIODIVERSITY OFFSET AREA	REPLICATE MONITORING SITE	DATE
Merriendi	Me1, Me3, Me4	16 October 2018
Namoi	N1, N2, N3, N4, N9, N12, N14	16–17 October 2018
Goonbri	G2	17 October 2018
Wirrilah	W1, W4, W5	17–18 October 2018
Myall Plains	My2, My4, Ma6	18 October 2018
Mallee BOA	Ma2, Ma3, Ma4	
Nioka North	Ni1, Ni4	19 October 2018
Braefield	B1, B3, B5	

2.2.4.5 TARGETED SWIFT PARROT AND REGENT HONEYEATER SURVEY

The distribution of blossom nomads, such as the Swift Parrot and Regent Honeyeater, is reliant upon the distribution of blossom and lerps at any one time. The distribution of blossom and lerp varies considerably season to season in response to climatic variations and tree species cyclic blossoming intervals. Due to variations in the distribution of blossom from year to year their distribution may shift from the NSW western slopes to the coast or in the tablelands. Therefore, whilst they can occur throughout much of NSW, Victoria and south-east Queensland they are likely only to reside in areas where blossom and lerp resources are plentiful (i.e. may occur in discrete areas where localised resources occur such as winter flowering Eucalypts).

Both the Regent Honeyeater and Swift Parrot are rare species; with Swift Parrots blending all too easily into canopy foliage and Regent Honeyeaters characterised by relatively quiet dispositions and so not easily detectable for bird surveyors to pick up.

Therefore, survey methodologies for these species rely heavily on observing the distribution of blossom resources and other associated indicators, such as the occurrence of high nectarivorous bird density and diversity.

With the ecology of the birds and associated nectarivorous species in mind, surveys conducted within the BOA's concentrate on patches of tree species, which the birds are likely to use. During the winter period when Swift Parrots are present on the mainland, the key nectar producing tree species in the Boggabri area is *Eucalyptus albens* (White Box).

Therefore, surveys involve checking White Box patches throughout the BOAs for the presence of blossom and nectarivorous bird activity to determine the likelihood that Swift Parrots and Regent Honeyeaters might be present locally. Targeted surveys for Regent Honeyeaters and Swift Parrots were undertaken over two sessions in June and August.

Where blossom and nectarivorous bird densities were elevated, opportunistic surveys in combination with formal 20 minute surveys were conducted to detect the potential presence of Swift Parrots or Regent Honeyeaters.

2.2.4.6 TARGETED CORBEN'S LONG-EARED BAT

Like other Long-eared Bat species Corben's Long-eared Bat (*Nyctophilus corbeni*) uses understorey strata for foraging and they roost in hollow-bearing trees. Although many microchiropteran bat species are detectable through use of Anabat call detection methodologies, the vocal differences between *Nyctophilus* spp. are too subtle to reliably differentiate between the various species occurring in the locality of the BOAs. Therefore, surveys for Corben's Long-eared Bat needed to be conducted with a methodology that enabled bats to be identified in the hand.

Harp traps are excellent for capture and release of microchiropteran bats and they are well suited to the capture of *Nyctophilus* spp. due to their propensity to use lower forest strata for their foraging habits. Site selection for the setting of harp traps included a number of rationale, such as targeting of those areas where *Nyctophilus* spp. had been previously detected during previous monitoring programs, woodland habitats in areas where hollow-bearing trees provide potential roosting sites and where suitable flyways were detected in forest and woodland settings.

Harp traps were set at each location over a two-consecutive night period during November and December, 2018 and January 2019 (surveys best conducted between October and April).

Captured bats were identified to species level, sexed, measured and weighed. Bats were released immediately after processing during dark conditions.

2.3 DATA ANALYSIS

Boggabri Coal operates under its currently approved Biodiversity Management Plan (WSP | Parsons Brinckerhoff 2015). This BMP was significantly revised in 2018, which is currently under regulatory review, to incorporate monitoring methodologies and performance and completion criteria nominated in the Leard Forest Regional Strategy Stage 2 Document (Umwelt (Australia) Pty Limited 2017) for the BOAs. The 2018 BMP nominated that Analogue benchmark data from Leard State Forest would be used to analyse fauna attribute data, whilst BBAM benchmarks would be used for plant community types.

2.3.1 LEARD STATE FOREST ANALOGUE BENCHMARK DATA

The Leard State Forest analogue benchmark data is derived from seven years (2012-2018) of data associated with a Before After Control Index (BACI) biological monitoring program in Leard State Forest. The data presented Table 2.7 is averaged from four long-term replicate monitoring sites representing each of the two broad vegetation types occupying Leard State Forest including:

- Shrubby woodland/forest on skeletal soils – BACI monitoring sites LSF1 and LSF4
- Grassy woodland (Box Gum Woodland) – BACI monitoring sites LSF2 and LSF3.

In accordance with the Leard Forst Regional Strategy (stage 2 document) and Boggabri Coal's Biodiversity Management Plan (WSP 2018) (which is currently under agency review for approval), this data will be used for comparative analysis of fauna attributes associated with the BOAs.

Table 2.7 Leard State Forest analogue benchmark data

BIODIVERSITY ATTRIBUTE	LEARD STATE FOREST AVERAGE (2012–2018)		
	Shrubby woodland/forest	Grassy woodland	Combined average
Diurnal bird species richness	13.7	14.6	14.1
Diurnal bird abundance	26.1	31.6	28.9
Microchiropteran bat species richness	5.2	4.1	4.6
Microchiropteran bat activity	82.3	60.5	71.4

2.3.2 BBAM BENCHMARK DATA

The BioBanking Assessment Methodology (BBAM) 2014 vegetation type benchmarks were used for comparative analysis of biodiversity attributes within the BOAs in accordance with Boggabri Coal'sss BMP (WSP 2018).

The BOAs encompass a diversity of plant community types all of which have differing BBAM benchmark values. Due to the infancy of the restoration program associated with BOAs, a collective mean of each vegetation attribute for all vegetation types specified above was determined for the purposes of allowing a comparison of data. The mean BBAM benchmarks are provided in the results section of this report.

3 EASTERN OFFSET AREA – 2018 RESULTS

3.1 INTRODUCTION

The Eastern Offset Area encompasses the Braefield, Sunshine and Nioka North BOA properties which collectively cover approximately 2,996.3 ha and are located approximately 15 km east of the project (Figure 1.1). The Eastern Offsets lie within the Nandewar Range and form part of the eastern section of the Regional East-West Wildlife Corridor. The most intact areas of woodland habitat occur in the west and east of the Eastern Offsets (predominantly within the Nioka North and Braefield BOA). The understorey vegetation on the lower slopes does however exhibit the effects of grazing, including large areas of the Sunshine BOA. Elsewhere throughout the BOAs, remnant woodland trees are largely scattered or form residual patches along drainage lines or regrowth covering on hills.

The vegetation and management zones within the Eastern Offset Area are illustrated in Figure 3.1, Figure 3.2 and Figure 3.3.

3.2 FLORA

190 plant species were recorded within the Eastern Offsets during the 2018 monitoring session. Of these, 129 (68%) were native and 61 (32%) were exotic (Table C.1, Table C.2 and Table C.3 of Appendix C). The most diverse families recorded were the Poaceae with 37 species followed by the Asteraceae with 34 species. No threatened flora species have been recorded within the Eastern Offsets to date.

Of the 61-exotic species recorded in 2018, two species were previously listed as noxious weeds under the *Noxious Weeds Act 1993* (Table 3.1). The *Noxious Weeds Act 1993* has since been repealed and replaced by the *Biosecurity Act 2015* under which noxious weeds are replaced by priority weeds. One introduced species listed as a priority weed within the North West Local Land Services (LLS) control region was recorded within the Eastern Offsets during 2018; *Opuntia stricta**. This species is also listed as a Weed of National Significance (WONS).

Table 3.1 Noxious weeds recorded within the Eastern Offset Area

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY (NW ACT)	PRIORITY WEEDS (BA ACT)	WONS	2015	2016	2017	2018
Prickly Pear	<i>Opuntia stricta</i> *	4	Yes	Yes	✓	✓	✓	✓
Mexican Poppy	<i>Argemone mexicana</i> *	5	No	No	✓	✓	✓	✓

The Eastern Offsets also contained other invasive species which occurred abundantly throughout the BOAs. These species included common pasture grass species (such as *Vulpia spp.* and *Lolium perenne** (Perennial Rye Grass)), thistle species (such as *Carthamus lanatus** (Saffron Thistle), *Cirsium vulgare** (Spear Thistle), *Centaurea melitensis** (Maltese Thistle), *Onopordum acanthium** (Scotch Thistle) and *Lactuca serriola** (Prickly Lettuce)) and common herbaceous herbs and forbs commonly found in pastures (including *Arctotheca calendula** (Cape Dandelion), *Alternanthera pungens** (Khaki Weed), *Hedypnois rhagadioloides** (Cretan Weed), *Sysymbrium spp.**, *Rapistrum rugosum** (Turnip Weed), *Petrorhagia nanteuilii** (Childling Pink) as well as *Trifolium** and *Medicago* species*).

Whilst these species are not listed under the *Biosecurity Act 2015* management of these species should still be considered.

3.3 FAUNA

The 2018 monitoring event recorded 137 species of animal within the Eastern BOAs, including 130 native species and seven introduced species (Table 3.2, Table D.1 to Table D.3 of Appendix D).

Table 3.2 Summary of terrestrial animal species identified in the Eastern Offset Area

GROUP	SPECIES RICHNESS	
	Native	Introduced
Birds	104	2
Microbats	15	0
Mammals (non-microbats)	4	5
Reptiles	3	0
Amphibians	4	0
Total	130	7

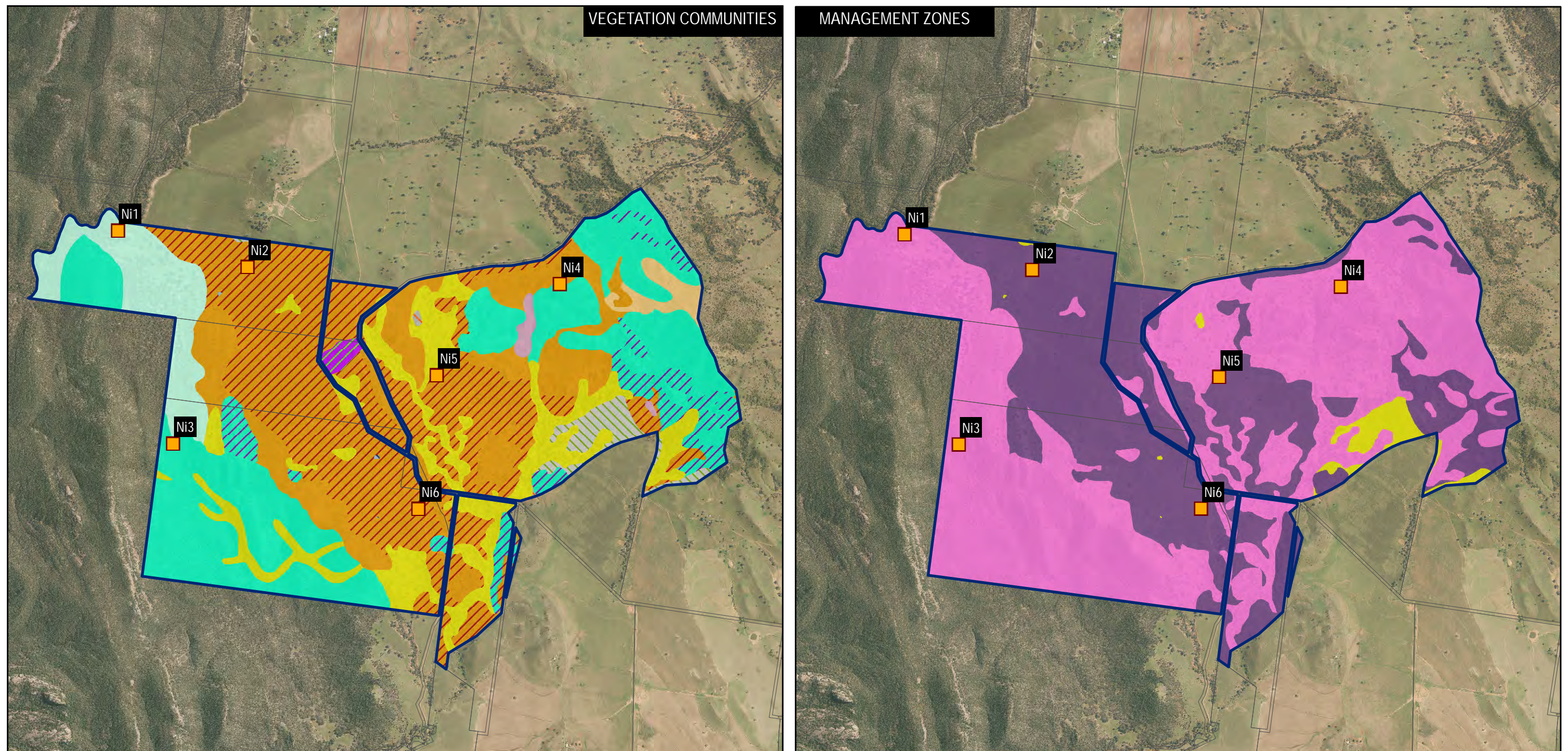
A total of 13 threatened species were recorded within the Eastern Offsets during 2018 monitoring; encompassing the BOA monitoring program, targeted Swift Parrot and Regent Honeyeater surveys, and targeted Corben's Long-eared Bat surveys (Table 3.3, Table D.1 to Table D.3 of Appendix D).

Table 3.3 Threatened species recorded within the Eastern Offset Area

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	BC ACT	2015	2016	2017	2018
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	–	V	✓	✓	✓	✓
Dusky Woodswallow	<i>Artamus cyanopterus</i>	–	V			✓	✓
Speckled Warbler	<i>Chthonicola sagittata</i>	–	V	✓	✓	✓	✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>	–	V	✓	✓	✓	✓
Little Lorikeet	<i>Glossopsitta pusilla</i>	–	V	✓	✓	✓	✓
Hooded Robin	<i>Melanodryas cucullata</i>	–	V		✓	✓	✓
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	–	V		✓		
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	–	V	✓	✓	✓	✓
Turquoise Parrot	<i>Neophema pulchella</i>	–	V	✓	✓	✓	✓
Diamond Firetail	<i>Stagonopleura guttata</i>	–	V		✓	✓	✓
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	–	V	✓	✓	✓	✓
Squirrel Glider	<i>Petaurus norfolcensis</i>	–	V	✓			
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	–	V	✓	✓	✓	✓
Northern Free-tailed Bat	<i>Mormopterus lumsdenae</i>	–	V				✓
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V			✓	✓
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V			✓	

VEGETATION COMMUNITIES

MANAGEMENT ZONES



<ul style="list-style-type: none"> Ecological survey locations Offset boundary Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245] Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165] 	<ul style="list-style-type: none"> Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165] Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197] White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1308/NA225] 	<ul style="list-style-type: none"> White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226] White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226] White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion - Derived Native Grassland [PCT1307/NA224] 	<ul style="list-style-type: none"> Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237] Miscellaneous Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Low Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Not applicable (crop land) Miscellaneous Ecosystems - water bodies, rivers, lakes, streams (not wetlands), Not applicable (crop land) 	<ul style="list-style-type: none"> Management zones Corridor enhancement zone Habitat management zone Habitat restoration zone
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Map: PS110420_GIS_BOA003_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N. Cooper

Scale: 1:27,500
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



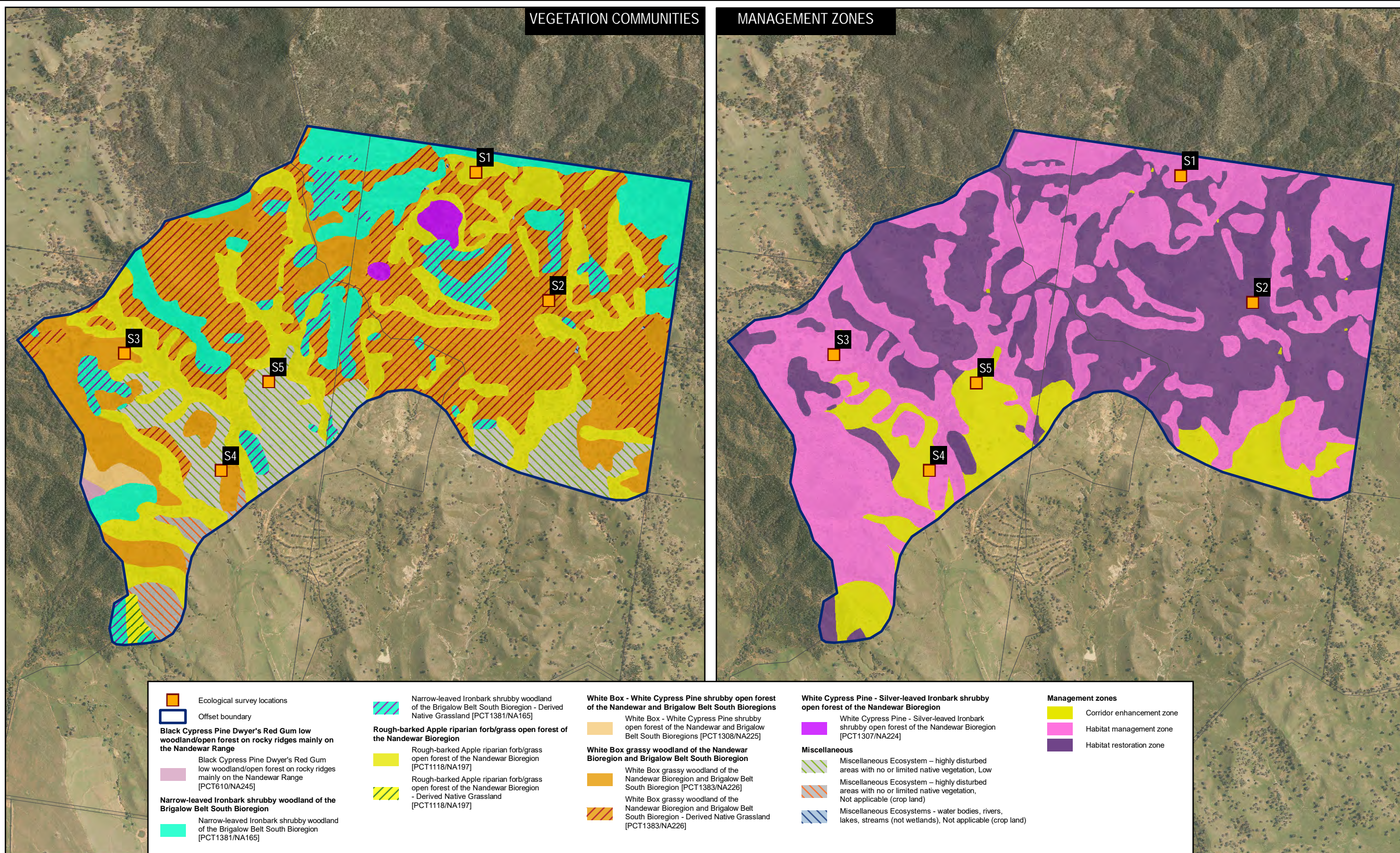
BIODIVERSITY OFFSET MONITORING

Figure 3.1
 Vegetation communities and management zones
 - Nioka North BOA

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VEGETATION COMMUNITIES

MANAGEMENT ZONES



Ecological survey locations	Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165]	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1308/NA225]	White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion [PCT1307/NA224]	Corridor enhancement zone
Offset boundary	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]	White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]	Miscellaneous Ecosystem – highly disturbed areas with no or limited native vegetation, Low	Habitat management zone
Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion - Derived Native Grassland [PCT1118/NA197]	White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]	Miscellaneous Ecosystems - water bodies, rivers, lakes, streams (not wetlands), Not applicable (crop land)	Habitat restoration zone
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]				

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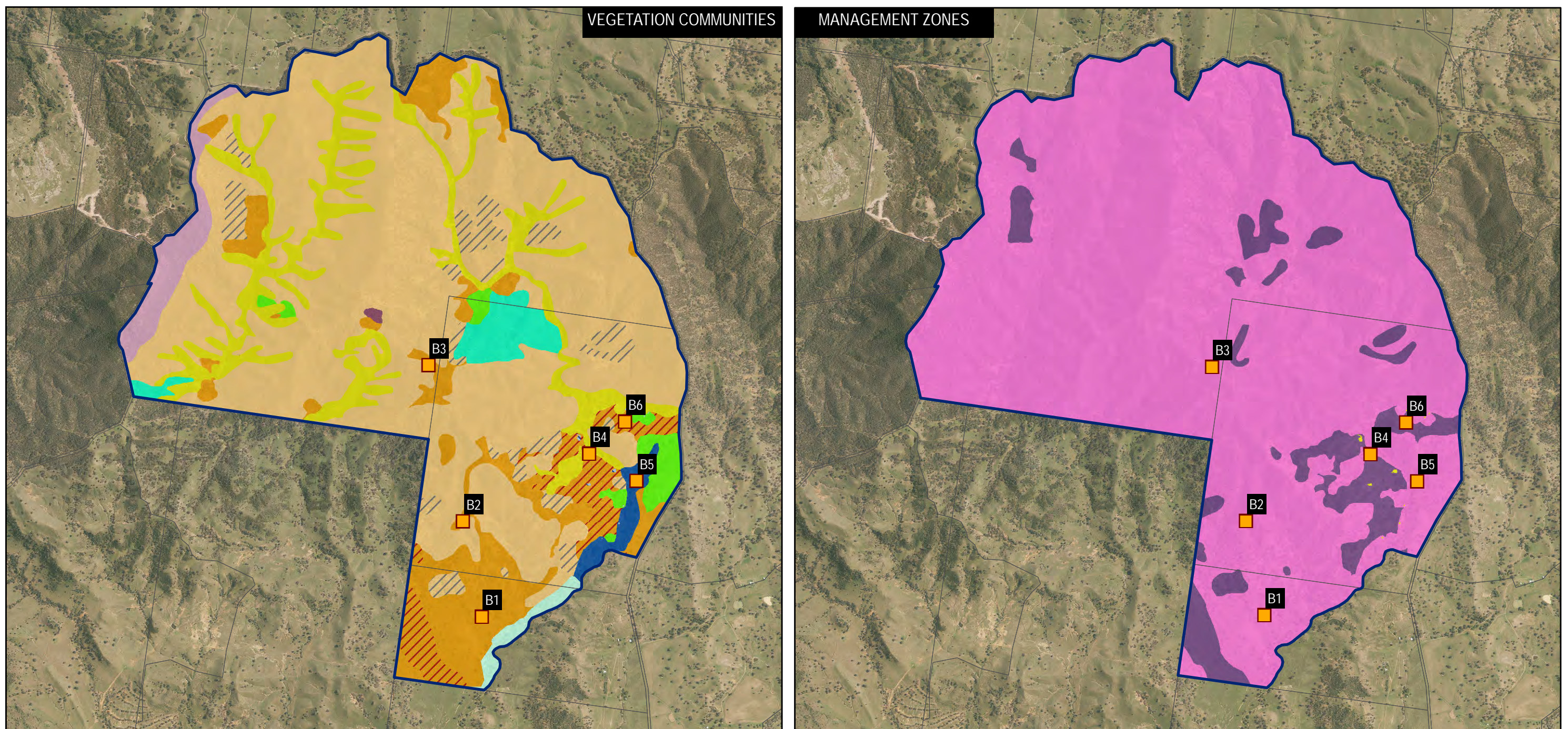
BIODIVERSITY OFFSET MONITORING

Figure 3.2
 Vegetation communities and management zones
 - Sunshine BOA

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VEGETATION COMMUNITIES

MANAGEMENT ZONES



<p> Ecological survey locations</p> <p> Offset boundary</p> <p>Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range</p> <p>Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]</p> <p>Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion</p> <p>Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427/NA410]</p>	<p>Nandewar Box – Western New England Blackbutt – Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion</p> <p>Nandewar Box – Western New England Blackbutt – Red Stringybark open forest in the Kaputar area of the Nandewar Bioregion [PCT530/NA309]</p> <p>Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion</p> <p>Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]</p> <p>River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions</p> <p>River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191]</p>	<p>Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion</p> <p>Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]</p> <p>White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions</p> <p>White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [PCT1308/NA225]</p> <p>White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions - Derived Native Grassland [PCT1308/NA225]</p>	<p>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion</p> <p>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]</p> <p>White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]</p> <p>Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion</p> <p>Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237]</p> <p>Miscellaneous</p> <p>Miscellaneous Ecosystems - water bodies, rivers, lakes, streams (not wetlands), Not applicable (crop land)</p>	<p>Management zones</p> <p> Corridor enhancement zone</p> <p> Habitat management zone</p> <p> Habitat restoration zone</p>
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Boggabri Coal

BIODIVERSITY OFFSET MONITORING

Figure 3.3
 Vegetation communities and management zones
 - Braefield BOA

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3.4 PROGRESSIVE RESTORATION WORKS

No progressive restoration works have been completed to date on any of the Eastern BOAs. Progressive restoration works are proposed to commence within the Eastern Offsets in 2020/2022.

3.5 COMPARISON OF OFFSET MANAGEMENT ZONES

The Eastern Offsets has been separated into three management zones (habitat management, habitat restoration and corridor enhancement) based on the condition of vegetation, past land uses and management actions required (Figure 3.1, Figure 3.2 and Figure 3.3). Monitoring sites for the Eastern Offsets have been established within each of these management zones. A comparison of the 2018 monitoring mean flora attributes and fauna assemblages for each management zone is provided below.

3.5.1 FLORA

3.5.1.1 NATIVE VEGETATION ATTRIBUTES

Total mean native species richness at the Eastern Offsets was recorded highest within the habitat management zones (35.6) followed by the habitat restoration zones (33) and corridor enhancement zone (18). Native species richness has remained relatively similar within the habitat management and habitat restoration zones since 2015 baseline monitoring. Native species richness has however doubled within the corridor enhancement zone since 2017 (Table 3.4).

Mean native overstorey percentage cover at the Eastern Offsets was highest within the habitat management zones (17.7%). No native overstorey cover was recorded from either the habitat restoration or the corridor enhancement zones. The void of native canopy cover within these areas is attributed to past vegetation clearing and agricultural land uses which has resulted in these areas now occurring as derived native grassland. Mean native overstorey percentage cover within all offset management zones has remained relatively constant since the 2015 baseline monitoring, decreasing slightly during the 2018 monitoring session (Table 3.4). This is likely attributed to canopy die back in response to drought conditions which was observed throughout the locality during the monitoring session.

Mean native midstorey percentage cover at the Eastern Offsets was highest within the habitat management zones (22.1%) followed by the habitat restoration zones (5%) and lowest at the corridor enhancement zone (0.4%). Mean native midstorey percentage cover at all offset management zones has increased incrementally since the 2015 baseline monitoring (Table 3.4).

Mean native grass groundcover at the Eastern Offsets was highest within the habitat management zones (42.7%) followed by the habitat restoration zones (28.3%) and lowest at the corridor enhancement zone (13%). Mean native grass groundcover is showing an increasing trend over time since 2016 within the habitat management and habitat restoration zones (Table 3.4). The results and field observations from 2017 and 2018 confirm this trend is likely due to the reduction in thistle cover and abundance (high influx of thistle recorded during the 2016 monitoring campaign due to favourable conditions i.e. higher than average rainfall).

Mean native other groundcover at the Eastern Offsets was highest within the habitat management zones (25.6%) followed by the habitat restoration zones (15.7%) and lowest at the corridor enhancement sites (5%). Mean native other groundcover in habitat management and corridor enhancement zones had stayed relatively similar over the past two years. However, the habitat restoration zone mean native other groundcover has decreased by half (Table 3.4) this may be attributed to heavy grazing during drought conditions.

Mean native shrub groundcover at the Eastern Offsets was highest within the habitat management zones (13.8%) followed by the habitat restoration zones (0.2%). No groundcover shrub cover was recorded within the corridor enhancement zone. Mean native shrub groundcover has increased within both the habitat management zone since the 2015 baseline, 2016 and 2017 monitoring (Table 3.4).

Mean number of hollow bearing trees at the Eastern Offsets was highest at the habitat management zones (1.1). No hollow bearing trees were recorded within the habitat restoration or the corridor enhancement zones. Number of hollow bearing trees remain constant with the 2015 baseline, 2016 and 2017 monitoring (Table 3.4).

The mean total length of fallen timber at the Eastern Offsets was highest within the habitat management zones (45.2 m) followed by the habitat restoration zones (1.3 m). No fallen timber was recorded at the corridor enhancement monitoring sites. Fallen timber has decreased within both the habitat management zone and habitat restoration zones since the 2017 monitoring (Table 3.4).

3.5.1.2 EXOTIC VEGETATION ATTRIBUTES

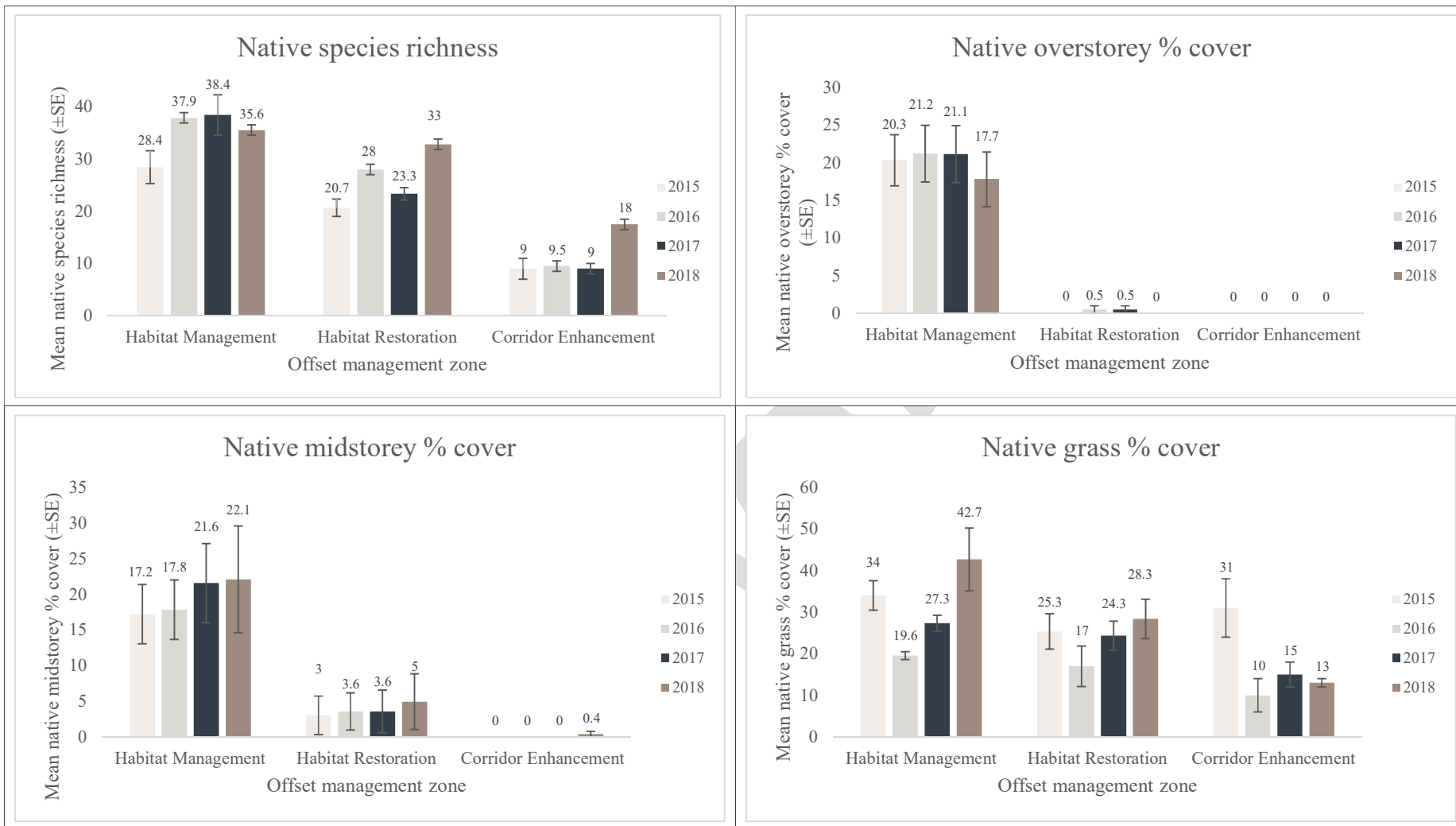
Mean exotic species richness and mean exotic groundcover percentage cover was recorded highest from within corridor enhancement zones (19 and 51 respectively) followed by habitat restoration zones (17 and 43 respectively) and lowest from within habitat management zones (14.4 and 25.3 respectively). Both these attributes have remained relatively consistent since the 2015 baseline monitoring session (Table 3.4).

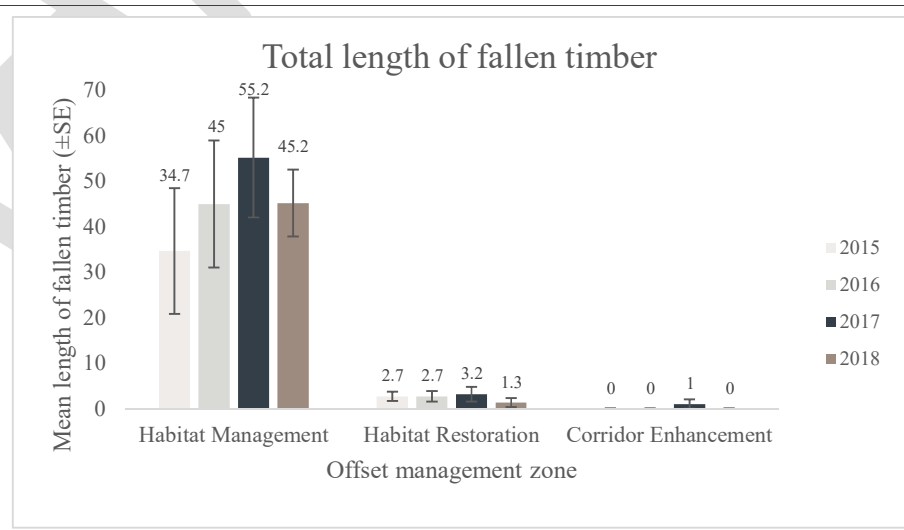
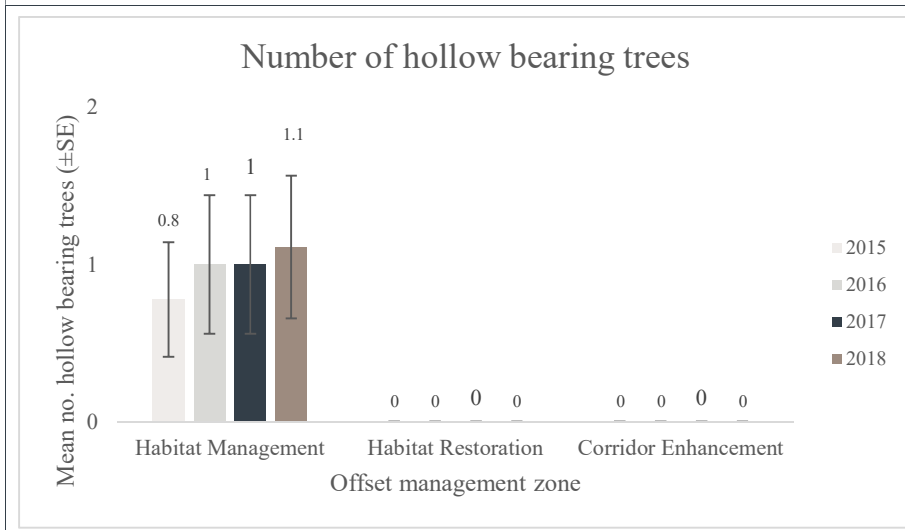
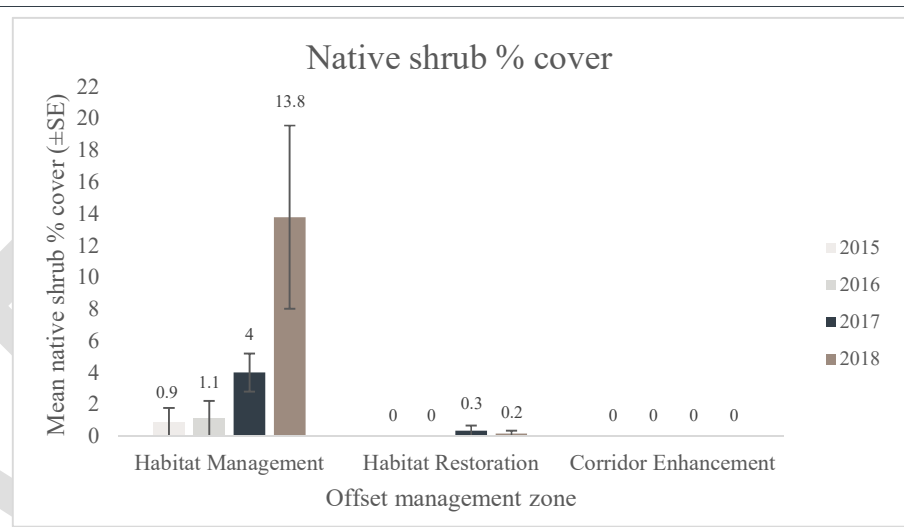
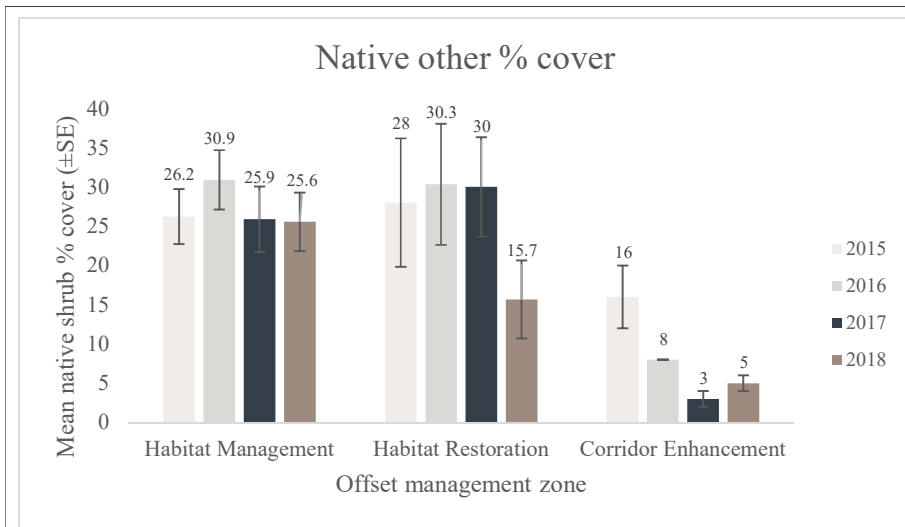
3.5.1.3 CYPRESS PINE DENSITY

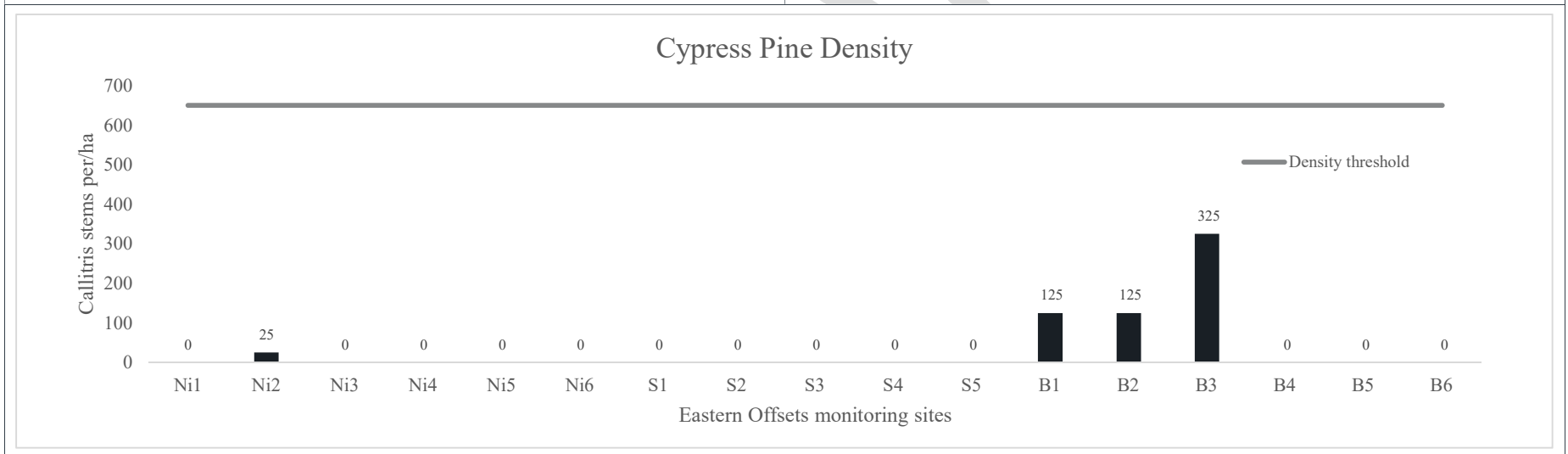
Cypress Pine was recorded at four Eastern Offset monitoring sites (i.e. three within habitat management zones (B1, B2 and B3) and one within a habitat restoration zone (Ni2). From these sites, Cypress Pine stems per hectare was recorded highest from within monitoring site B3 (325 stems per/hectare) and lowest within monitoring site Ni2 (25 stems per/hectare) (Table 3.4).

No monitoring locations within the Eastern Offsets exceeded the Cypress Pine density threshold (Table 3.4). As such, Cypress Pine thinning within these locations is not required. There are however areas within the Eastern Offsets which do not contain annual BOA permanent monitoring sites which might require Cypress Pine thinning, refer to BMP for more details.

Table 3.4 Eastern Offset Area – 2018 vegetation attributes and benchmark data (\pm SE)







3.5.2 FAUNA ASSEMBLAGES

3.5.2.1 DIURNAL BIRDS

A total of 106 species of diurnal bird were collectively recorded from the Eastern Offset Area in 2018 (Table 3.2). This comprised species common to the region, with Speckled Warbler, Weebill, Yellow-faced Honeyeater, Noisy Friarbird, Rufous Whistler and Eastern Rosella recorded widely (Table D.1, Table D.2, Table D.3 in Appendix D). The presence of large, contiguous and high quality woodland habitats associated with the Eastern Offset Area (particularly including the Braefield BOA and western extent of Nioka North BOA) support a diversity of threatened species, including Speckled Warbler, Dusky Woodswallow, Brown Treecreeper, Diamond Firetail, Varied Sittella, Hooded Robin, Little Lorikeet, Turquoise Parrot and Grey-crowned Babbler; all of which were recorded during the 2018 monitoring event (Table 3.3, Figure 3.4, Figure 3.5 and Figure 3.6).

Following the 2015 baseline monitoring survey, diurnal bird species richness in the Eastern Offset Area has been comparable between years within management zones (Table 3.5). Habitat management zones retained the largest diurnal bird species richness during the 2018 monitoring event, with an average of 13.7 birds (Table 3.5). Habitat restoration zones and corridor enhancement zones returned a lower mean species richness of 3.9 and 3.8 respectively. Replicate monitoring site Ni2 (Nioka North BOA) recorded the highest mean species richness of 22.5 (as averaged from duplicate surveys), followed by S1 (Sunshine BOA) at 18.5 (Appendix D).

During the 2018 monitoring event, habitat management zones realised a diurnal bird species richness approximately 97 % of the LSF analogue benchmark (Table 3.5). Three replicate monitoring sites associated with habitat management zones met or exceeded the LSF benchmark, including Ni1, S1, and Ni4. Habitat restoration and corridor enhancement zones recorded a mean species richness about 28 % of the LSF analogue benchmark.

Mean diurnal bird abundance largely mirrored species richness, with habitat management zones retaining the highest abundance (34.7) during the 2018 monitoring event, followed by corridor enhancement (10.5) and habitat restoration zones (6.8) (Table 3.5). Habitat management zones exceeded the LSF benchmark for mean diurnal abundance (28.9), whilst habitat restoration and corridor enhancement zones recorded approximately 24 % and 36 % of the LSF benchmark respectively.

3.5.2.2 MICROCHIROPTERAN BATS

A total of 15 species of microchiropteran bat were collectively recorded from the Eastern Offset Area in 2018. This comprised species common to dry woodland in the region, with Gould's Wattled Bat, South-eastern Free-tailed Bat and Little Forest Bat most prevalent (Appendix D). Four threatened species were recorded from the Anabat sample population (those active up to two hours after last light) and targeted harp trapping, including Eastern False Pipistrelle, Northern Free-tailed Bat, Yellow-bellied Sheath-tail-bat and Corben's Long-eared Bat (Appendix D).

Mean microchiropteran bat species richness was recorded highest in habitat management zones (4.9), followed by habitat restoration zones (4.1) and corridor enhancement zone (3.3) (Table 3.5). Within management zones, microchiropteran bat species richness has largely remained comparable between years since the 2015 baseline monitoring event. Replicate monitoring site Ni4 (Nioka North BOA) recorded the highest mean species diversity with eight species recorded from duplicate surveys, followed by Ni1 and S2 (Sunshine BOA) with seven species.

In accordance with Boggabri Coal's BMP (WSP 2018) and as described in Section 2.3, a mean microchiropteran bat species richness analogue benchmark of 4.6 was calculated from four long-term monitoring sites in Leard State Forest. To meet the BMP performance and completion criteria, habitat restoration zones must meet at least 80 % of the LSF analogue benchmark (i.e. 3.7 species). Similarly to 2015 and 2017, habitat management zones met the LSF benchmark in 2018 (Table 3.5). Habitat restoration zones and corridor enhancement zones achieved approximately 89 % and 72 % of the LSF benchmark during the 2018 monitoring period.

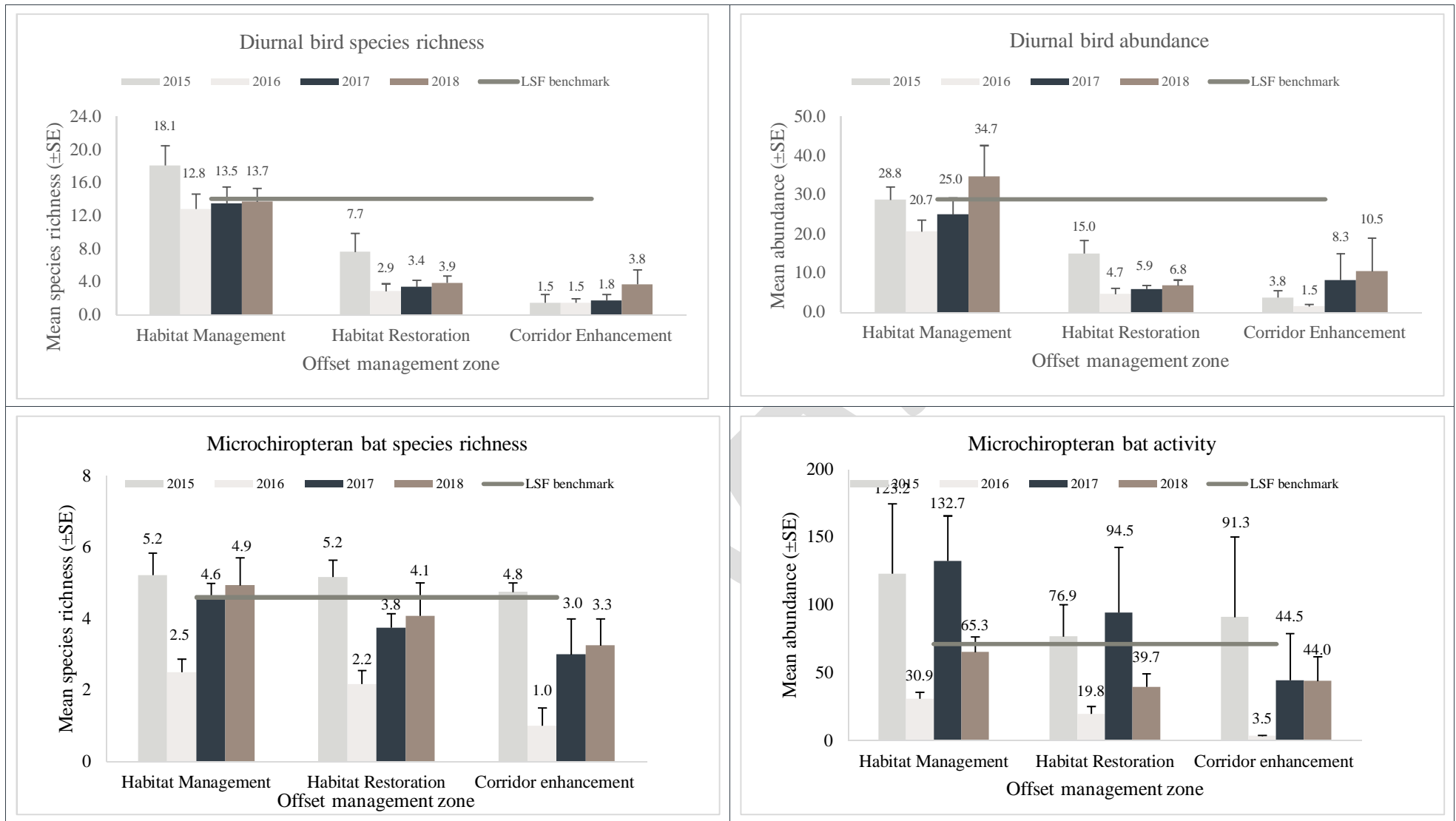
A reduction in microchiropteran bat activity was observed in habitat management and habitat restoration zones between 2017 and 2018. Nevertheless, habitat management zones retained approximately 91 % of the LSF benchmark (71.4), whilst habitat restoration and corridor enhancement zones achieved 56 % and 62 % respectively (Table 3.5).

3.5.2.3 NOCTURNAL BIRDS AND MAMMALS

Nocturnal surveys were completed in the Braefield and Nioka North BOAs during the 2018 monitoring event, and comprised call playback and spotlighting methodologies. Species recorded included Southern Boobook, Common Brush-tailed Possum, Peron's Tree Frog, Green Tree Frog, Ornate Burrowing Frog, Broad-palmed Frog and Little Red Tree Frog. One introduced mammal (Fox) was recorded during nocturnal surveys.

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Table 3.5 Eastern Offset Area – 2018 fauna attribute and benchmark data (\pm SE)



3.6 STATE OF BOX GUM WOODLAND

The Eastern Offset Area contains approximately 1,295.7 ha Box Gum Woodland, which is listed under the BC Act and/or EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Eastern Offset Area on lower slopes and flatter land (Figure 3.4, Figure 3.5, Figure 3.6). Within the Eastern Offset Area Box Gum Woodland occurs in two states:

- State 1: Woodland – occupies 726.3 ha
- State 2: Native Pastures – occupies 569.4 ha.

Eleven monitoring sites within the Eastern Offset Area (five within habitat management zone and six within habitat restoration zone) represent the Box Gum Woodland ecological community.

A comparison of these monitoring sites against BBAM vegetation type benchmarks is provided in Table 3.6 and below in Section 3.6.1. An assessment of these monitoring sites against EPBC Act Policy Statement 3.5 for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is also provided in Table 3.7 and Section 3.6.2.

3.6.1 COMPARISON OF BOX GUM WOODLAND AGAINST BBAM BENCHMARK VALUES

An assessment of Box Gum Woodland Eastern Offset monitoring locations against the respective BBAM vegetation type benchmarks for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion and Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion vegetation types (Table 3.6) identified the following:

- All but one site (S3 – habitat management zone) meet the native species richness benchmark value (i.e. 23 native species richness).
- All habitat restoration monitoring sites and one habitat management site (S3) failed to meet the native overstorey percentage cover benchmark value (i.e. 6–25%).
- All monitoring sites meet, were within or exceeded the native midstorey percentage cover benchmark value (i.e. 0–5%).
- One habitat management (S3) and three habitat restoration monitoring sites (B4, Ni5, Ni6) failed to meet the native groundcover (grass) benchmark value (i.e. 30–40%).
- All monitoring sites meet, were within or exceeded the native groundcover (other) benchmark value (i.e. 3–5%).
- All monitoring sites meet, were within or exceeded the native groundcover (shrub) benchmark value (i.e. 0–0%) – no shrub cover within Box Gum Woodland Eastern Offset monitoring sites exceeded 30%.
- All monitoring sites, except for two habitat management monitoring sites (Ni1 and B1), failed to meet the hollow bearing tree benchmark value (i.e. 1 hollow bearing tree).
- All monitoring sites, except for two habitat management monitoring sites (Ni1 and B1), failed to meet the fallen length of timber benchmark value (i.e. 30 m).
- No monitoring sites from within habitat restoration zones show evidence of regeneration, 75% of sites within habitat management zones show evidence of regeneration.

Although it is acknowledged that some of these attributes will increase naturally over time, the results indicate that habitat restoration and corridor enhancement zones would benefit from active management. Of particular importance is the management of vegetation attributes that take a long time to form such as canopy cover and fauna habitat resources.

Due to the above, management within these management zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna

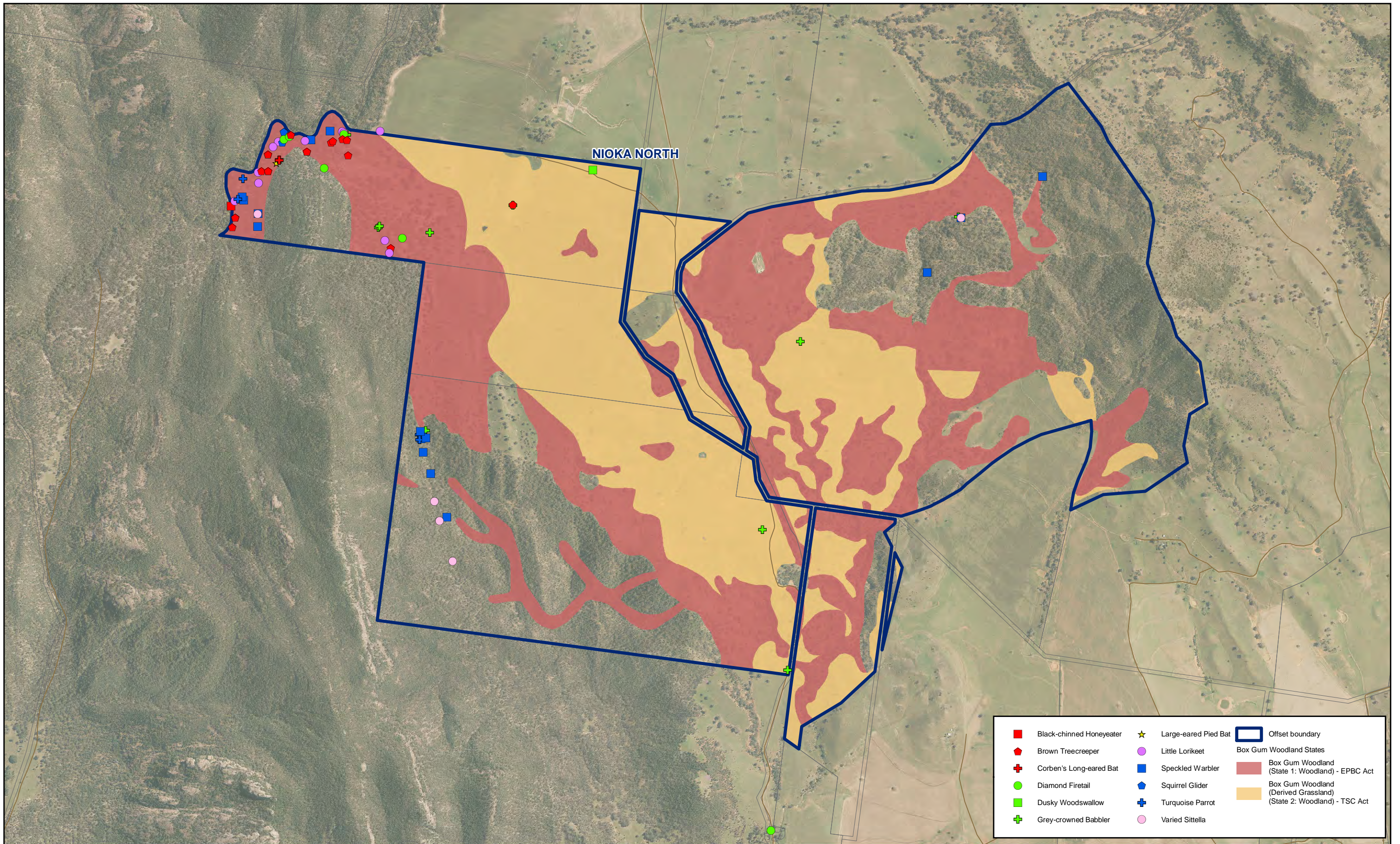
usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.

3.6.2 EPBC ACT ANALYSIS OF BOX GUM WOODLAND

An assessment of Eastern Offset Box Gum Woodland monitoring sites against the EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland concluded that of the ten Box Gum Woodland monitoring sites six meet the EPBC Act listing for this threatened ecological community (Table 3.7).

The Box Gum Woodland monitoring sites which meet the EPBC Act listing for the threatened ecological community included three sites from habitat management zones (Ni1, Ni4 and B1 - all State 1 Grassy Woodlands) and three from habitat restoration zones (S2, B4 and B6 – all State 2 Native Pastures). All remaining sites (Ni2, Ni5, Ni6 and S3) failed to listed EPBC Act listed as they either did not contain a predominantly native understorey and/or did not meet the required native understorey species richness criteria.

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Biodiversity Offset Monitoring

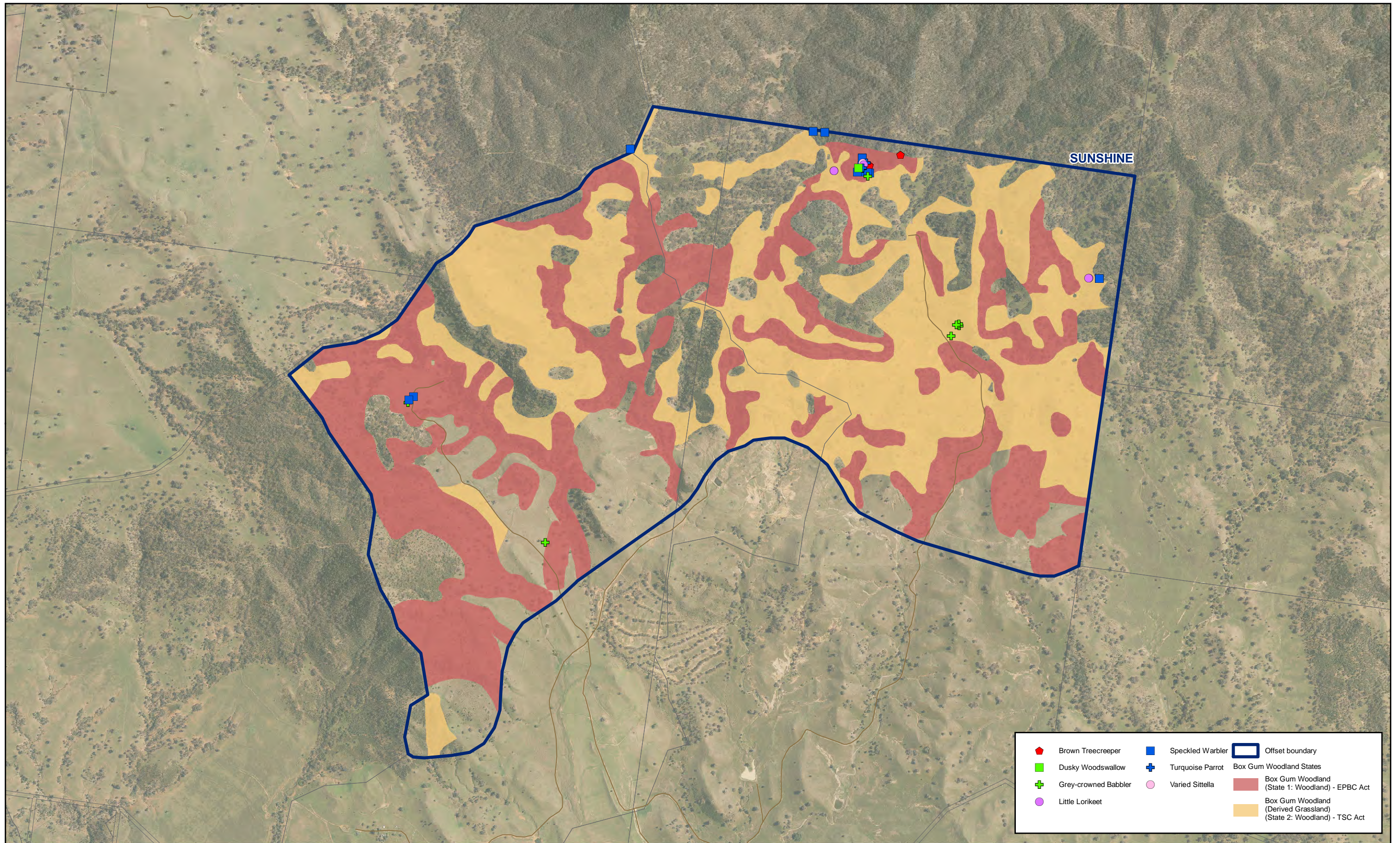
Figure 3.4
Box Gum Woodland within Nioka North BOA

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	Brown Treecreeper		Speckled Warbler		Offset boundary
	Dusky Woodswallow		Turquoise Parrot		Box Gum Woodland States
	Grey-crowned Babbler		Varied Sittella		Box Gum Woodland (State 1: Woodland) - EPBC Act
	Little Lorikeet				Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act

Map: PS110420_GIS_BOA004_A1	Author: SuansriR
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Coordinate system: GDA 1994 MGA Zone 56

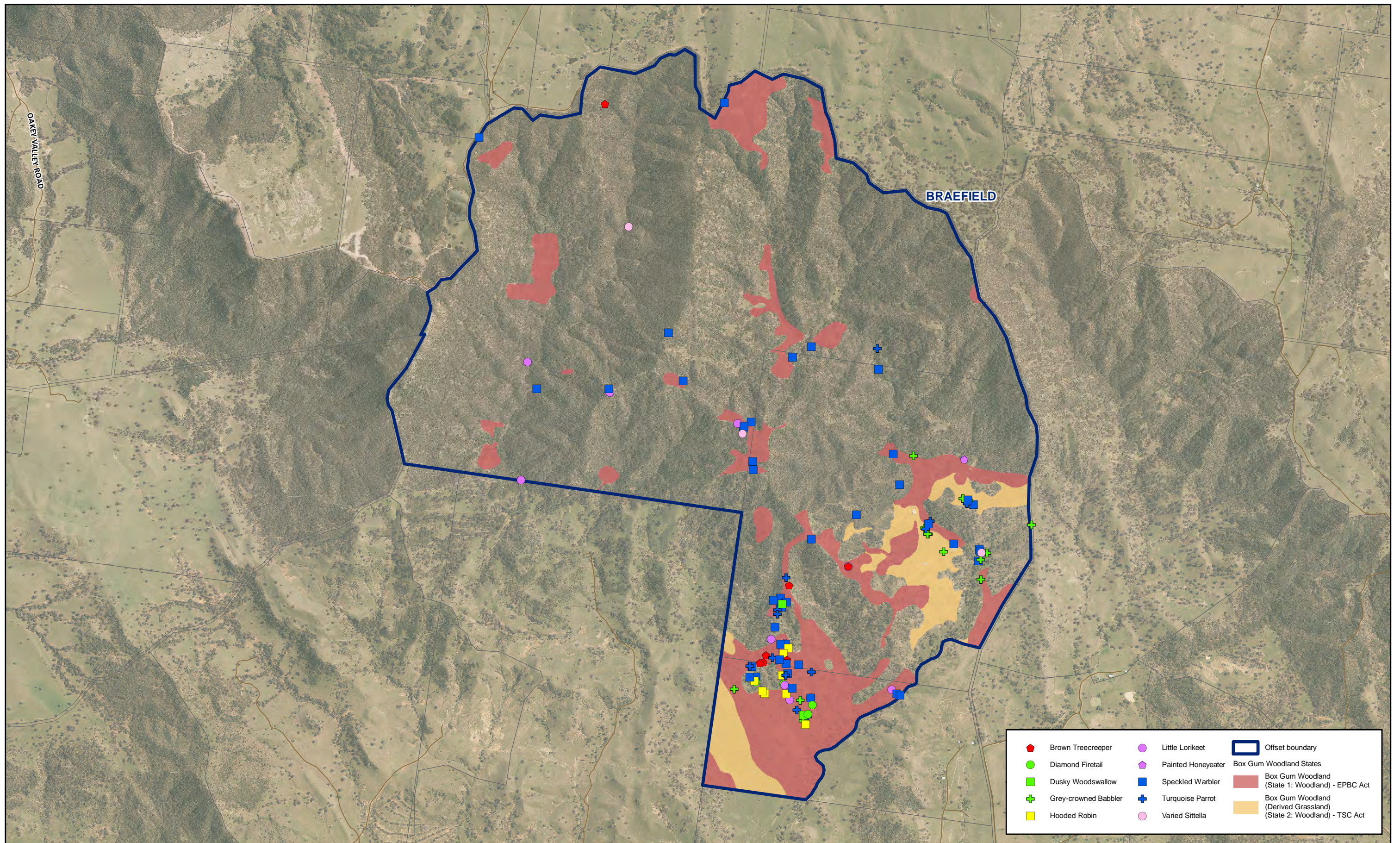
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Figure 3.5
Box Gum Woodland within Sunshine BOA

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BIODIVERSITY OFFSET MONITORING

Figure 3.6
 Box Gum Woodland within Braefield BOA

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Table 3.6 Summary comparison of Box Gum Woodland between 2018 data and biometric data for the Eastern Offset Area

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GROUND COVER (GRASS) PERCENTAGE	NATIVE GROUND COVER (SHRUB) PERCENTAGE	NATIVE GROUND COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
BBAM Benchmark		6 to 25	0 to 0	30 to 40	0 to 0	3 to 5	23	1	30	n/a	n/a	Native species richness >80% of BBAM benchmark, all other attributes within or above benchmark values. 100% regeneration required across each management zone.
Habitat Management Zone												
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Nioka North 1	18.5 ✓	0.9 >	48 >	14 >	30 >	32 >	2 >	76 >	0	Box Gum Woodland – State 1 Grassy Woodland Evidence of livestock and feral herbivore grazing present (Cattle and Goats).	All vegetation attributes are within or exceed BBAM benchmark values.
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Nioka North 4	12 ✓	14.2 >	60 >	6 >	22 >	36 >	0 X	19 X	1	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present (Rabbits).	Total length of fallen timber and number of trees with hollows are below BBAM benchmark values.
	Sunshine 3	0 X	0.1 >	12 X	0 ✓	4 ✓	12 X	0 X	4 X	1	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present (Pigs).	Native overstorey projected foliage cover, native groundcover grasses cover, native species richness, number of trees with hollows and fallen timber are below BBAM benchmark values.
	Braefield 1	9.7 ✓	4.5 >	76 >	2 >	22 >	45 >	1 ✓	53 >	1	Box Gum Woodland – State 1 Grassy Woodland Evidence of livestock and feral herbivore grazing present (Cattle, Pigs and Goats).	All vegetation attributes are within or exceed BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Eastern Offset Habitat Management Zone					75%					-	Regeneration does not meet performance criteria.	

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GROUND COVER (GRASS) PERCENTAGE	NATIVE GROUND COVER (SHRUB) PERCENTAGE	NATIVE GROUND COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
Habitat Restoration Zones												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Nioka North 2	0 X	0.1 >	40 ✓	0 ✓	4 ✓	30 >	0 X	2 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle and Rabbits).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Nioka North 5	0 X	0.1 >	20 X	0 ✓	12 >	28 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle and Rabbits).	Native overstorey projected foliage cover, native groundcover grasses cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Nioka North 6	0 X	0.1 >	20 X	0 ✓	8 >	28 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle and Rabbits).	Native overstorey projected foliage cover, native groundcover grasses cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Sunshine 2	0 X	5 >	36 ✓	1 >	30 >	43 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Pigs).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Braefield 4	0 X	0.4 >	14 X	0 ✓	32 >	37 >	0 X	6 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle, Pigs and Goats).	Native overstorey projected foliage cover, native groundcover grasses cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Braefield 6	0 X	24 >	40 ✓	0 ✓	8 >	31 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle, Pigs and Goats).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Eastern Offset Habitat Management Zone					0%					-	Regeneration does not meet performance criteria.	

Note: 1) Red shaded X = variable below benchmark value, Green shaded ✓ = variable within benchmark value, Orange shading > = variable exceeds benchmark. 2) Green shaded = indicates all vegetation attributes meet performance criteria and therefore maintenance is only required, Red shaded = indicates that although some vegetation attributes meet or are within benchmark values some fail to meet benchmarks.

Table 3.7 2018 Eastern Offset BOA monitoring data assessment against EPBC Act Box Gum Woodland determining criteria

CRITERIA	HABITAT MANAGEMENT ZONE				HABITAT RESTORATION ZONE					
	Ni1	Ni4	B1	S3	Ni2	Ni5	Ni6	S2	B4	B6
Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Rd Gum?	Yes – overstorey species are or where previously dominated by either <i>Eucalyptus albens</i> (White Box) and/or <i>Eucalyptus melliodora</i> (Yellow Box).									
Does the patch have a predominantly native understorey?	Yes - native groundcover > 50%			No – groundcover >50% exotic	No – groundcover >50% exotic			Yes - native groundcover > 50%		
Is the patch 0.1 ha or greater in size?	Yes – patches exceed 0.1 ha in size			n/a	n/a			Yes – patches exceed 0.1 ha in size		
There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	Yes, 16 native understorey spp. & 6 important spp.	Yes – 17 native understorey spp. & 8 important spp.	Yes – 17 native understorey spp. & 8 important spp.	No – 6 native understorey spp. & 1 important spp.	Yes – 12 native understorey spp. & 5 important spp.	Yes – 15 native understorey spp. & 7 important spp.	Yes – 13 native understorey spp. & 6 important spp.	Yes – 19 native understorey spp. & 8 important spp.	Yes – 16 native understorey spp. & 6 important spp.	Yes – 15 native understorey spp. & 8 important spp.
Meet EPBC Act listing criteria?	Yes, does meet criteria			No, does not meet criteria	No, does not meet criteria			Yes, does meet criteria		

Note: Analysis based on 0.04 ha (20 X 20 m) vegetation quadrat undertaken as part of 2018 annual BOA monitoring.

4 CENTRAL OFFSET AREA – 2018 RESULTS

4.1 INTRODUCTION

The Central Offsets encompass the Mallee, Myall Plains, Wirrilah and Goonbri BOA properties which collectively cover approximately 3,654.7 ha and are located 3.9 km east of the project (Figure 1.1). The Central Offsets occur between the eastern extremity of Leard State Forest and the Nandewar Range and form part of the central-eastern section of the Regional East-West Wildlife Corridor. The majority of remnant woodland occurs within the north-eastern areas of the Central Offset Area (predominantly within Mallee and Myall Plains BOAs), although understorey vegetation exhibits the effects of grazing on the lower slopes. Elsewhere throughout the properties remnant woodland trees are largely scattered or form residual patches. The vegetation and management zones within the Central Offsets are illustrated in Figure 4.1, Figure 4.2 and Figure 4.3.

During the 2018 monitoring session, three new monitoring sites were established in the Central Offset Area, including the Wirrilah BOA (W7) and Goonvri BOA (G1 and G2). These sites were established to provide further data on the success (or otherwise) of restoration efforts on improving connectivity and fauna usage within the landscape:

4.2 FLORA

198 plant species were recorded within the Central Offsets during the 2018 monitoring session. Of these, 165 (83%) were native and 33 (17%) were exotic (Table C.4, Table C.5, Table C.6 and Table C.7 of Appendix C). The most diverse families recorded were the Poaceae with 47 species followed by the Asteraceae with 26 species.

One threatened flora species was recorded within the Central Offsets from two locations (W1 and My3) during the 2018 monitoring session (*Tylophora linearis*) (Table 4.3, Figure 4.5 and Figure 4.6).

Of the 33-exotic species that were recorded in 2018, two were previously listed as noxious weeds under the *Noxious Weeds Act 1993* (Table 4.1). The *Noxious Weeds Act 1993* has since been repealed and replaced by the *Biosecurity Act 2015* under which noxious weeds have now been replaced by priority weeds. Three introduced species listed as priority weeds within the North West LLS control region were recorded within the Central Offsets during 2018. These species are also listed as a Weed of National Significance (WONs).

Table 4.1 Noxious weeds recorded within the Central Offset Area

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY (NW ACT)	PRIORITY WEED (BA ACT)	WONS	2015	2016	2017	2018
Prickly Pear	<i>Opuntia stricta</i> *	4	Yes	Yes	✓	✓	✓	✓
Tiger Pear	<i>Opuntia aurantiaca</i> *	4	Yes	Yes			✓	
African Olive	<i>Olea europea var. cuspidata</i> *	4	Yes	Yes				✓

The Central Offsets also contained other invasive species which occurred abundantly throughout the BOAs. These species included common thistle species (such as *Carthamus lanatus** (Saffron Thistle), *Cirsium vulgare** (Spear Thistle) and *Centaurea melitensis** (Maltese Thistle)) and common herbaceous herbs and forbs commonly found in pastures (including *Arctotheca calendula** (Cape Dandelion), *Hedypnois rhagadioloides** (Cretan Weed), *Schkuhria pinnata var. abrotanoides** as well as *Trifolium** and *Medicago* species*).

Whilst these species are not listed under the *Biosecurity Act 2015* management of these species should still be considered.

4.3 FAUNA

The 2018 monitoring session recorded 131 species of animal within the Central Offsets, including 126 native species and five introduced species (Table 4.2; Table D.4, Table D.5, Table D.6 and Table D.7 of Appendix D).

Table 4.2 Summary of terrestrial animal species identified in the Central Offset Area

GROUP	SPECIES RICHNESS	
	Native	Introduced
Birds	103	1
Microchiropteran bats	14	0
Mammals (non-bats)	4	4
Reptiles	5	0
Amphibians	0	0
Total	126	5

A total of 11 threatened species were recorded within the Central Offset Area during 2018 monitoring; encompassing BOA monitoring, targeted Swift Parrot and Regent Honeyeater survey, and targeted Corben's Long-eared Bat survey (Table 4.3; Table D.4, Table D.5, Table D.6 and Table D.7 of Appendix D).

Table 4.3 Threatened species recorded within the Central Offset Area

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	BC ACT	2015	2016	2017	2018
Flora species							
–	<i>Tylophora linearis</i>	E	V				✓
Fauna species							
Dusky Woodswallow	<i>Artamus cyanopterus</i>	–	V		✓	✓	✓
Speckled Warbler	<i>Chthonicola sagittata</i>	–	V	✓	✓	✓	✓
Brown Treecreeper	<i>Climacteris picumnus</i>	–	V	✓	✓	✓	✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>	–	V	✓	✓	✓	✓
Little Lorikeet	<i>Glossopsitta pusilla</i>	–	V			✓	
Hooded Robin	<i>Melanodryas cucullata</i>	–	V		✓		✓
Turquoise Parrot	<i>Neophema pulchella</i>	–	V	✓	✓	✓	✓
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	–	V	✓	✓	✓	✓
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V		✓		✓
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	–	V	✓	✓	✓	✓
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	–	V	✓	✓	✓	✓
Northern Free-tailed Bat	<i>Mormopterus lumsdenae</i>	–	V				✓

4.4 PROGRESSIVE RESTORATION WORKS

Restoration activities commenced in the Wirrilah BOA in 2017, with most of the habitat restoration and corridor enhancement zones planted with canopy and shrubs species (Photo 4.1, Photo 4.2 and Photo 4.3). In addition, and as stipulated in Boggabri Coal's BMP, naturally sparse habitat features such as fallen woody debris, which is collected during Boggabri Coal's annual tree clearing program, has also been stockpiled on the Wirrilah BOA for subsequent inclusion into habitat restoration and corridor enhancement zones (Photo 4.4).

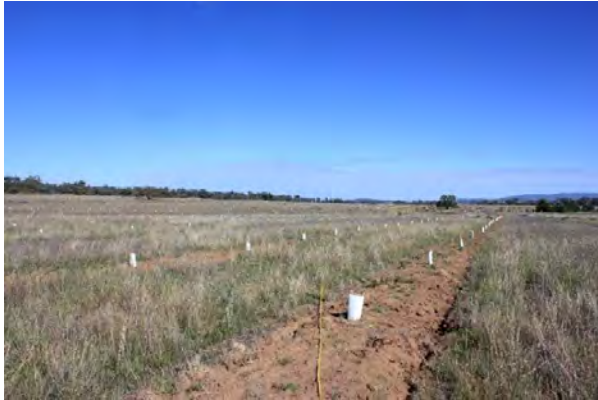


Photo 4.1 An example of restoration works completed in the Wirrilah BOA in 2017



Photo 4.2 An example of restoration work completed in the Wirrilah BOA in 2017



Photo 4.3 An example of a *Eucalyptus albens* seedling in the Wirrilah BOA

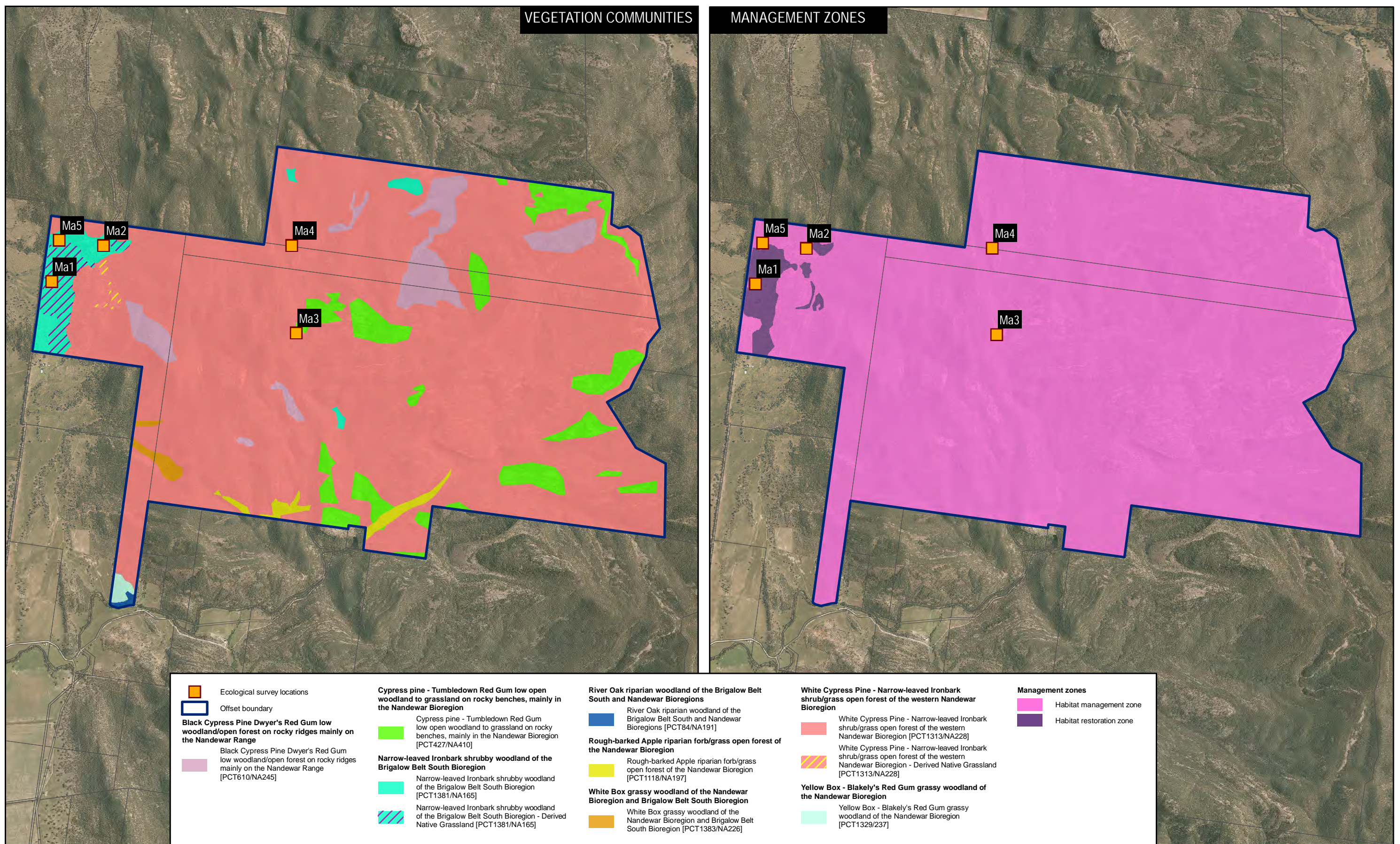


Photo 4.4 Example of stockpiled woody debris on Wirrilah BOA for use in restoration areas

Two of the Central Offset monitoring locations surveyed in 2018 occur within areas where these restoration activities were completed (Wi6 and Wi7). The survivorship of tube stock planting was recorded during the 2018 monitoring session. Survivorship was 96% at Wi6 and 87% at Wi7 and dieback appeared to be highest for *Eucalyptus albens* and *Acacia decora* individuals. It should be noted that this survival percentage may not be representative of all areas of the Wirrilah BOA and are specific to the two monitoring sites. More plots would be required across the BOA to provide a more reliable estimate of survivorship.

VEGETATION COMMUNITIES

MANAGEMENT ZONES



<ul style="list-style-type: none"> Ecological survey locations Offset boundary Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245] 	<ul style="list-style-type: none"> Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion [PCT427/NA410] Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165] Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165] 	<ul style="list-style-type: none"> River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191] Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197] White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226] 	<ul style="list-style-type: none"> White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228] White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion - Derived Native Grassland [PCT1313/NA228] Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237] 	<ul style="list-style-type: none"> Management zones Habitat management zone Habitat restoration zone
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Map: PS110420_GIS_BOA003_A1
 Author: SuansriR
 Date: 8/03/2019
 Approved by: - N. Cooper

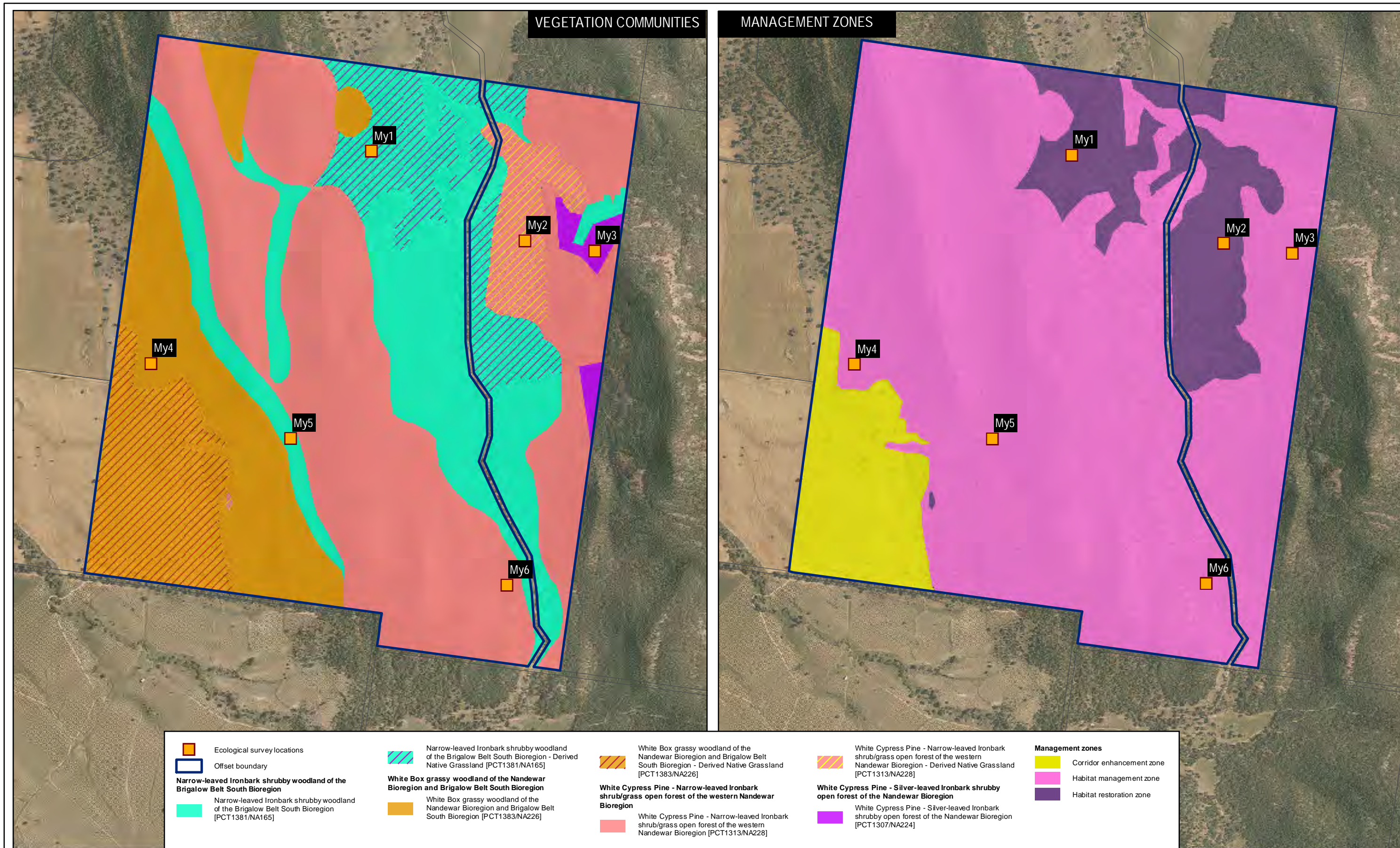
Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 4.1
 Vegetation communities and management zones
 - Mallee BOA

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Map: PS110420_GIS_BOA003_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N.Cooper

0 0.2 0.4 km
 1:15,000
 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



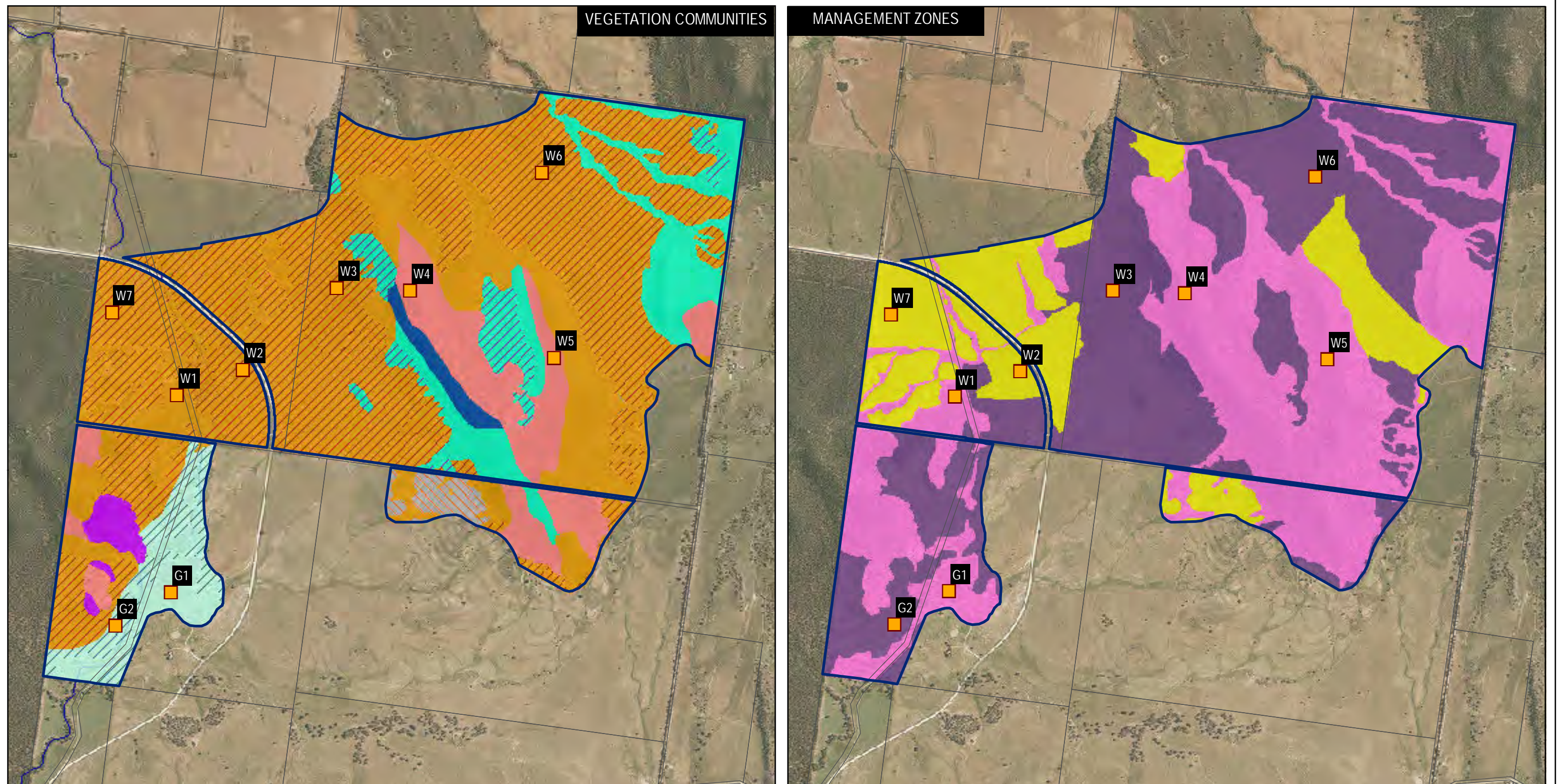
BIODIVERSITY OFFSET MONITORING

Figure 4.2
 Vegetation communities and management zones
 - Myall Plains BOA

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VEGETATION COMMUNITIES

MANAGEMENT ZONES



<ul style="list-style-type: none"> Ecological survey locations Offset boundary Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165] Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165] 	<ul style="list-style-type: none"> River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191] White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226] 	<ul style="list-style-type: none"> White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226] White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228] 	<ul style="list-style-type: none"> White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion [PCT1307/NA224] Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237] 	<ul style="list-style-type: none"> Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion - Derived Native Grassland [PCT1329/237] Miscellaneous Miscellaneous Ecosystem – highly disturbed areas with no or limited native vegetation. Not applicable (crop land) 	<ul style="list-style-type: none"> Management zones Corridor enhancement zone Habitat management zone Habitat restoration zone
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Map: PS110420_GIS_BOA003_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N.Cooper

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 Coordinate system: GDA 1994 MGA Zone 56
 Scale ratio correct when printed at A3



BIODIVERSITY OFFSET MONITORING

Figure 4.3
 Vegetation communities and management zones
 - Wirralah and Goonabri BOA

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4.5 COMPARISON OF OFFSET MANAGEMENT ZONES

The Central Offsets has been separated into three management zones (habitat management, habitat restoration and corridor enhancement) based on the condition of vegetation, past land uses and management actions required (Figure 4.1, Figure 4.2, Figure 4.3). Biodiversity monitoring sites for the Central Offsets have been established within each of these offset management zones. A comparison of the 2018 monitoring mean flora attributes and fauna assemblages for each management zone is provided below.

4.5.1 FLORA

4.5.1.1 NATIVE VEGETATION ATTRIBUTES

Total mean native species richness at the Central Offsets was recorded highest within the habitat management zones (41) followed by the habitat restoration zone (30) and recorded lowest at the corridor enhancement zone (24.0). The native species richness at all management zones has increased since the 2015 baseline monitoring session and remained relatively consistent since 2016. The drop in native species in 2018 compared to the 2017 data is likely attributed to seasonal conditions associated with drought conditions preceding the monitoring event (Table 4.4).

Mean native overstorey percentage cover at the Central Offsets was highest within the habitat management zones (12.0%) followed by the habitat restoration zone (0.1%). No overstorey cover was recorded within the corridor enhancement zone. The void of native canopy cover within these areas is thought to be attributed to past vegetation clearing and agricultural land uses which has resulted in these areas now occurring as derived native grassland. The habitat management zone showed a decrease (almost 40%) in overstorey cover since the 2017 monitoring event. This was attributed to severe canopy die back in response to drought conditions which was observed throughout the locality during the monitoring session. Overstorey cover within the habitat restoration and corridor enhancement zones have remained consistent since 2015 (Table 4.4).

Mean native midstorey percentage cover at the Central Offsets was highest within the habitat management zones (18.5%) followed by the habitat restoration zone (10.5%). No native midstorey cover was recorded within the corridor enhancement zone. Mean native midstorey percentage cover has incrementally increased at both the habitat management and habitat restoration zones since the 2015 baseline monitoring (Table 4.4).

Mean native grass groundcover at the Central Offsets was highest this year in the corridor enhancement zones (76%) followed by the habitat restoration zone (63.7%) and lowest at the habitat management zones (57.5). Native grass groundcover has shown a notable increase this year across all zones this year (Table 4.4).

Mean native other groundcover at the Central Offsets was highest within the habitat restoration zone (16.3%) followed by habitat management zones (11.3%) and lowest at the corridor enhancement zone (7%). Mean native other groundcover in 2018, is considerably lower when compared to the 2017 and 2016 monitoring sessions, particularly within the habitat management and corridor enhancement zones. These decreases are likely due to the drought conditions experienced leading up to the monitoring session (Table 4.4).

Mean native shrub groundcover at the Central Offsets was highest within the habitat management zone (13.8%) followed by the habitat restoration zone (4%) and lowest at the corridor enhancement zone (1%). Native shrub cover has increased within the habitat management and habitat restoration zones, however has decreased within the corridor enhancement zone (Table 4.4). The increase in shrub cover observed within the habitat management zones is likely attributed to the regeneration of *Callitris glaucophylla* at some monitoring locations.

Mean number of hollow bearing trees at the Central Offsets was highest at the habitat management zones (1.9) followed by the habitat restoration zone (0.3). No hollow bearing trees were recorded within the corridor enhancement zone. Number of hollow bearing trees has increased within the habitat management zones since the 2015 baseline, 2016 and 2017. Habitat restoration has remained essentially the same since 2015 baseline, 2016, 2017 monitoring sessions (Table 4.4).

The mean total length of fallen timber at the Central Offsets was highest within the habitat management zones (27.9 m) followed by the habitat restoration zones (1 m). No fallen timber was recorded within the corridor enhancement zone. Mean total length of fallen timber has decreased slightly in habitat management zones and habitat restoration since the 2015 baseline monitoring (Table 4.4).

4.5.1.2 EXOTIC VEGETATION ATTRIBUTES

Mean exotic species richness and mean exotic groundcover percentage cover was recorded highest from within corridor enhancement zones (11 and 25 respectively) followed by habitat restoration zones (7.3 and 4.7 respectively) and lowest from within habitat management zones (2.3 and 4.0 respectively). Both these attributes have remained relatively consistent since the 2015 baseline monitoring session within the habitat management and corridor enhancement zones. These attributes however have decreased considerably within the habitat restoration zones since the 2017 monitoring session. This decrease is due to the establishment of site G1 during 2018 which recorded considerable higher exotic groundcover percentage cover compared to the other sites (Table 4.4).

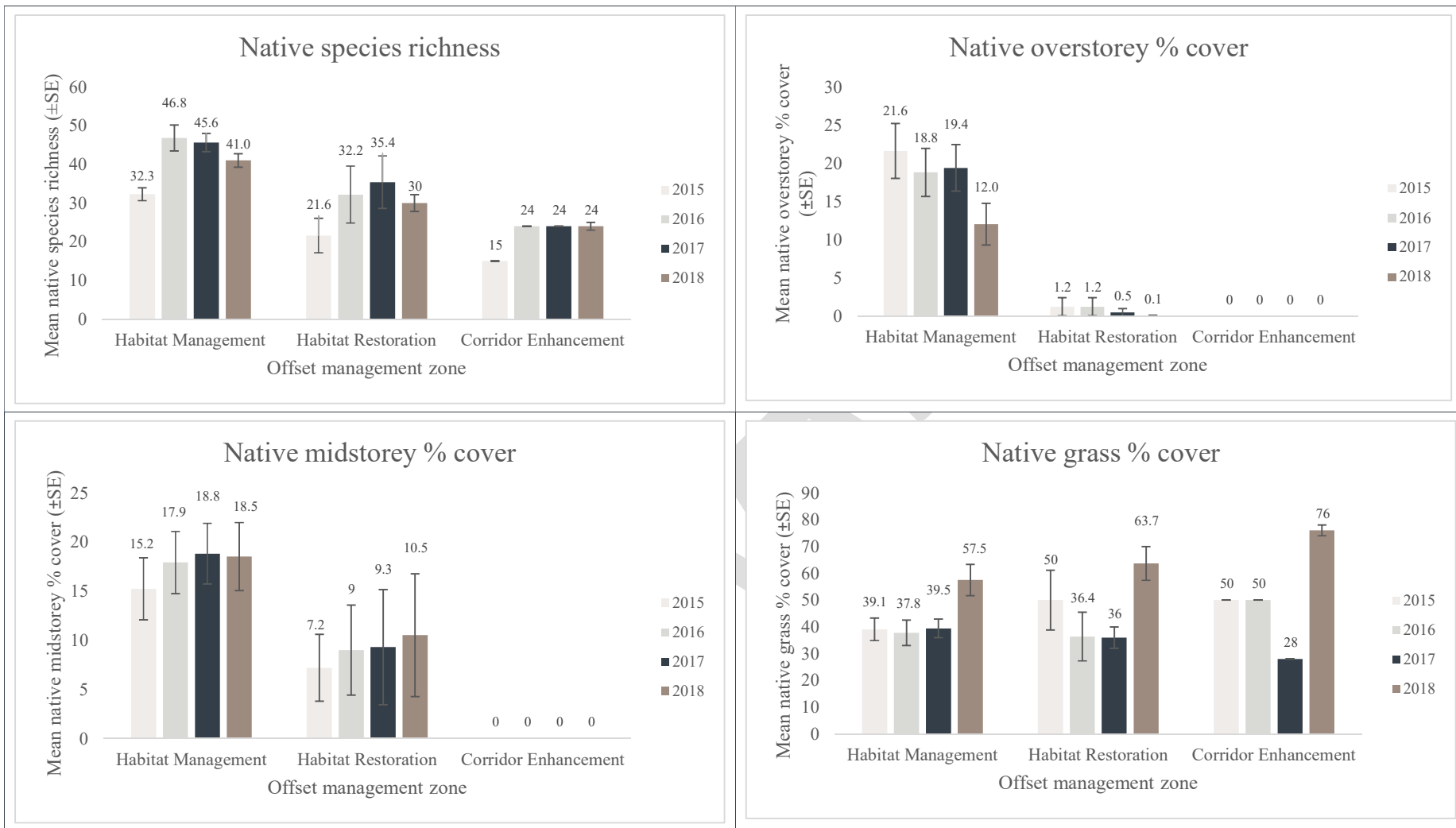
4.5.1.3 CYPRESS PINE DENSITY

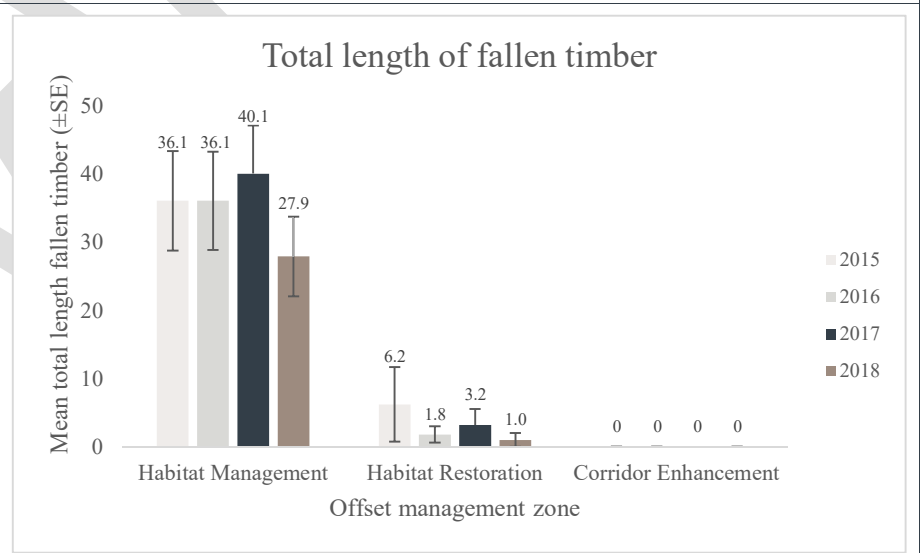
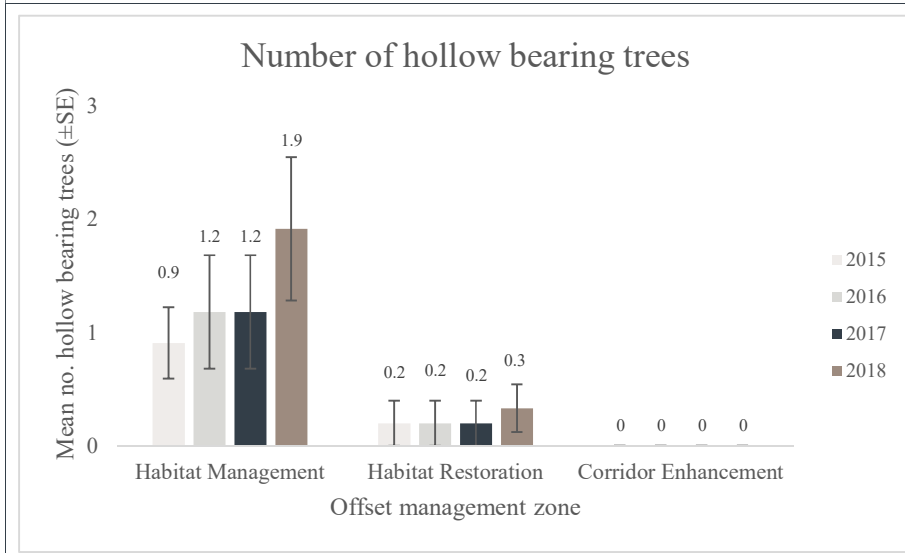
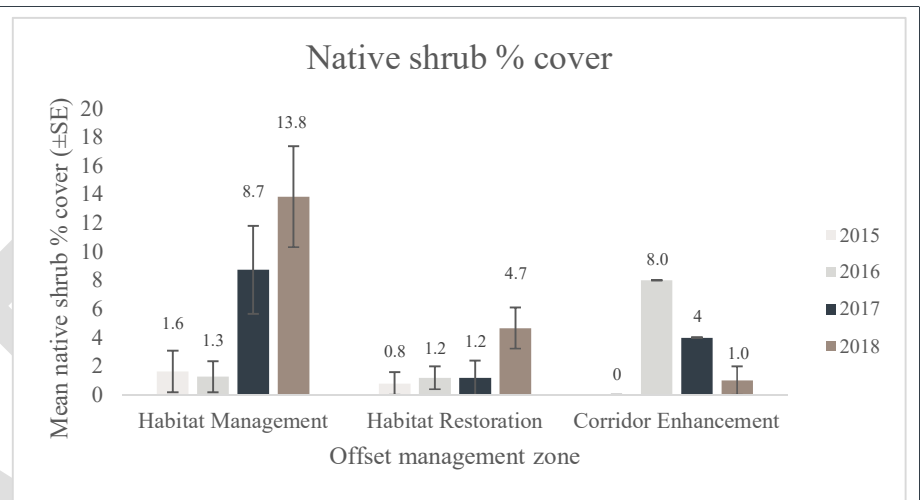
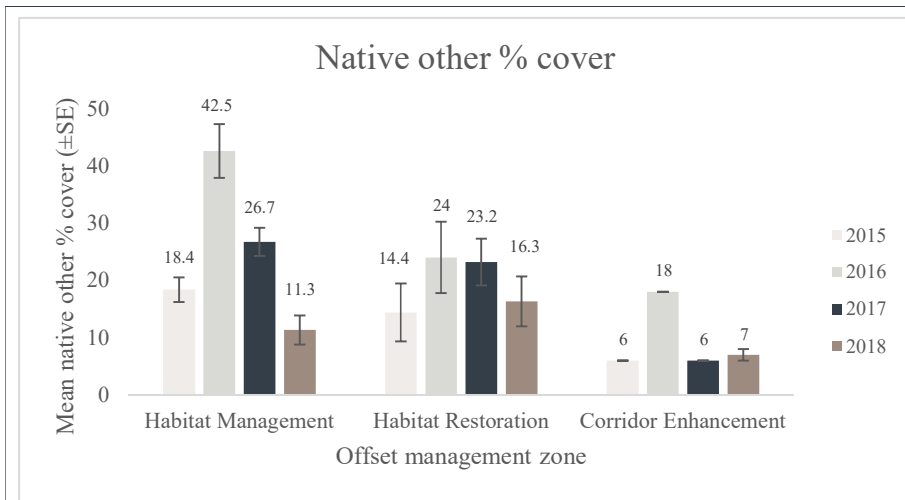
Cypress Pine was recorded at 14 Central Offset monitoring sites (i.e. 12 within habitat management zones (Ma2, Ma3, Ma4, Ma5, My3, My4, My5, My6, Wi1, Wi4, Wi5 and G1) and two within habitat restoration zones (My1 and W3) (Table 4.4).

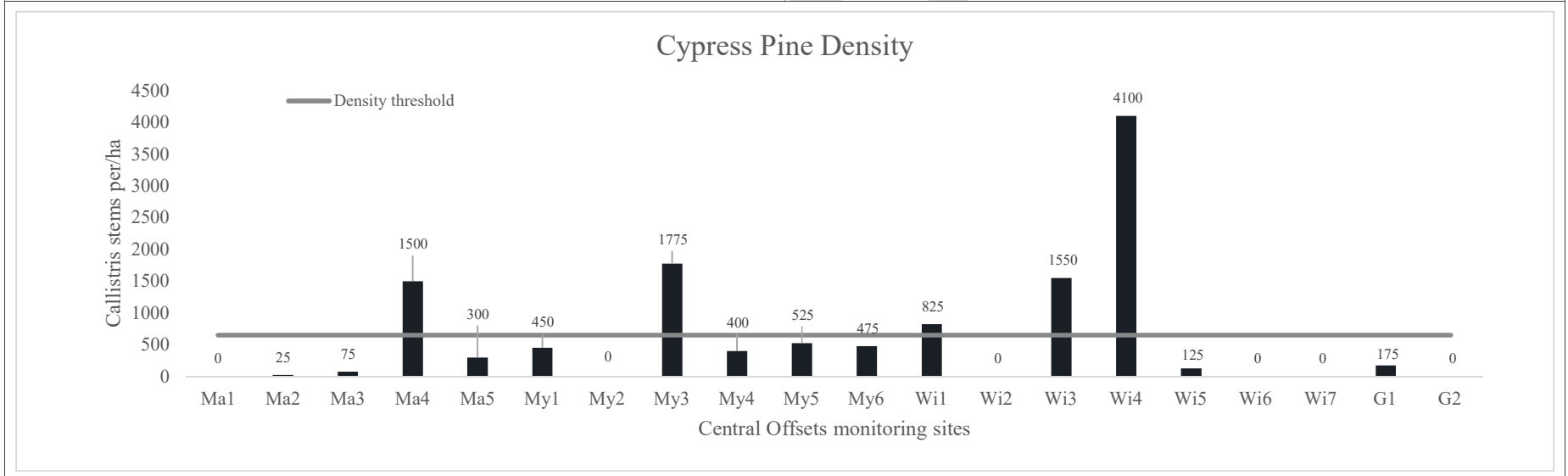
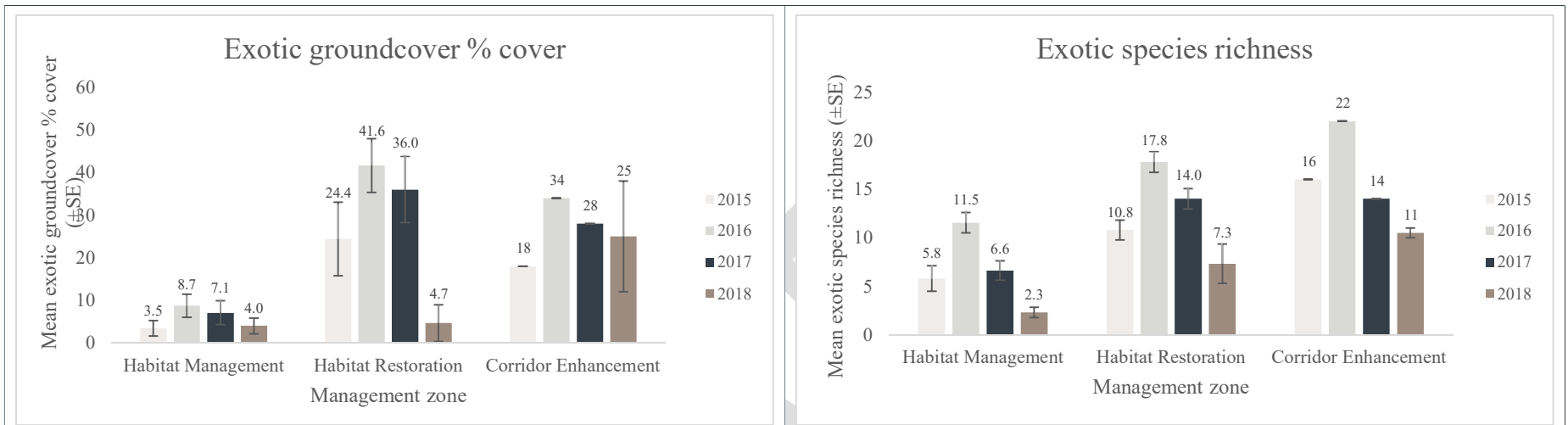
Five monitoring locations within the Central Offsets exceeded the Cypress Pine density threshold (i.e. Ma4, My3, Wi1, Wi3, Wi4) (Table 4.4), four of these sites contained Cypress Pine densities which were over double the threshold. Two of these sites showed no evidence of canopy recruitment (Wi1 and My3), however the other vegetation attributes (such as groundcover species composition and cover etc.) were generally within or exceeding the BBAM benchmark for their corresponding vegetation type.

It is possible that the germination and establishment of canopy species at Wi1 and My3 may be prohibited by the high density of Cypress Pine present, however given that most other vegetation attributes were within or exceeded the BBAM benchmarks they should be monitored further before commencing any thinning activities. As such, the five sites should be continuously monitored in subsequent years to determine whether Cypress Pine thinning is required to promote successful canopy recruitment.

Table 4.4 Central Offset Area – 2018 vegetation attributes and benchmark data (\pm SE)







4.5.2 FAUNA ASSEMBLAGES

4.5.2.1 DIURNAL BIRDS

A total of 104 species of diurnal bird were collectively recorded from the Central Offset Area in 2018 (Table 4.2). This comprised species common to the region, with Grey Fantail, Rufous Whistler, Eastern Yellow Robin, Mistletoebird, Willie Wagtail and Galah being most prevalent (Table D.4, Table D.5, Table D.6 and Table D.7 in Appendix D). Due to the presence of high quality woodland habitats in the Central Offset Area, eight threatened species of bird were recorded during the 2018 monitoring event including, Brown Treecreeper, Diamond Firetail, Dusky Woodswallow, Grey-crowned Babbler, Hooded Robin, Speckled Warbler, Turquoise Parrot, Varied Sittella (Figure 4.4, Figure 4.5, Figure 4.6).

In 2018, habitat management zones retained the highest diurnal bird species richness, with an average of 12.5 birds (Table 4.5). Habitat restoration and corridor enhancement zones recorded a lower mean diurnal bird species richness of 5.7 and 5.8 respectively. Replicate monitoring site Ma2 (Mallee BOA) recorded the highest mean species richness of 23.0 (as averaged from duplicate surveys), followed by G1 (Goonbri BOA) at 14.5 (Appendix D).

Species richness within habitat management zones has remained relatively consistent between years following the 2015 baseline monitoring event, meeting approximately 88 % of the LSF analogue benchmark for mean diurnal bird species richness in 2018 (Table 4.5). Four replicate monitoring sites associated with habitat management zones met or exceed the LSF benchmark, including My4, Ma2, W1 and G1. Habitat restoration and corridor enhancement zones recorded a mean species richness about 40 % of the LSF analogue benchmark.

Mean diurnal bird abundance has been comparable between years for habitat management zones, meeting about 94 % of the LSF analogue benchmark of 21.9 during the 2018 monitoring event (Table 4.5). Habitat restoration and corridor enhancement zones recorded approximately 35 % and 74 % of the LSF benchmark respectively.

4.5.2.2 MICROCHIROPTERAN BATS

A total of 14 species of microchiropteran bat were collectively recorded from the Central Offset Area in 2018. This comprised species common to dry woodland in the region, with Gould's Wattle-tailed Bat, South-eastern Free-tailed Bat and Little Broad-nosed Bat most prevalent (Appendix D). Four threatened species were recorded from the Anabat sample population (those active up to two hours after last light) and targeted harp trapping, including Eastern False Pipistrelle, Northern Free-tailed Bat, Yellow-bellied Shear-tail-bat and Corben's Long-eared Bat (Table 4.3, Appendix D).

Mean microchiropteran bat species richness was recorded highest in corridor enhancement zone (6.3), followed by habitat management zones (5.2) and habitat restoration zones (3.7) (Table 4.5). Replicate monitoring site G1 (Goonbri BOA) recorded the highest mean species richness of 9.0 (as averaged from duplicate surveys), followed by W1 (Wirrilah BOA) with 8.5.

Species richness within habitat management zones has largely remained consistent between years since the 2015 baseline monitoring event, and continues to meet the LSF analogue benchmark for mean microchiropteran bat species richness (Table 4.5). Habitat restoration zones have observed a progressive increase in mean microchiropteran bat species richness over the last three years, trending back towards results recorded during the 2015 baseline monitoring event. Habitat restoration zones achieved approximately 80 % of the LSF benchmark. Corridor enhancement zones observed a doubling in mean species richness from the 2017 monitoring event, to exceed the LSF analogue benchmark in 2018. This result was likely facilitated by the addition of replicate monitoring site W7 (Wirrilah BOA), which occurs immediately to the east of high quality remnant habitat associated with LSF.

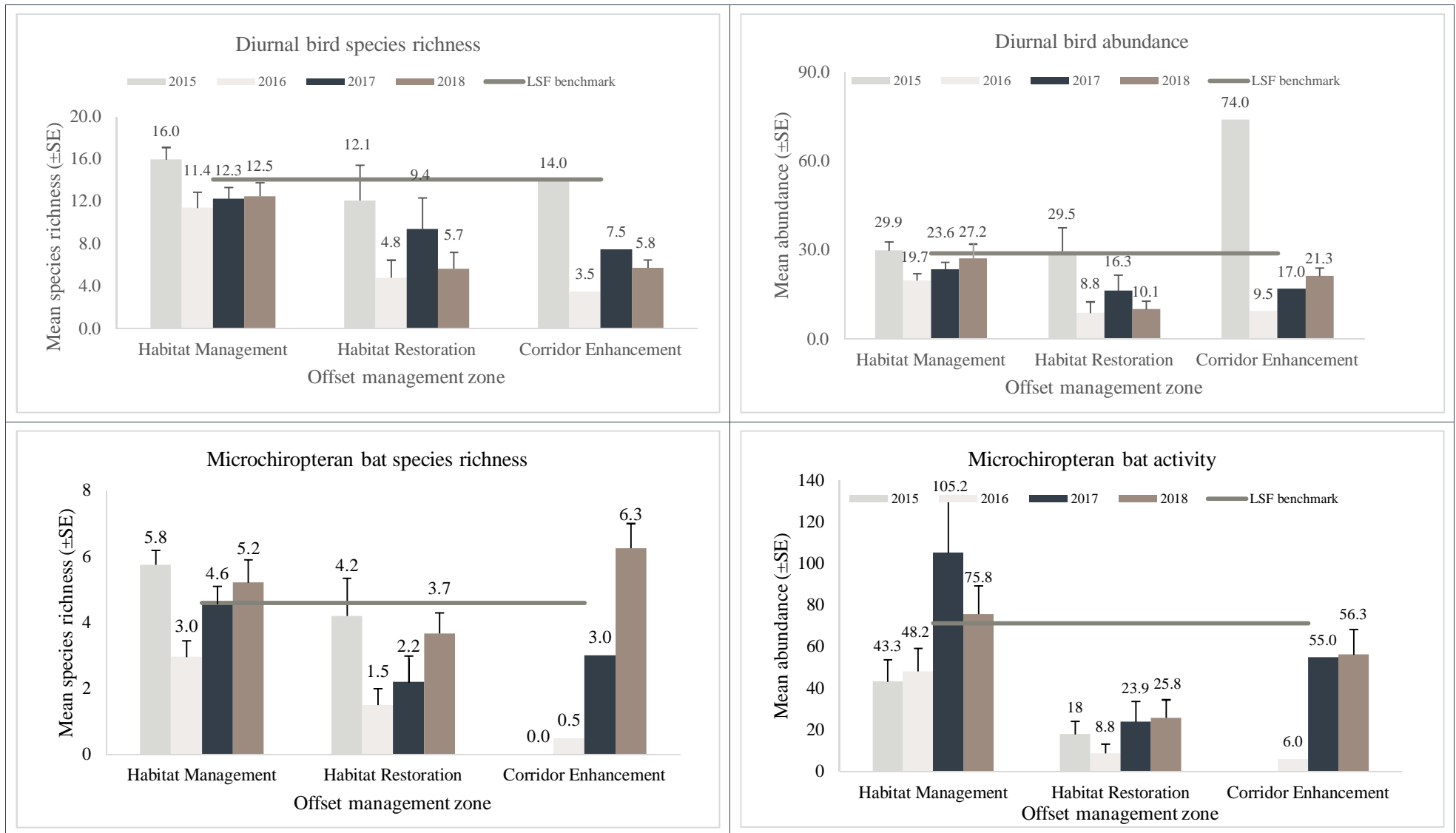
Mean microchiropteran bat activity during the 2018 monitoring event was relatively consistent within management zones when compared to 2017 (Table 4.5). Habitat management zones met the LSF benchmark for microchiropteran bat activity of 71.4. Habitat restoration and corridor enhancement zones achieved approximately 36 % and 79 % of the LSF benchmark respectively.

4.5.2.3 NOCTURNAL BIRDS AND MAMMALS

Nocturnal surveys were completed in the Goonbri, Wirrilah, Myall Plains and Mallee BOAs during the 2018 monitoring event, and comprised call playback and spotlighting methodologies. Species recorded included Australian Owlet-nightjar, Tawny Frogmouth, Eastern Grey Kangaroo, Common Wallaroo, Red-necked Wallaby and Swamp Wallaby (Appendix D).

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Table 4.5 Central Offset Area – 2018 fauna attribute and benchmark data (\pm SE)



4.6 STATE OF BOX GUM WOODLAND

The Central Offset Area contains approximately 948.8 ha of Box Gum woodland, which is listed under the BC Act and/ or EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Central Offset Area on lower slopes and flatter land (Figure 4.4, Figure 4.5, Figure 4.6). Within the Central Offset Area, Box Gum Woodland occurs in two states:

- State 1: Woodland – occupies 299.1 ha
- State 2: Native Pastures (derived native grassland) – occupies approximately 649.7.

Eight monitoring sites within the Central Offset Area (three within habitat management zone, three within habitat restoration zone and two within the corridor enhancement zone) represent the Box Gum Woodland ecological community.

A comparison of these monitoring sites against BBAM vegetation type benchmarks is provided in Table 4.6 and below in Section 4.6.1. An assessment of each Box Gum Woodland Central Offset monitoring site against the EPBC Act Policy Statement 3.5 for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is also provided in Table 4.7 and Section 4.6.2.

4.6.1 COMPARISON OF BOX GUM WOODLAND AGAINST BBAM BENCHMARK VALUES

An assessment of Box Gum Woodland Central Offset monitoring locations against the respective BBAM vegetation type benchmarks for White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion and Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion vegetation types (Table 4.6) identified the following:

- All but one monitoring site (Wi7 – corridor enhancement zone) meet the native species richness benchmark value (i.e. 23 native species richness).
- All habitat restoration and corridor enhancement zone sites failed to meet the native overstorey percentage cover benchmark value (i.e. 6–25%), alternatively all habitat management sites meet benchmark values.
- All monitoring sites meet, were within or exceeded the native midstorey percentage cover benchmark value (i.e. 0–5%).
- All monitoring sites meet, were within or exceeded the native groundcover (grass) benchmark value (i.e. 30–40%).
- All monitoring sites meet, were within or exceeded the native groundcover benchmark value (other) (i.e. 3–5%).
- All monitoring sites meet native groundcover (shrub) benchmark value (i.e. 0–0%) – no shrub cover Box Gum Woodland monitoring sites within the Central offsets exceeded 30%.
- All but monitoring site (My4 – habitat management zone) failed to meet the hollow bearing tree benchmark value (i.e. 1 hollow bearing tree).
- All monitoring sites failed to meet the fallen length of timber benchmark value (i.e. 30 m).
- No evidence of regeneration from habitat restoration and corridor enhancement zones, 33% of sites within habitat management zones show evidence of regeneration.

Although it is acknowledged that some of these attributes will increase naturally over time, the results indicate that habitat restoration and corridor enhancement zones would benefit from active management. Of particular importance is the management of vegetation attributes that take a long time to form such as canopy cover and fauna habitat resources.

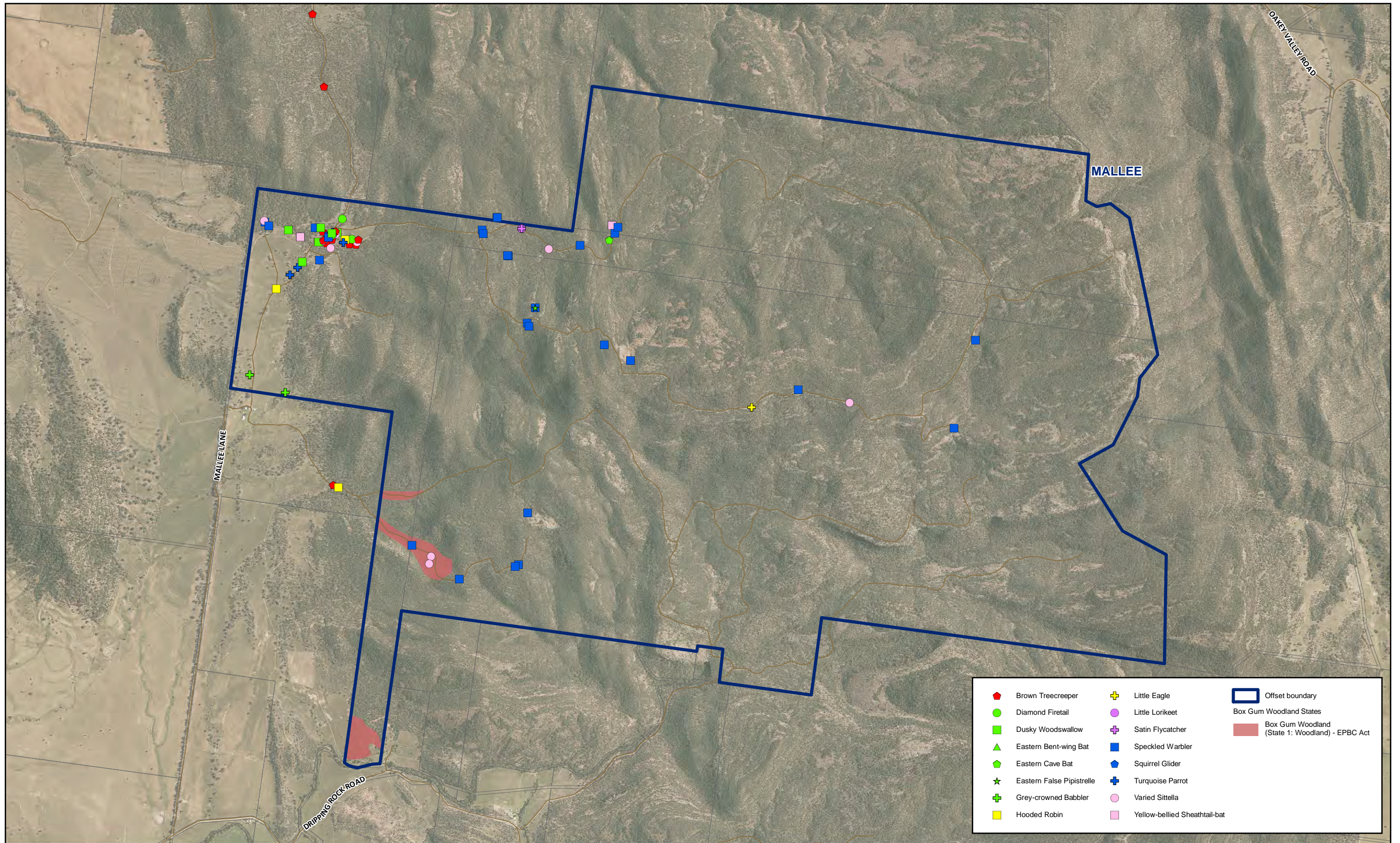
Due to the above, management within these management zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.

4.6.2 EPBC ACT ANALYSIS OF BOX GUM WOODLAND

An assessment of Central Offset Box Gum Woodland monitoring sites against the EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland concluded that of the eight Box Gum Woodland monitoring sites four are considered to meet the EPBC Act listing for this threatened ecological community (Table 4.7).

The Box Gum Woodland monitoring sites which meet the EPBC Act listing for the threatened ecological community included three sites from habitat management zones (G1, My4 and Wi1 all State 1 Grassy Woodlands) and one from habitat restoration zones (G2 – State 2 Native Pastures). Although G2 does not meet the understorey species richness criteria it did contain 11 of the 12 species required from within a 0.04 ha survey area. If a survey was conducted within a 0.1 ha it is considered likely that at least one additional species would be recorded. Therefore, this site is also considered likely to meet the EPBC Act listing.

All remaining sites (Wi3, Wi6, Wi2 and Wi7) failed to listed EPBC Act listed as they did not meet the required native understorey species richness criteria.



Map: PS110420_GIS_BOA004_A1
 Date: 8/03/2019
 Data source: BCOPL (2017)

Author: SuansriR
 Approved by: - N.Cooper

Scale ratio correct when printed at A3

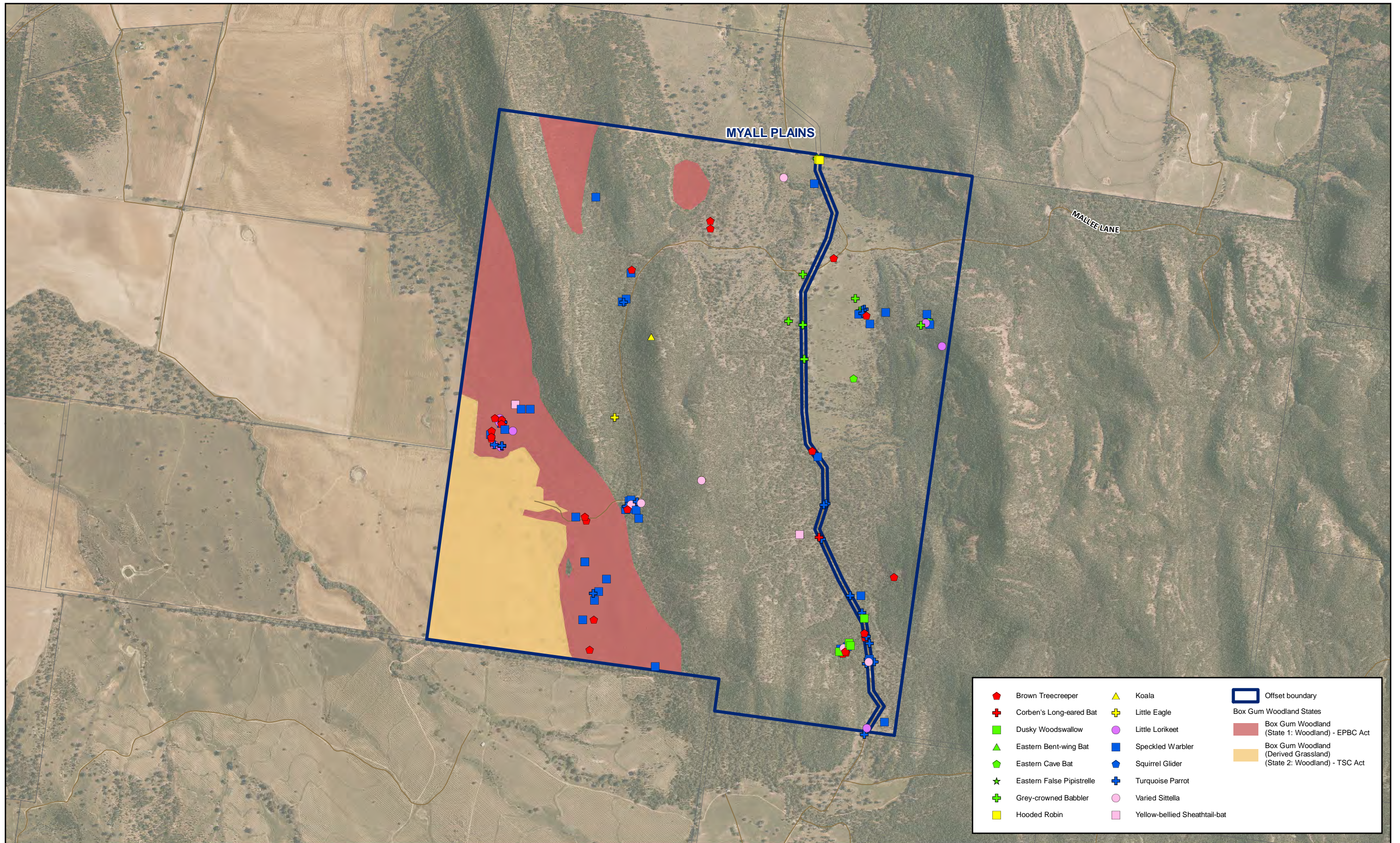
Coordinate system: GDA 1994 MGA Zone 56

wsp

Biodiversity Offset Monitoring

Figure 4.4
 Box Gum Woodland within Mallee BOA

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Brown Treecreeper	Koala	Offset boundary
Corben's Long-eared Bat	Little Eagle	Box Gum Woodland States
Dusky Woodswallow	Little Lorikeet	Box Gum Woodland (State 1: Woodland) - EPBC Act
Eastern Bent-wing Bat	Speckled Warbler	Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act
Eastern Cave Bat	Squirrel Glider	
Eastern False Pipistrelle	Turquoise Parrot	
Grey-crowned Babbler	Varied Sittella	
Hooded Robin	Yellow-bellied Sheathtail-bat	

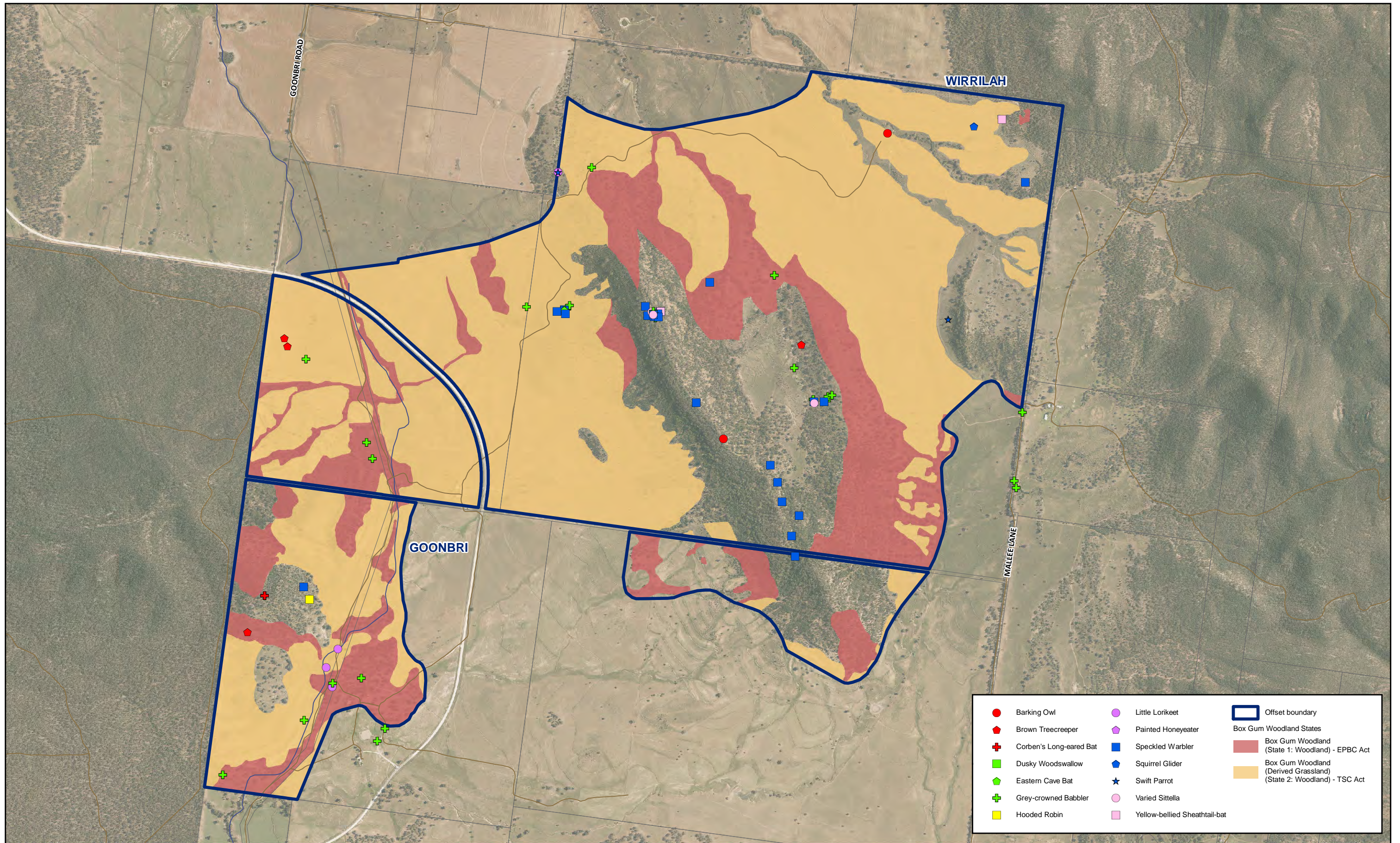
Map: PS110420_GIS_BOA004_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N. Cooper

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BIODIVERSITY OFFSET MONITORING
 Figure 4.5
 Box Gum Woodland within Myall Plains BOA

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	Barking Owl		Little Lorikeet		Offset boundary
	Brown Treecreeper		Painted Honeyeater	Box Gum Woodland States	
	Corben's Long-eared Bat		Speckled Warbler		Box Gum Woodland (State 1: Woodland) - EPBC Act
	Dusky Woodswallow		Squirrel Glider		Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act
	Eastern Cave Bat		Swift Parrot		
	Grey-crowned Babbler		Varied Sittella		
	Hooded Robin		Yellow-bellied Sheathtail-bat		

Map: PS110420_GIS_BOA004_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N.Cooper

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BIODIVERSITY OFFSET MONITORING

Figure 4.6
 Box Gum Woodland within Wirrilah BOA

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Table 4.6 Summary comparison of Box Gum Woodland between 2018 data and biometric data for the Central Offset Area

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GROUND COVER (GRASS) PERCENTAGE	NATIVE GROUND COVER (SHRUB) PERCENTAGE	NATIVE GROUND COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
BBAM Benchmark		6 to 25	0 to 0	30 to 40	0 to 0	3 to 5	23	1	30	n/a	n/a	Native species richness >80% of BBAM benchmark, all other attributes within or above benchmark values. 100% regeneration required across each management zone.
Habitat Management Zone												
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Goonbri 1	11 ✓	3.7 >	84 >	0 ✓	12 >	38 >	0 X	11 X	0.5	Box Gum Woodland – State 1 Grassy Woodland Evidence of livestock and feral herbivore grazing present.	Number of trees with hollows and length of fallen timber is below BBAM benchmark values.
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Myall Plains 4	13.5 ✓	29.5 >	56 >	24 >	12 >	50 >	5 >	22 X	0	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present.	Length of fallen timber is below BBAM benchmark values.
	Wirrilah 1	15 ✓	4.4 >	70 >	6 >	24 >	43 >	0 X	12 X	0	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present.	Number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Habitat Management Zone										33%	-	Regeneration does not meet performance criteria.
Habitat Restoration Zone												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Wirrilah 3	0.4 X	37.5 >	64 >	10 >	20 >	36 >	0 X	0 X	1	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Pigs).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Wirrilah 6	0 X	0 ✓	52 >	6 >	4 ✓	24 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present (Cattle and Pigs).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Goonbri 2	0 X	0 ✓	48 >	6 >	20 >	25 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of livestock and feral herbivore grazing present.	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Habitat Management Zone										33%	-	Regeneration does not meet performance criteria.

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GROUND COVER (GRASS) PERCENTAGE	NATIVE GROUND COVER (SHRUB) PERCENTAGE	NATIVE GROUND COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
Corridor Enhancement Zone												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Wirrilah 2	0 X	0 ✓	74 >	0 ✓	6 >	24 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Pigs).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Wirrilah 7	0 X	0 ✓	78 >	2 >	8 >	22 X	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Pigs).	Native overstorey projected foliage cover, number of trees with hollows, length of fallen timber and native species richness is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Corridor Enhancement Zone										0%	-	Regeneration does not meet performance criteria.

Note: 1) Red shaded X = variable below benchmark value, Green shaded ✓ = variable within benchmark value, Orange shading > = variable exceeds benchmark. 2) Green shaded = indicates all vegetation attributes meet performance criteria and therefore maintenance is only required, Red shaded = indicates that although some vegetation attributes meet or are within benchmark values some fail to meet benchmarks.

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Table 4.7 2018 Central Offset BOA monitoring data assessment against EPBC Act Box Gum Woodland determining criteria

CRITERIA	HABITAT MANAGEMENT ZONE			HABITAT RESTORATION ZONE			CORRIDOR ENHANCEMENT ZONE	
	G1	My4	Wi1	Wi3	Wi6	G2	Wi2	Wi7
Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Rd Gum?	Yes – overstorey species are or where previously dominated by either <i>Eucalyptus albens</i> (White Box) and/or <i>Eucalyptus melliodora</i> (Yellow Box).							
Does the patch have a predominantly native understorey?	Yes - native groundcover > 50%			Yes - native groundcover > 50%			Yes - native groundcover > 50%	
Is the patch 0.1 ha or greater in size?	Yes – patches exceed 0.1 ha in size			Yes – patches exceed 0.1 ha in size			Yes – patches exceed 0.1 ha in size	
There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	Yes – 16 native understorey spp. & 5 important spp. recorded.	Yes – 15 native understorey spp. & 5 important spp. recorded.	Yes – 16 native understorey spp. & 6 important spp. recorded.	Yes – 13 native understorey spp. & 5 important spp. recorded.	No – 7 native understorey spp. & 3 important spp. recorded.	No – 11 native understorey spp. & 5 important spp. recorded.	No – 8 native understorey spp. & 2 important spp. recorded.	No – 6 native understorey spp. & 2 important spp. recorded.
Meet EPBC Act listing criteria?	Yes, does meet criteria			Yes, does meet criteria	No, does not meet criteria	Yes, if species inventory was completed over 0.1 ha it's considered likely to meet the criteria	No, does not meet criteria	

Note: Analysis based on 0.04 ha (20 X 20 m) vegetation quadrat undertaken as part of 2018 annual BOA monitoring.

5 NAMOI OFFSET AREA – 2018 RESULTS

5.1 INTRODUCTION

The Namoi Offset Area encompasses the Namoi and Jerralong BOAs, which collectively cover approximately 3,785.0 ha and are located approximately 2 km south-west of the of the project (Figure 1.1). The Namoi and Jerralong BOAs occur on the Namoi floodplain (and Nagero Creek) and Bollol Creek floodplain respectively, much of which was historically used for agriculture. Although most the lower slopes exhibit the effects of grazing there are areas that contain remnant vegetation; particularly to the west of the Kamilaroi Highway. The vegetation and management zones within the Namoi Offset Area are illustrated in Figure 5.1.

5.2 FLORA

235 plant species were recorded within the Namoi Offsets during the 2018 monitoring session. Of these, 178 (76%) were native and 57 (24) were exotic (Table C.8 of Appendix C). The most diverse families recorded were the Poaceae with 51 species and the Asteraceae with 34 species. No threatened flora species have been recorded within the Namoi Offset Area.

Of the 51-exotic species that were recorded in 2018, three were previously listed as noxious weeds under the *Noxious Weeds Act 1993* (Table 5.1). The *Noxious Weeds Act 1993* has since been repealed and replaced by the *Biosecurity Act 2015* under which noxious weeds have been replaced by priority weeds. Three introduced species listed within the North West LLS control region were recorded within the Namoi Offsets during 2018. Two of these weeds are also listed as Weeds of National Significance (WONs).

Table 5.1 Noxious weeds recorded within the Namoi Offset Area

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY (NW ACT)	PRIORITY WEED (BA ACT)	WONS	2015	2016	2017	2018
Prickly Pear	<i>Opuntia stricta</i> *	4	Yes	Yes	✓	✓	✓	✓
Fog-fruit	<i>Phyla canescens</i> *	4	No	No	✓	✓	✓	✓
African Boxthorn	<i>Lycium ferocissimum</i> *	4	Yes	Yes	✓	✓	✓	✓
Mexican Poppy	<i>Argemone ochroleuca</i> *	5	No	No		✓	✓	
Sweet briar	<i>Rosa rubiginosa</i> *	–	Yes	No			✓	

The Namoi Offsets also contained other invasive species which occurred abundantly throughout the BOA. These species included common pasture grasses (such as *Avena fatua** (Wild Oats), *Lolium perenne** (Perennial Ryegrass), *Bromus molliformis**, *Bromus catharticus**)), thistle species (such as *Silybum marianum** (Variegated Thistle), *Lactuca serriola** (Prickly Lettuce), *Carthamus lanatus** (Saffron Thistle), *Cirsium vulgare** (Spear Thistle) and *Centaurea melitensis** (Maltese Thistle)) and common herbaceous herbs and forbs commonly found in pastures (including *Arctotheca calendula** (Cape Dandelion), *Echium plantagineum** (Paterson's Curse), *Xanthium occidentale** (Noogoora Burr), *Rapistrum rugosum** (Turnip Weed) as well as *Trifolium** and *Medicago* species*).

Whilst these species are not listed under the *Biosecurity Act 2015* management of these species should still be considered.

5.3 FAUNA

The 2018 monitoring event recorded 130 species of animal within the Namoi Offset Area, including 126 native species and four introduced species (Table 5.2; Table D.8 of Appendix D).

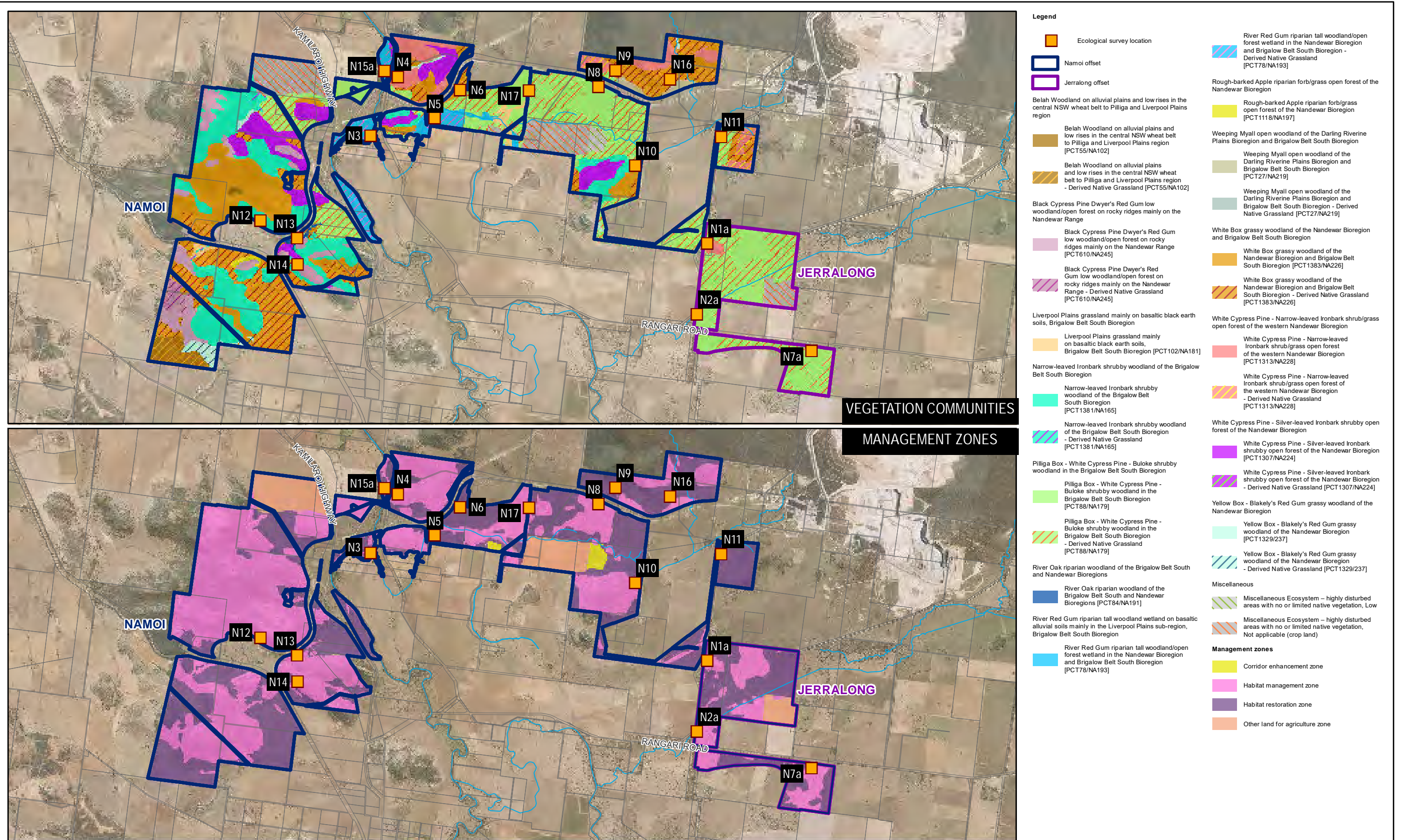
Table 5.2 Summary of terrestrial animal species identified in the Namoi Offset Area

GROUP	SPECIES RICHNESS	
	Native	Introduced
Birds	102	2
Microbats	15	0
Mammals (non-bats)	3	2
Reptiles	2	0
Frogs	4	0
Total	126	4

A total of 10 threatened species were recorded within the Namoi Offset Area during 2018 monitoring; encompassing BOA monitoring, targeted Swift Parrot and Regent Honeyeater survey, and targeted Corben's Long-eared Bat survey (Table 5.3; Table D.8 of Appendix D).

Table 5.3 Threatened species recorded within the Namoi Offset Area

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT	2015	2016	2017	2018
Speckled Warbler	<i>Chthonicola sagittata</i>	–	V	✓	✓	✓	✓
Spotted Harrier	<i>Circus assimilis</i>	–	V	✓		✓	
Little Eagle	<i>Hieraaetus morphnoides</i>	–	V	✓			
Brown Treecreeper	<i>Climacteris picumnus</i>	–	V			✓	
Dusky Woodswallow	<i>Artamus cyanopterus</i>	–	V		✓	✓	✓
Painted Honeyeater	<i>Grantiella picta</i>	V	V	✓	✓	✓	✓
Varied Sittella	<i>Daphoenositta chrysoptera</i>	–	V	✓	✓	✓	✓
Diamond Firetail	<i>Stagonopleura guttata</i>	–	V	✓			
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis temporalis</i>	–	V	✓	✓	✓	✓
Little Lorikeet	<i>Glossopsitta pusilla</i>	–	V	✓		✓	
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V	✓	✓	✓	✓
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V		✓		
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	–	V	✓	✓	✓	✓
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	–	V	✓	✓	✓	✓
Eastern Cave Bat	<i>Vespadelus troughtoni</i>		V		✓		✓
Northern Free-tailed Bat	<i>Mormopterus lumsdenae</i>		V				✓
Little Pied Bat	<i>Chalinolobus pictatus</i>	–	V			✓	



- Legend**
- Ecological survey location
 - Namoi offset
 - Jerralong offset
- Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region
- Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region [PCT55/NA102]
 - Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region - Derived Native Grassland [PCT55/NA102]
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range
- Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range [PCT610/NA245]
 - Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range - Derived Native Grassland [PCT610/NA245]
- Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion
- Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion [PCT102/NA181]
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion
- Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion [PCT1381/NA165]
 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion - Derived Native Grassland [PCT1381/NA165]
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion
- Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion [PCT88/NA179]
 - Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion - Derived Native Grassland [PCT88/NA179]
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions
- River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions [PCT84/NA191]
- River Red Gum riparian tall woodland/wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland/wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion [PCT78/NA193]
- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT78/NA193]
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion [PCT1118/NA197]
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
- Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion [PCT27/NA219]
 - Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT27/NA219]
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion [PCT1383/NA226]
 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion - Derived Native Grassland [PCT1383/NA226]
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [PCT1313/NA228]
 - White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion - Derived Native Grassland [PCT1313/NA228]
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
- White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion [PCT1307/NA224]
 - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion - Derived Native Grassland [PCT1307/NA224]
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion
- Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [PCT1329/237]
 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion - Derived Native Grassland [PCT1329/237]
- Miscellaneous**
- Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Low
 - Miscellaneous Ecosystem - highly disturbed areas with no or limited native vegetation, Not applicable (crop land)
- Management zones**
- Corridor enhancement zone
 - Habitat management zone
 - Habitat restoration zone
 - Other land for agriculture zone

Map: PS110420_GIS_BOA006_A1 Author: SuansriR

Date: 12/03/2019 Approved by: - N.Cooper

Data source: Imagery from Atlas-Aerometrex Pty Ltd (31/10/2017). Copyright: © 2014 Esri

Scale: 1:80,000
Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3



Boggabri Coal

BIODIVERSITY OFFSET MONITORING

Figure 5.1
Vegetation communities and management zones
- Namoi BOA

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5.4 PROGRESSIVE RESTORATION WORKS

Restoration activities complete within the Namoi BOA to date include:

- 2016: a trial revegetation area was established within the Namoi Offset Area (area south west of the Project, east of Leard State Forest Road and north of Goonbri Road).
- 2017: revegetation works commenced in habitat restoration zones of the Namoi BOA (section north of the rail corridor and immediately south of Leard State Forest in vicinity of Merriown Mountain)
- 2018: revegetation works continued within habitat restoration zones of the Namoi BOA (along the Namoi floodplain either side of the haul road from Merriown Mountain to the Kamilaroi Highway).

These restoration works have largely involved tube stock planting of canopy and shrub species as depicted in (Photo 5.1, Photo 5.2, Photo 5.3 and Photo 5.4).



Photo 5.1 An example of 2016 planting trial completed in the Namoi BOA in 2018



Photo 5.2 An example of 2017 restoration work completed in the Namoi BOA



Photo 5.3 An example of 2018 restoration works completed in the Namoi BOA



Photo 5.4 An example of 2018 restoration works completed in the Namoi BOA

Five of the Namoi Offset monitoring locations surveyed in 2018 occur within areas where these restoration activities were completed (Na5, Na6, Na11, Na16 and Na17). The survivorship of tube stock planted during 2016, 2017 and 2018 was highest at Na5 (2017 plantings) with 100% survival recorded followed by Na11 (2016 planting trial) and Na6 (2017 plantings) both with 91%. Survival of tube stock was least successful at Na17 with 78% survival recorded. Dieback appeared to be highest for *Eucalyptus albens* and *Eucalyptus pilligaensis* individuals.

It should be noted that this survival percentage may not be representative of all areas of the Namoi BOA as these results are specific to the five monitoring sites. More plots would be required across the BOA to provide a more reliable estimate of survivorship.

5.5 COMPARISON OF OFFSET MANAGEMENT ZONES

The Namoi Offsets have been separated into two management zones (habitat management and habitat restoration) based on the condition of vegetation, past land uses and management actions required (Table 5.4). Biodiversity monitoring sites for the Namoi Offsets have been established within each of these offset management zones. A comparison of the 2018 monitoring mean flora attributes and fauna assemblages for each management zone is provided below.

5.5.1 FLORA

5.5.1.1 NATIVE VEGETATION ATTRIBUTES

Total mean native species richness at the Namoi Offsets was recorded highest within the habitat management zones (47.1) and lowest at the habitat restoration zones (29.7). Both habitat management and restorations zones had shown an incremental increase in total mean native species richness since the 2015 baseline monitoring (Table 5.4). The 2018 results are higher than 2017 for both habitat management and restorations zones.

Mean native overstorey percentage cover at the Namoi Offsets was highest within the habitat management zones (17%) and entirely void at the habitat restoration zones. The void of native canopy cover within these areas is attributed to past vegetation clearing and agricultural land uses which has resulted in these areas now occurring as derived native grassland. Mean native overstorey percentage cover at the habitat management zones remained relatively similar to the 2017 monitoring event both of which are higher than than the 2015 baseline monitoring (Table 5.4).

Mean native midstorey percentage cover at the Namoi Offsets was highest within the habitat management zones (9.3%) and lowest at the habitat restoration zones (1.2%). Mean native midstorey percentage cover at both offset management zones has decreased since the 2017 monitoring session. Results were however relatively consistent with previous years data (Table 5.4).

Mean native grass groundcover at the Namoi Offsets was highest within the habitat management zones (40.6%) and lowest at the habitat restoration zones (35.7%). Mean native grass groundcover has remained relatively consistent within the habitat restoration and habitat management zones since the 2015 baseline monitoring (Table 5.4).

Mean native other groundcover at the Namoi Offsets was highest within the habitat management zones (23.8%) and lowest at the habitat restoration zones (13.7%). Native other cover within the habitat management zones has increased since the 2015 baseline monitoring however remained slightly decreased with the habitat restoration zones (Table 5.4).

Mean native shrub groundcover at the Namoi Offsets was highest within the habitat management zones (6.4%) and lowest in the habitat restoration zones (8%). Mean native shrub groundcover has remained relatively similar across both management zones since the 2015 baseline monitoring (Table 5.4).

Mean number of hollow bearing trees at the Namoi Offsets was highest at the habitat management zones (0.8). No hollow bearing trees were recorded within the habitat restoration zones. Number of hollow bearing trees has decreased slightly since the 2015 baseline monitoring (Table 5.4).

The mean total length of fallen timber at the Namoi Offsets was highest within the habitat management zones (56.5 m) and entirely void within the habitat restoration zones. Fallen timber has incrementally increased within the habitat management zones since the 2015 baseline monitoring (Table 5.4).

5.5.1.2 EXOTIC VEGETATION ATTRIBUTES

Mean exotic species richness and mean exotic groundcover percentage cover was recorded highest from within habitat restoration zones (16 and 36% respectively) and lowest from within habitat management zones (11.4 and 20.2% respectively). Both these attributes have remained relatively consistent since the 2015 baseline monitoring session within the habitat management and corridor enhancement zones (Table 5.4).

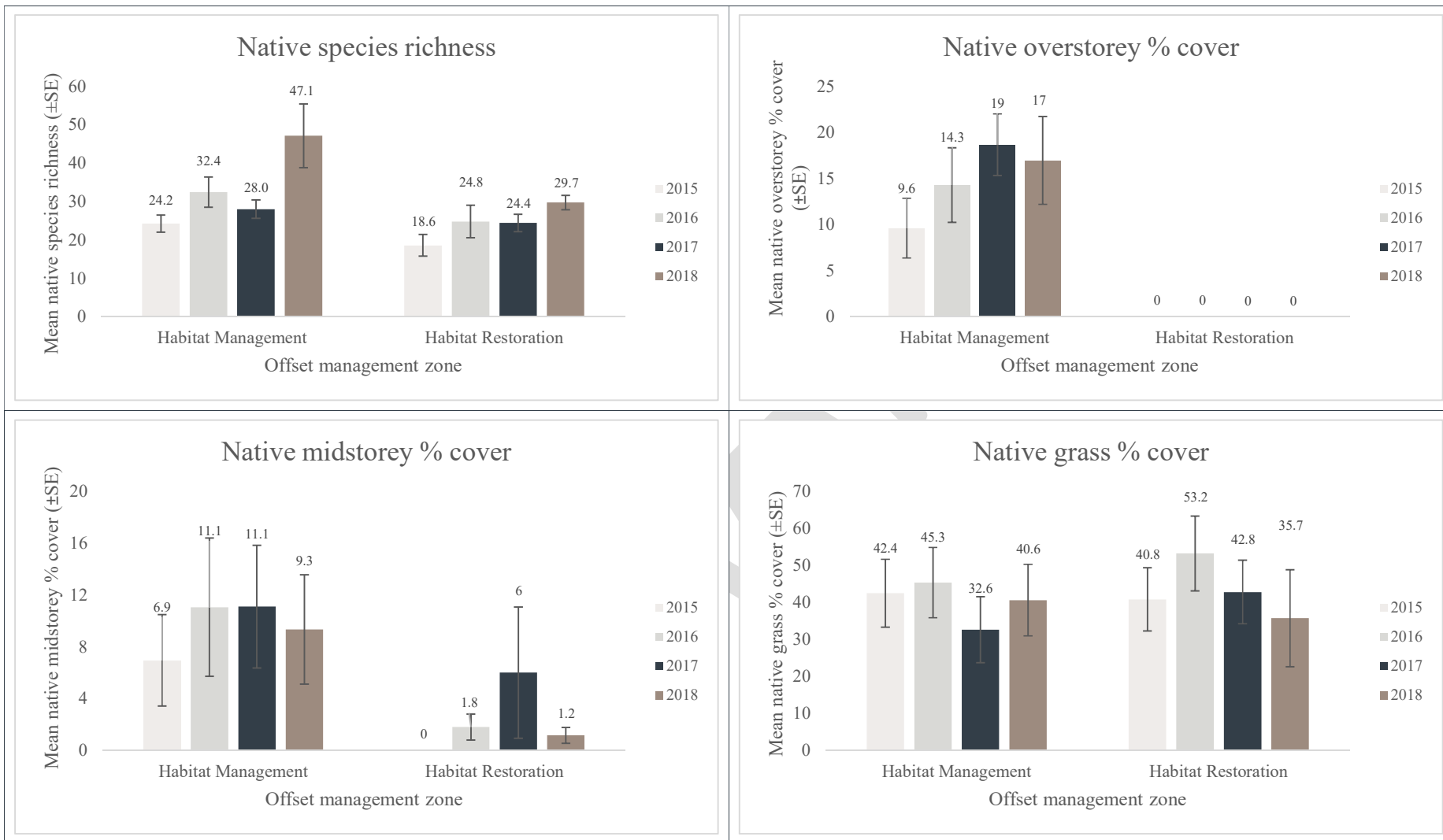
5.5.1.3 CYPRESS PINE DENSITY

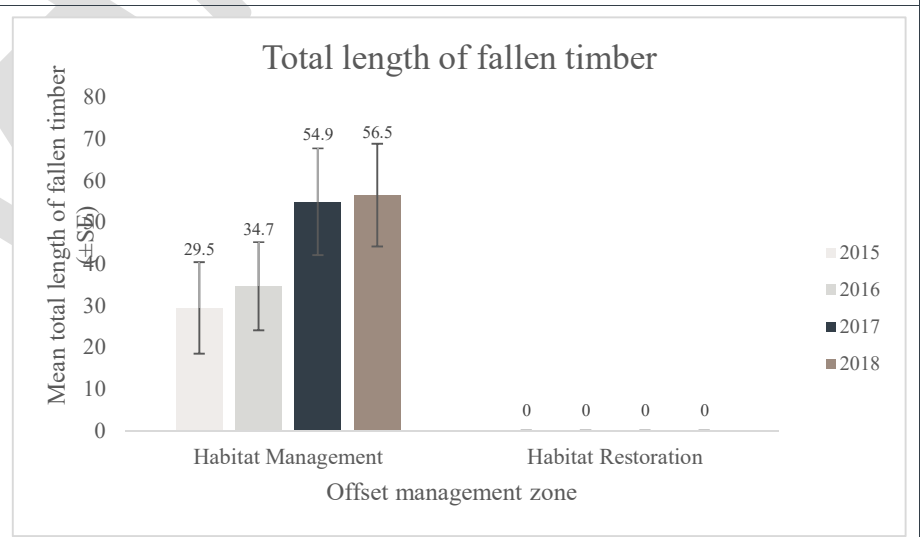
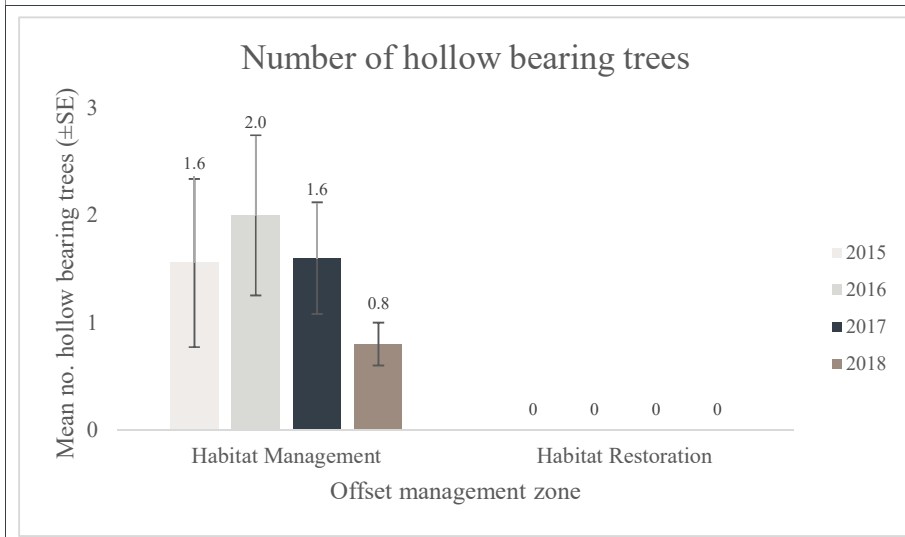
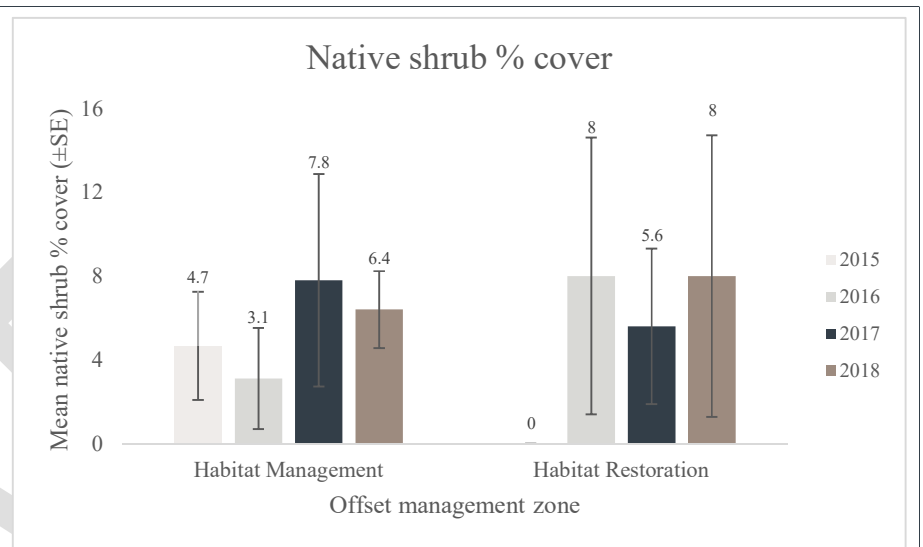
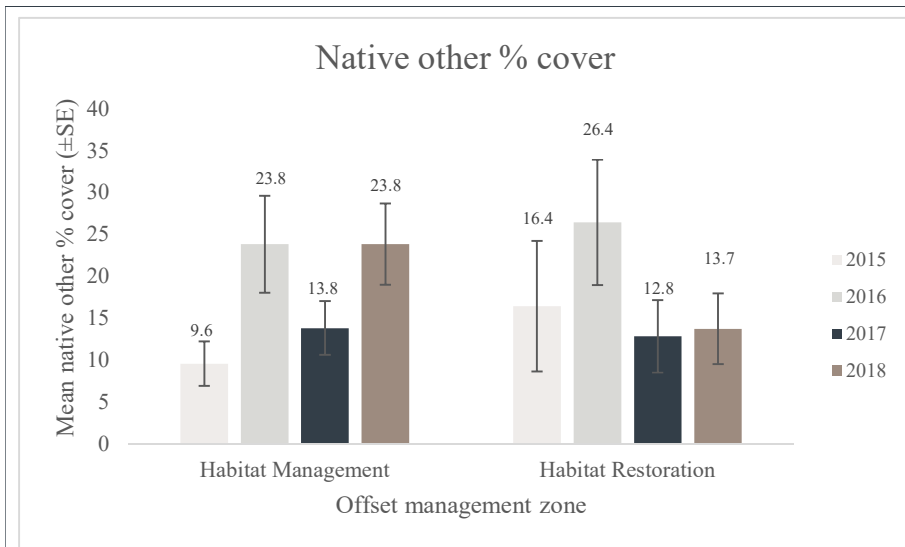
Cypress Pine was recorded at eight Central Offset monitoring sites (i.e. five within habitat management zones (Na1, Na4, Na10, Na12 and Na14) and three within habitat restoration zones (Na9, Na11 and Na16). From these sites, Cypress Pine stems per hectare were recorded highest from monitoring site Na11 (400 stems per/hectare) and lowest at Na12, Na14 and Na16 (all with 25 stems/hectare) (Table 5.4).

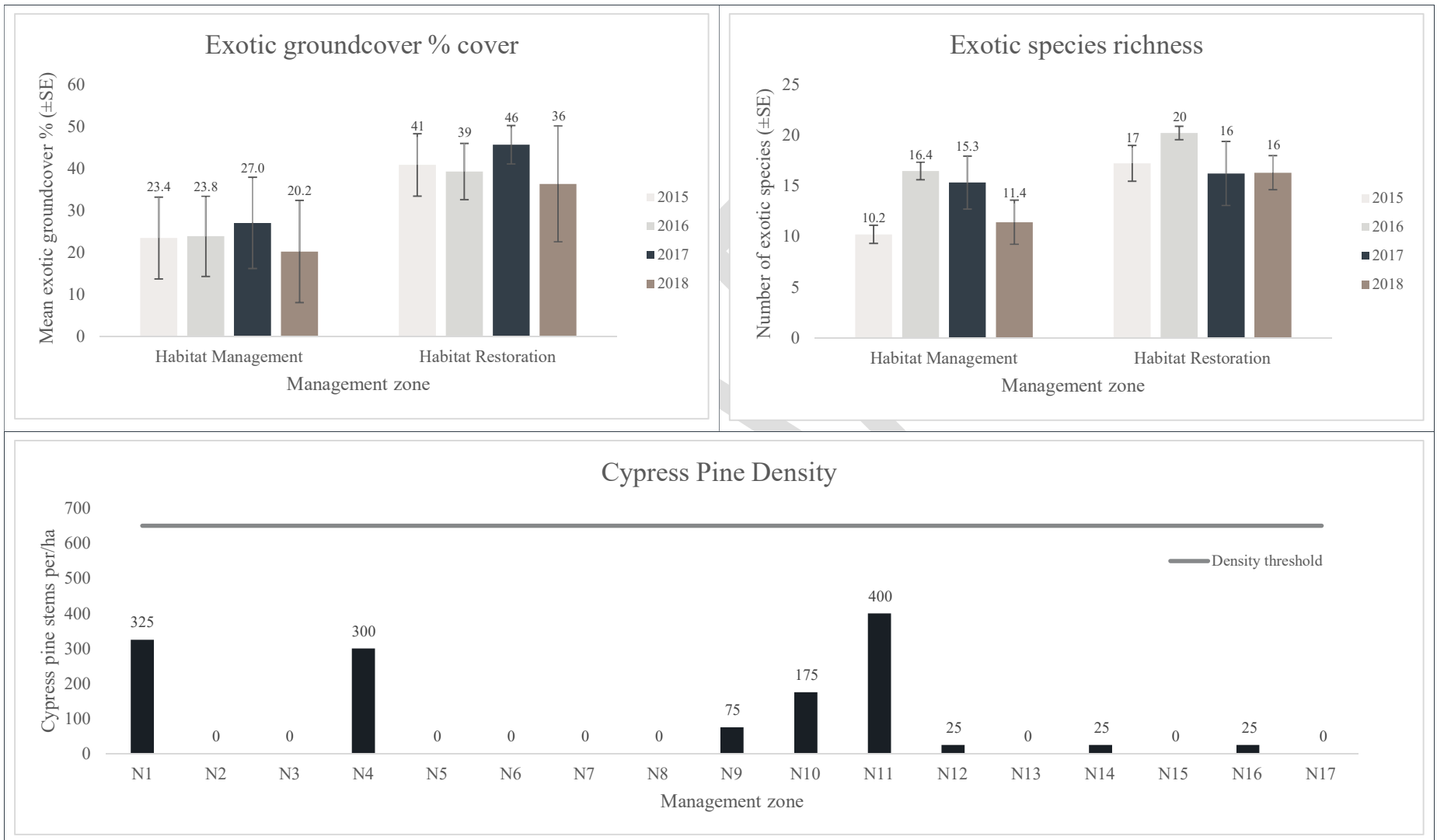
No monitoring locations within the Namoi Offsets exceeded the Cypress Pine density threshold (Table 5.4). As such, Cypress Pine thinning in proximity to these monitoring sites is not required.

DRAFT

Table 5.4 Namoi Offset Area – 2018 vegetation attributes and benchmark data (\pm SE)







5.5.2 FAUNA ASSEMBLAGES

5.5.2.1 DIURNAL BIRDS

A total of 104 species of diurnal bird were collectively recorded from the Namoi Offset Area in 2018 (Table 5.2). This include open country species common to the region, with Pied Butcherbird, Australian Magpie, Galah, Crested Pigeon, Australian Raven, Superb Fairywren, Striated Pardalote and Eastern Rosella the most prevalent (Table D.8 in Appendix D). Due to previous agricultural practices, most remnant habitat from the Namoi River floodplain to the eastern extremity of the Namoi Offset Area largely consists of vegetated drainage lines, isolated vegetated acclivities and partially cleared footslopes. It follows that threatened species recorded in the Namoi Offset Area consist of mobile species, small resident passerines, or species that favour edge or ecotonal habitats. Nevertheless, large patches high condition woodland occurs within the Namoi Offset Area (particularly to the west of the Kamilaroi Highway) and the diversity of habitats that it encompasses ensures the presence of a diverse fauna. Five threatened species were recorded during the 2018 monitoring event, including Dusky Woodswallow, Painted Honeyeater, Speckled Warbler, Varied Sittella and Grey-crowned Babbler (Table 5.3, Figure 5.2).

Following the 2015 baseline monitoring survey, diurnal bird species richness in the Namoi Offset Area has been largely comparable between years within management zones (Table 5.5). Habitat management zones retained the largest diurnal bird species richness during the 2018 monitoring event, with an average of 11.6 birds. Habitat restoration zones returned a lower mean species richness of 5.3 (Table 5.5). Replicate monitoring site N1a (Jerralong BOA) recorded the highest mean species richness of 17.5 (as averaged from duplicate surveys), followed by N3 (Namoi BOA) at 15.5 (Appendix D).

During the 2018 monitoring event, habitat management zones realised a diurnal bird species richness approximately 82 % of the LSF analogue benchmark (Table 5.5). Two replicate monitoring sites associated with habitat management zones met or exceeded the LSF benchmark, including N1 and N3. Habitat restoration zones recorded a mean species richness about 38 % of the LSF analogue benchmark.

Mean diurnal bird abundance has been comparable between years for habitat management zones, exceeding the LSF analogue benchmark of 21.9 during the 2018 monitoring event (Table 5.5). Habitat restoration zones recorded approximately 35 % and 74 % of the LSF benchmark respectively.

5.5.2.2 MICROCHIROPTERAN BATS

A total of 15 species of microchiropteran bat were collectively recorded from the Namoi Offsets in 2018. This comprised species common to dry woodland in the region, with Gould's Wattled Bat, Inland Free-tailed Bat, South-eastern Free-tailed Bat and Yellow-bellied Sheat-tail-bat the most widespread (Appendix D). Five threatened species were recorded from the Anabat sample population (those active up to two hours after last light) and targeted harp trapping, including Corben's Long-eared Bat, Eastern Cave Bat, Eastern False Pipistrelle, Northern Free-tailed Bat and Yellow-bellied Sheat-tail-bat (Appendix D).

Mean microchiropteran bat species richness was observed to be higher in habitat management zones compared to habitat restoration zones during the 2018 monitoring event, with an average of 5.0 and 2.2 recorded respectively (Table 5.5). An increase in mean species richness was observed in habitat management zones from 2017 values, whilst those for habitat restoration zones were observed to be similar. Within the habitat management zone, replicate monitoring site N12 and N13 recorded the highest mean species richness (8.5), as averaged from duplicate surveys. Habitat management zones met the LSF benchmark for mean species richness during the 2018 monitoring period, while habitat restoration zones achieved approximately 48% of the benchmark (Table 5.5).

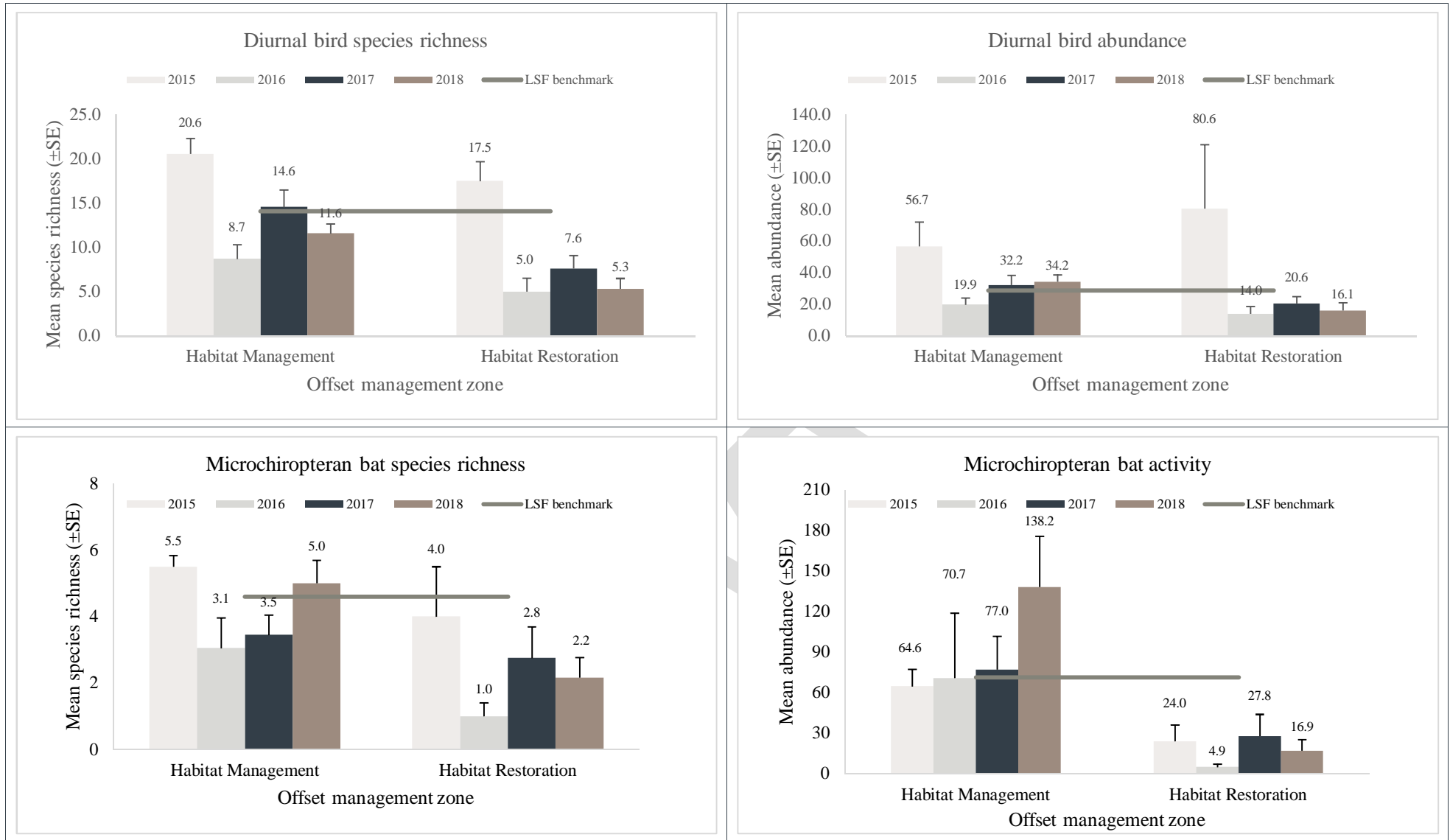
Habitat management zones retained a higher mean microchiropteran bat activity compared to habitat restoration zones during the 2018 monitoring period; a trend maintained since the 2015 baseline monitoring event. Mean activity has remained largely comparable between years within management zones. Habitat management zones exceeded the LSF benchmark for mean activity, whilst habitat restoration zones reached approximately 24 % (Table 5.5).

5.5.2.3 NOCTURNAL BIRDS AND MAMMALS

Nocturnal surveys were completed in the Namoi and Jerralong BOAs during the 2018 monitoring event, and comprised call playback and spotlighting methodologies. Species recorded included Tawny Frogmouth, Common Brush-tailed Possum, Eastern Grey Kangaroo, Common Wallaroo, Swamp Wallaby, White-striped Freetail-bat, Eastern Brown Snake and Peron's Tree Frog.

DRAFT

Table 5.5 Namoi Offsets Area – 2018 fauna attribute and benchmark data (\pm SE)



5.6 STATE OF BOX GUM WOODLAND

The Namoi Offset Area contains approximately 916.5 ha Box Gum Woodland, which is listed under the BC Act and/or EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Namoi Offset Area on lower slopes and flatter land (Figure 5.2). Within the Namoi Offset Area Box Gum Woodland occurs in two states:

- State 1: Woodland – occupies 326.4 ha
- State 2: Native Pastures – occupies 590.1 ha.

Two monitoring sites within the Namoi Offset Area (both within habitat restoration zones) represent the Box Gum Woodland ecological community.

A comparison of these monitoring sites against BBAM vegetation type benchmarks is provided in Table 5.6 and below in Section 5.6.1. An assessment of each Box Gum Woodland Namoi Offset monitoring site against the EPBC Act Policy Statement 3.5 for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is also provided in Table 5.7 and below in Section 5.6.2.

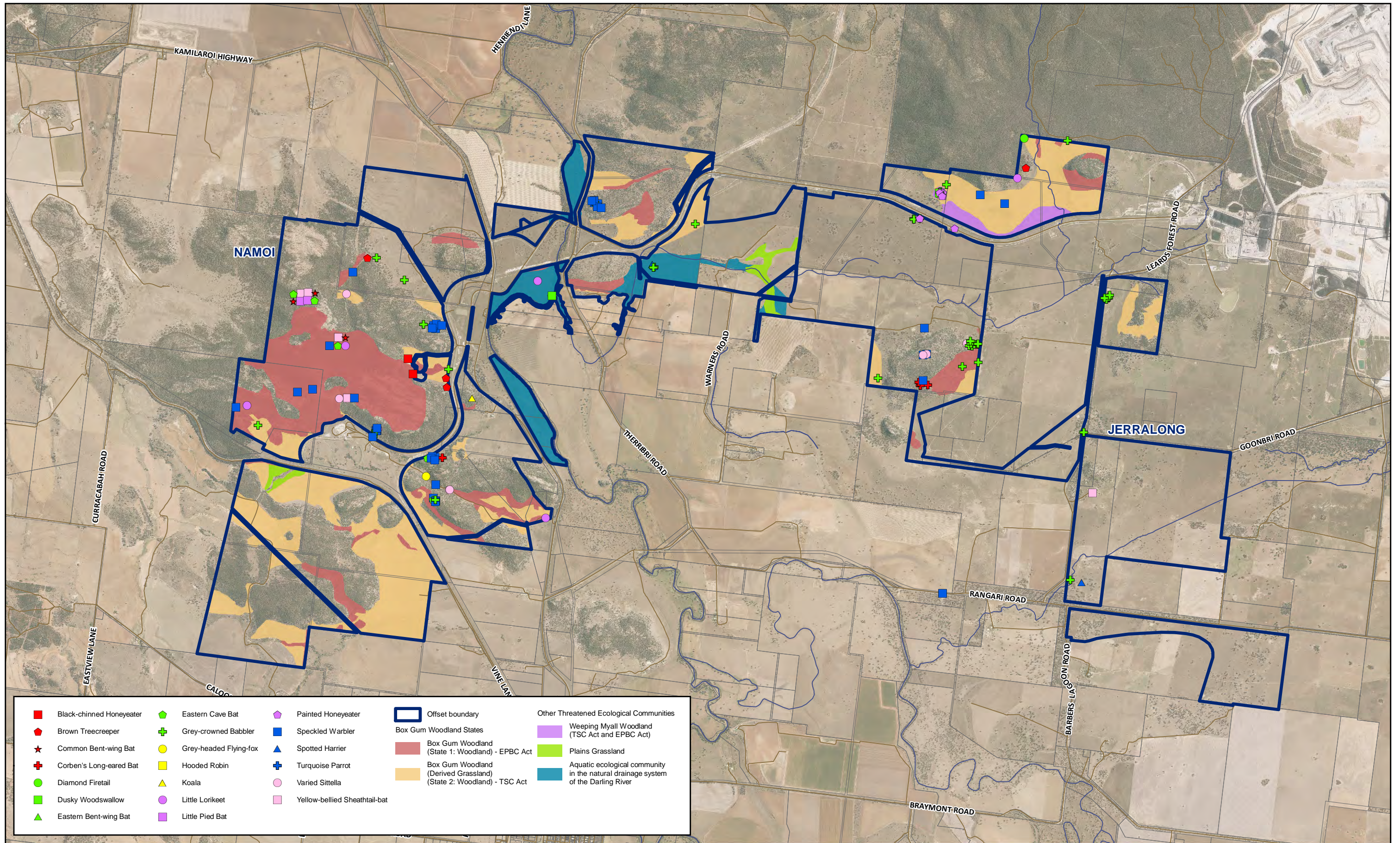
5.6.1 COMPARISON OF BOX GUM WOODLAND AGAINST BBAM BENCHMARK VALUES

An assessment of Box Gum Woodland Namoi Offset monitoring locations against the respective BBAM vegetation type benchmark for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 5.6) identified the following:

- All monitoring sites meet the native species richness benchmark value (i.e. 23 native species richness).
- All monitoring sites failed to meet the native overstorey percentage cover benchmark value (i.e. 6–25%).
- All monitoring sites meet, were within or exceeded the native midstorey percentage cover benchmark value (i.e. 0–5%).
- All monitoring sites failed to meet the native groundcover (grass) benchmark value (i.e. 30–40%).
- One monitoring site (Na16) were within the native groundcover (other) benchmark value (i.e. 3–5%) whilst the other (Na6) was below the the benchmark value.
- All monitoring sites meet, were within or exceeded the native groundcover (shrub) benchmark value (i.e. 0–0%) – no shrub cover Box Gum Woodland monitoring sites within the Central offsets exceeded 30%.
- All monitoring sites failed to meet the hollow bearing tree benchmark value (i.e. 1 hollow bearing tree).
- All monitoring sites failed to meet the fallen length of timber benchmark value (i.e. 30 m).
- No evidence of regeneration from either habitat management or habitat restoration zones.

Although it is acknowledged that some of these attributes will increase naturally over time, the results indicate that habitat restoration and corridor enhancement zones would benefit from active management. Of particular importance is the management of vegetation attributes that take a long time to form such as canopy cover and fauna habitat resources.

Due to the above, management within these management zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.



■ Black-chinned Honeyeater	◆ Eastern Cave Bat	◆ Painted Honeyeater	▭ Offset boundary	■ Other Threatened Ecological Communities
◆ Brown Treecreeper	◆ Grey-crowned Babbler	■ Speckled Warbler	■ Box Gum Woodland States	■ Weeping Myall Woodland (TSC Act and EPBC Act)
★ Common Bent-wing Bat	● Grey-headed Flying-fox	▲ Spotted Harrier	■ Box Gum Woodland (State 1: Woodland) - EPBC Act	■ Plains Grassland
✚ Corben's Long-eared Bat	■ Hooded Robin	◆ Turquoise Parrot	■ Box Gum Woodland (Derived Grassland) (State 2: Woodland) - TSC Act	■ Aquatic ecological community in the natural drainage system of the Darling River
● Diamond Firetail	▲ Koala	● Varied Sittella		
■ Dusky Woodswallow	● Little Lorikeet	■ Yellow-bellied Sheath-tail-bat		
▲ Eastern Bent-wing Bat	■ Little Pied Bat			

Map: PS110420_GIS_BOA004_A1
 Date: 8/03/2019
 Author: SuansriR
 Approved by: - N. Cooper

Scale ratio correct when printed at A3

Coordinate system: GDA 1994 MGA Zone 56



BIODIVERSITY OFFSET MONITORING

Figure 5.2
 Box Gum Woodland within Namoi BOA

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Table 5.6 Summary comparison of Box Gum Woodland between 2018 data and biometric data for the Central Offset Area

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GRASS COVER (GRASS) PERCENTAGE	NATIVE GRASS COVER (SHRUB) PERCENTAGE	NATIVE GRASS COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
BBAM Benchmark		6 to 25	0 to 0	30 to 40	0 to 0	3 to 5	23	1	30	n/a	n/a	Native species richness >80% of BBAM benchmark, all other attributes within or above benchmark values. 100% regeneration required across each management zone.
Habitat Restoration Zone												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Namoi 6	0 X	0.9 >	0 X	2 >	2 X	27 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present.	Native overstorey projected foliage cover, native grass groundcover percentage, native other groundcover percentage, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Namoi 16	0 X	0 ✓	22 X	0 ✓	4 ✓	30 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present.	Native overstorey projected foliage cover, native grass groundcover percentage, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Habitat Management Zone		0%									-	Regeneration does not meet performance criteria.

Note: 1) Red shaded X = variable below benchmark value, Green shaded ✓ = variable within benchmark value, Orange shading > = variable exceeds benchmark. 2) Green shaded = indicates all vegetation attributes meet performance criteria and therefore maintenance is only required, Red shaded = indicates that although some vegetation attributes meet or are within benchmark values some fail to meet benchmarks.

5.6.2 EPBC ACT ANALYSIS OF BOX GUM WOODLAND

An assessment of Namoi Offset Box Gum Woodland monitoring sites against the EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland concluded that none of the Box Gum Woodland sites within the Namoi BOA meet the EPBC Act listing for this threatened ecological community (Table 5.7).

The Box Gum Woodland monitoring sites (Na6 and Na16) failed to meet the EPBC Act listing for the threatened ecological community as the understorey cover was dominated by exotics (i.e. >50% exotic) and did not meet the required native understorey species richness criteria.

Table 5.7 2018 Namoi Offset BOA monitoring data assessment against EPBC Act Box Gum Woodland determining criteria

CRITERIA	HABITAT RESTORATION ZONE	
	Na6	Na16
Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Rd Gum?	Yes – overstorey species are or where previously dominated by either Eucalyptus albens (White Box)	
Does the patch have a predominantly native understorey?	No – understorey predominantly exotic (>50% exotic)	
Is the patch 0.1 ha or greater in size?	n/a	
There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	No – 4 native understorey species (excluding grasses) and 1 important species recorded.	Yes – 12 native understorey species (excluding grasses) recorded, 5 important species recorded.
Meet EPBC Act listing criteria?	No, do not meet criteria	

Note: Analysis based on 0.04 ha (20 X 20 m) vegetation quadrat undertaken as part of 2018 annual BOA monitoring

6 WESTERN OFFSET AREA – 2018 RESULTS

6.1 INTRODUCTION

The Western Offset Area encompasses the entirety of the Merriendi BOA, which covers approximately 483.2 ha and is located approximately 8.3 km north west of the project (Figure 1.1). The Western Offset Area occurs immediately west of the Leard State Forest Conservation Area. Although understorey vegetation along the lower slopes exhibits the effects of grazing, elsewhere the property contains remnant woodland habitat. The vegetation and management zones within the Western Offset Area are illustrated in Figure 6.1.

6.2 FLORA

134 plant species were recorded within the Western Offset Area during the 2018 monitoring session. Of these, 108 (80%) were native and 26 (20%) were exotic (Table C.9 of Appendix C). The most diverse families recorded were the Poaceae with 29 species followed by the Asteraceae with 24 species. No threatened flora species have been recorded within the Western Offset.

Of the 26-exotic species that were recorded in 2018, one species was previously listed as a noxious weed under the *Noxious Weeds Act 1993* (Table 6.1). The *Noxious Weeds Act 1993* has since been repealed and replaced by the *Biosecurity Act 2015* under which noxious weeds have been replaced by priority weeds. One introduced species listed as a priority weed within the north West LLS control region was recorded within the Western Offset Area during 2018; *Opuntia stricta**. This species is also listed as a Weed of National Significance (WONS).

Table 6.1 Noxious weeds recorded within the Western Offset Area

COMMON NAME	SCIENTIFIC NAME	CONTROL CATEGORY (NW ACT)	PRIORITY WEED (BA ACT)	WONS	2015	2016	2017	2018
Prickly Pear	<i>Opuntia stricta</i> *	4	Yes	Yes	✓	✓	✓	✓

The Western Offset Area also contained other invasive species which occurred abundantly throughout the Merriendi BOA. These species included numerous thistle species (such as *Carthamus lanatus** (Saffron Thistle), *Centaurea melitensis** (Maltese Thistle), *Cirsium vulgare** (Spear Thistle), *Silybum marianum** (Variegated Thistle) and *Lactuca serriola** (Prickly Lettuce)) and common herbaceous herbs and forbs commonly found in pastures (such as *Arctotheca calendula** (Cape Dandelion), *Rapistrum rugosum** (Turnip Weed) and *Hedypnois rhagadioloides** (Cretan Weed).

Whilst these species are not listed under the *Biosecurity Act 2015* management of these species should still be considered.

6.3 FAUNA

The 2018 monitoring event recorded 85 species of animal within the Western Offset Area, two of which were introduced species (Table 6.2; Table D.9 of Appendix D).

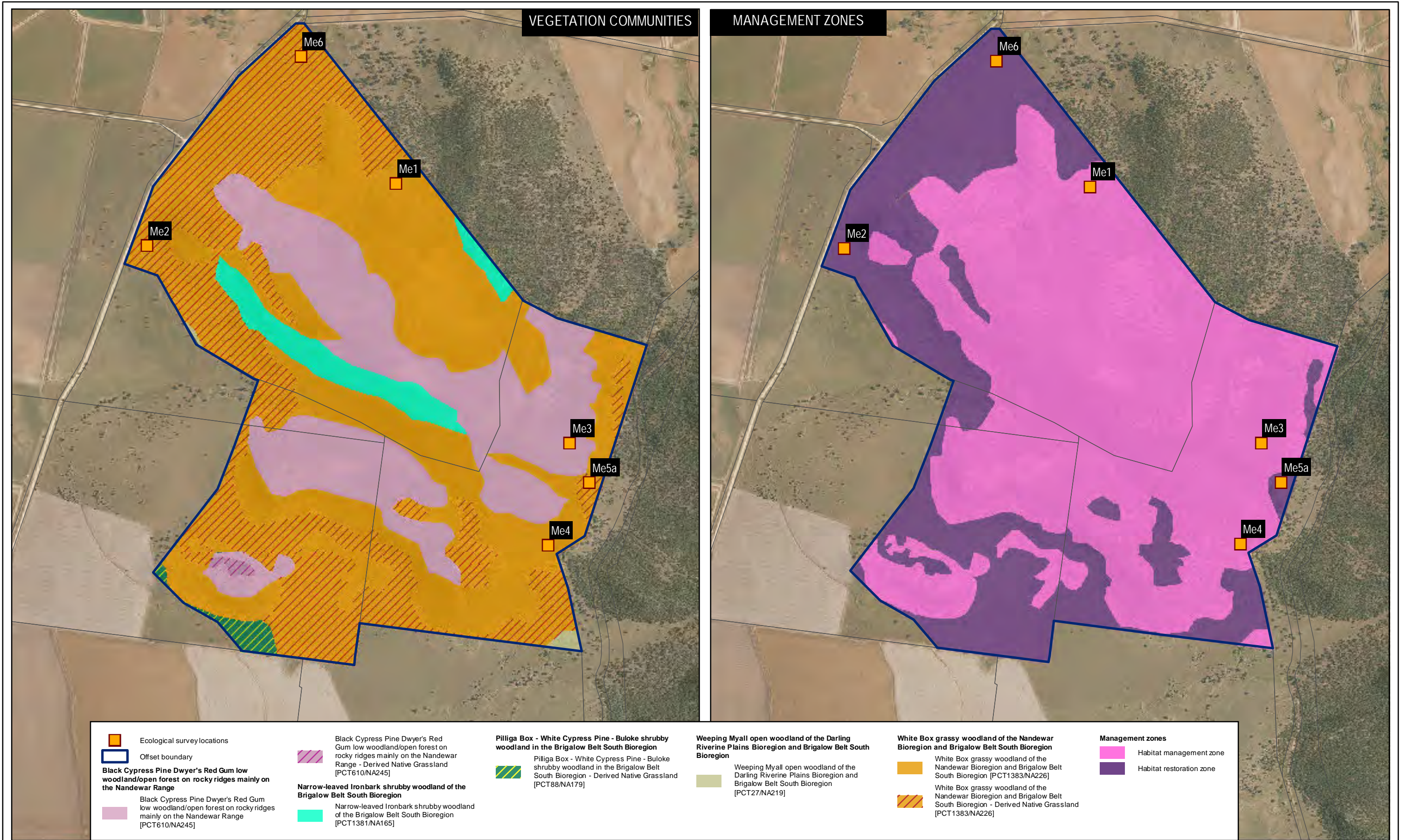
Table 6.2 Summary of terrestrial animal species identified in the Western Offset Area

GROUP	SPECIES RICHNESS	
	Native	Introduced
Birds	69	2
Microbats	11	0
Mammals (non-bats)	2	0
Reptiles	1	0
Frogs	0	0
Total	83	2

A total of eight threatened species were recorded within the Western Offset Area during the 2018 monitoring session (Table 6.3, Table D.9 of Appendix D).

Table 6.3 Threatened species recorded within the Western Offset Area

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	TSC ACT	2015	2016	2017	2018
Varied Sittella	<i>Daphoenositta chrysoptera</i>	–	V		✓	✓	
Speckled Warbler	<i>Chthonicola sagittata</i>	–	V	✓	✓	✓	✓
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	–	V	✓	✓		✓
Little Eagle	<i>Hieraaetus morphnoides</i>	–	V			✓	
Diamond Firetail	<i>Stagonopleura guttata</i>	–	V	✓			
Hooded Robin (South Eastern)	<i>Melanodryas cucullata</i>	–	V	✓	✓		
Little Lorikeet	<i>Glossopsitta pusilla</i>	–	V	✓			
Turquoise Parrot	<i>Neophema pulchella</i>	–	V	✓			✓
Grey-crowned Babbler (eastern sub-species)	<i>Pomatostomus temporalis</i>	–	V	✓	✓	✓	✓
Masked Owl	<i>Tyto novaehollandiae</i>	–	V	✓			
Dusky Woodswallow	<i>Artamus cyanopterus</i>	–	V				✓
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	–	V	✓	✓	✓	✓
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	–	V	✓	✓	✓	✓
Northern Freetailed-bat	<i>Mormopterus lumsdenae</i>	–	V				✓



6.4 PROGRESSIVE RESTORATION WORKS

No progressive restoration works have been completed to date in the Western Offset. Progressive restoration works are proposed to commence within the Western Offset in 2022/2023.

6.5 COMPARISON OF OFFSET MANAGEMENT ZONES

The Western Offset has been separated into two management zones (habitat management and habitat restoration) based on the condition of vegetation, past land uses and management actions required (Figure 6.1). Biodiversity monitoring sites for the Western Offset have been established within each of these offset management zones. A comparison of the 2018 monitoring mean flora attributes and fauna assemblages for each management zone is provided below.

6.5.1 FLORA

6.5.1.1 NATIVE VEGETATION ATTRIBUTES

Total mean native species richness at the Western Offset was recorded highest within the habitat management zones (43.7) and lowest at the habitat restoration zones (28). The native species richness at both the habitat management and restorations zones have increased since the 2015 baseline monitoring (Table 3.4).

Mean native overstorey percentage cover at the Western Offset was highest within the habitat management zones (3.2%). No overstorey cover was recorded within within the habitat restoration zones. The void of native canopy cover within these areas is attributed to past vegetation clearing and agricultural land uses which has resulted in these areas now occurring as derived native grassland. Mean native overstorey percentage cover at the habitat management zones has decreased compared to previous monitoring years (Table 6.4). This was likely attributed to severe canopy die back in response to drought conditions which was observed throughout the locality during the monitoring session.

Mean native midstorey percentage cover at the Western Offset was highest within the habitat management zones (20.8%) and lowest at the habitat restoration zones (0.4%). Mean native midstorey percentage cover has increased incrementally within the habitat management zones whilst cover within the habitat restoration zone has remained relatively similar since the 2015 baseline monitoring (Table 6.4).

Mean native grass groundcover at the Western Offset was highest within the habitat restoration zones (39.3%) and lowest at the habitat management zones (49.3%). Mean native grass groundcover has remained relatively consistent since 2016 (Table 6.4).

Mean native other groundcover at the Western Offset was highest within the habitat management zones (34.7%) and lowest at the habitat restoration zones (8.7%). Mean native other groundcover has remained relatively consistent over time except for the large increase in 2016 which was attributed to higher than average rainfall (Table 6.4).

Mean native shrub groundcover at the Western Offset was highest within the habitat management zones (18%) and lowest within the habitat restoration zones (4.7%). Mean native shrub groundcover has incrementally increased with the habitat management and habitat restoration zones since the 2015 baseline monitoring (Table 6.4).

Mean number of hollow bearing trees at the Western Offset was highest at the habitat management zones (1.3). No hollow bearing trees were recorded within the habitat restoration zone. Number of hollow bearing trees remains relatively constant with the 2015 baseline monitoring (Table 6.4).

The mean total length of fallen timber at the Western Offset was highest within the habitat management zones (16.3 m) and lowest at the habitat restoration zones (2 m). Fallen timber has decreased within the habitat management and restoration zones since the 2017 monitoring session, however it remains higher than the 2015 baseline monitoring (Table 6.4).

6.5.1.2 EXOTIC VEGETATION ATTRIBUTES

Mean exotic species richness and mean exotic groundcover percentage cover was recorded highest from within habitat restoration zones (11 and 37% respectively) and lowest from within habitat management zones (7.3 and 16.3% respectively). Both these attributes have remained relatively consistent since the 2015 baseline monitoring session within the habitat management and corridor enhancement zones (Table 6.4).

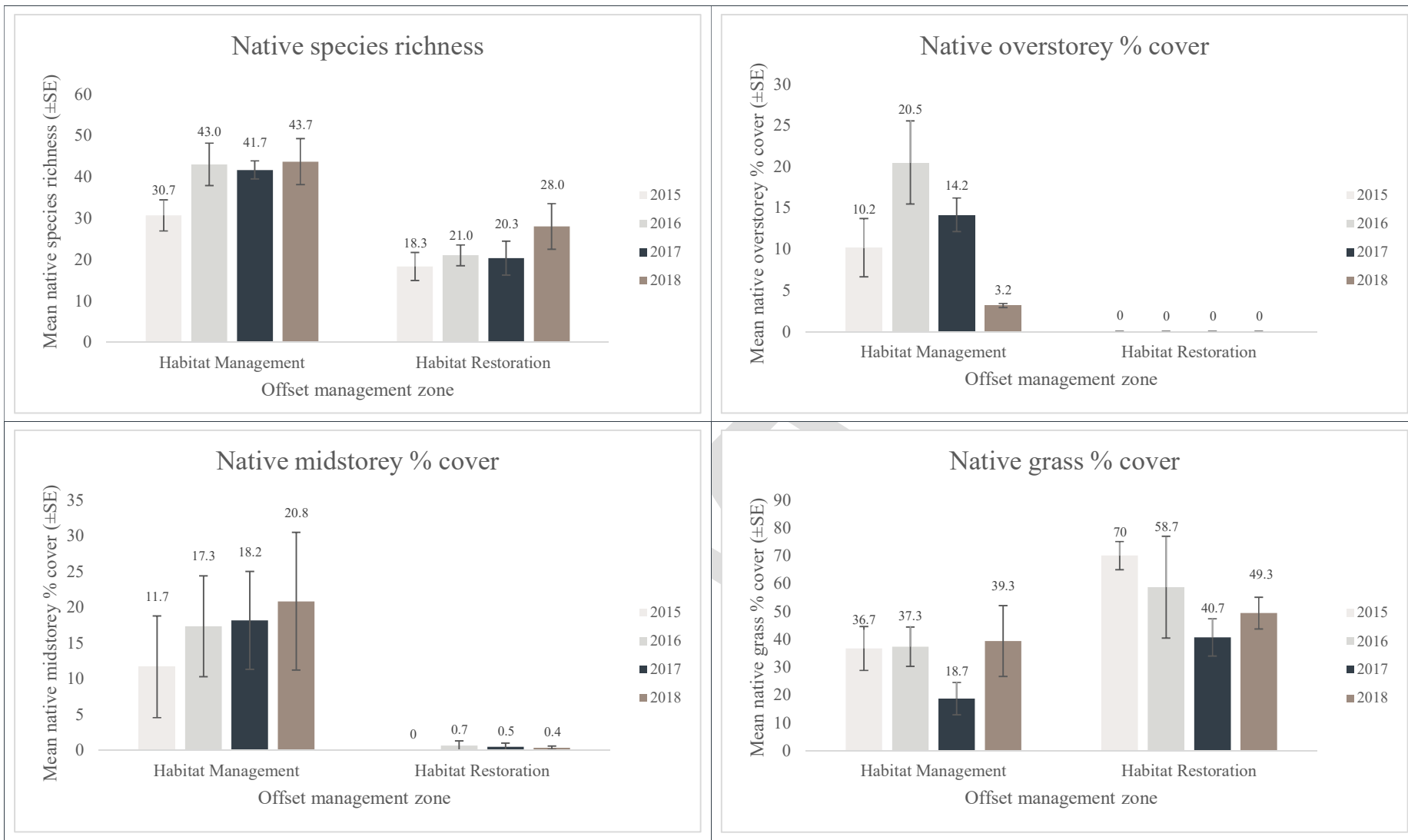
6.5.1.3 CYPRESS PINE DENSITY

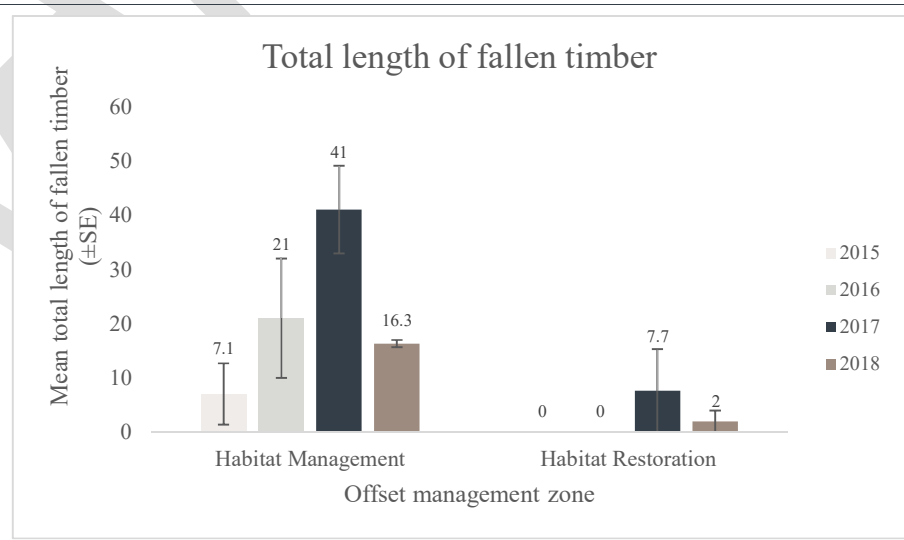
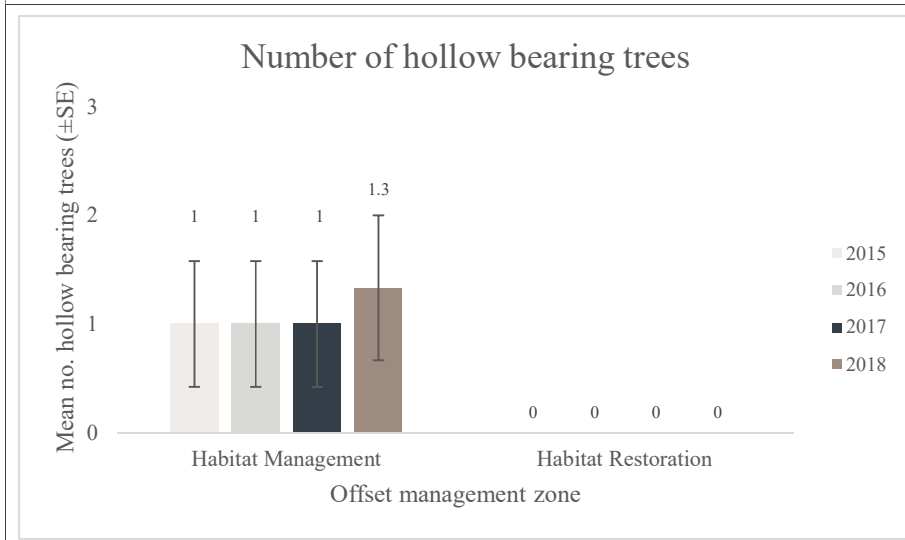
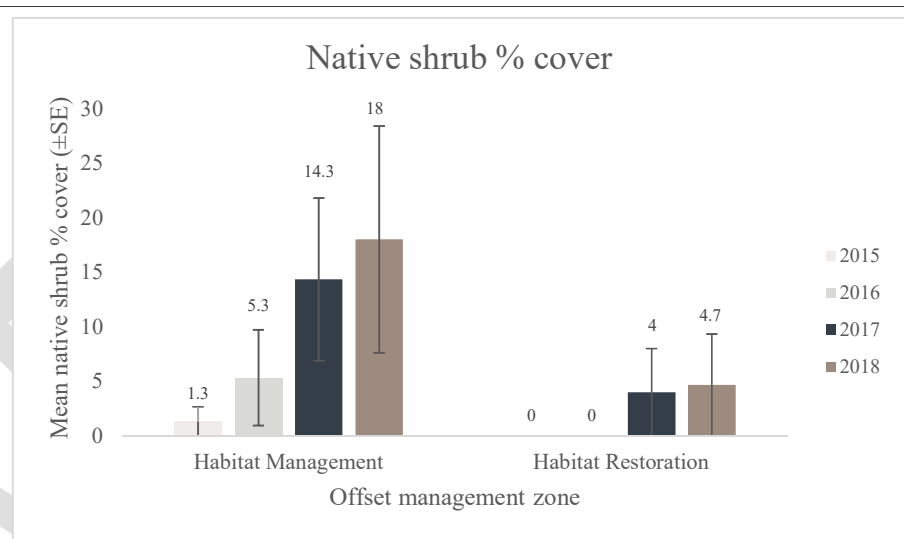
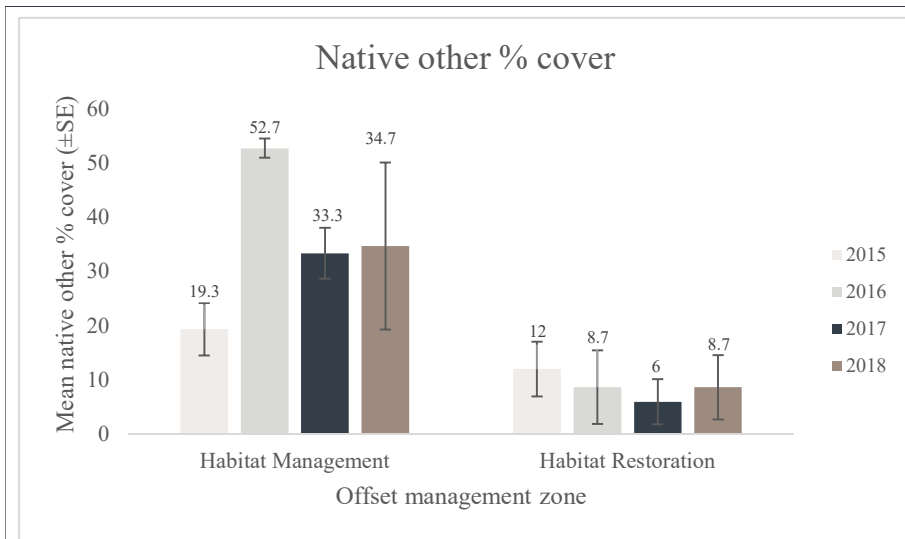
Cypress Pine was recorded at three Western Offset monitoring sites (i.e. two within habitat management zones (Me1 and Me3) and one within a habitat restoration zone (Me2) (Table 6.4).

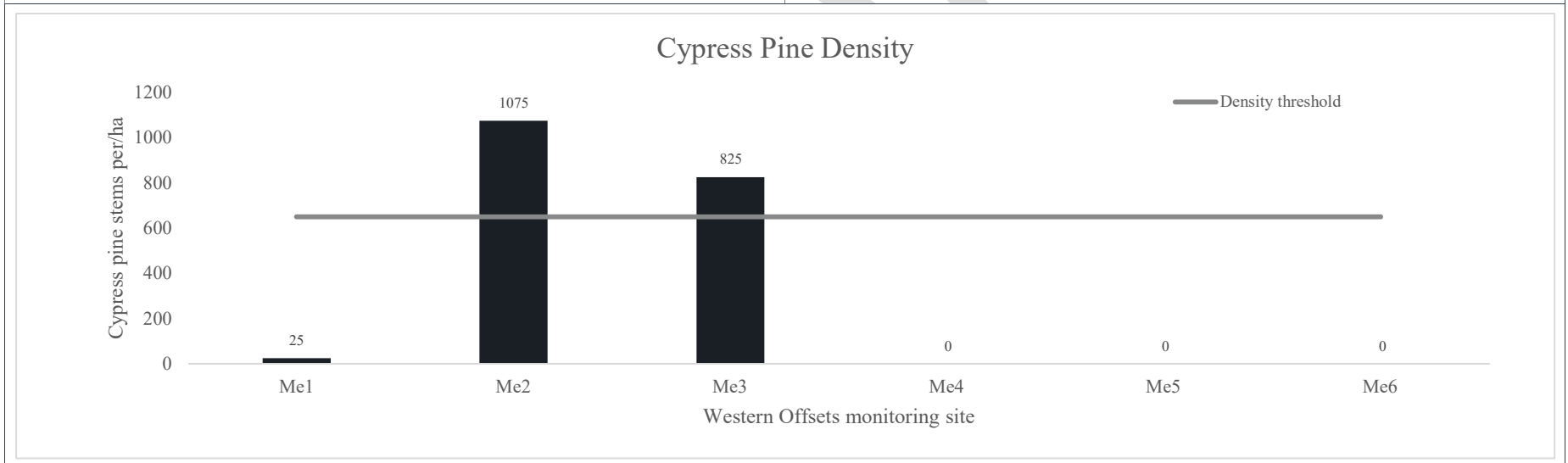
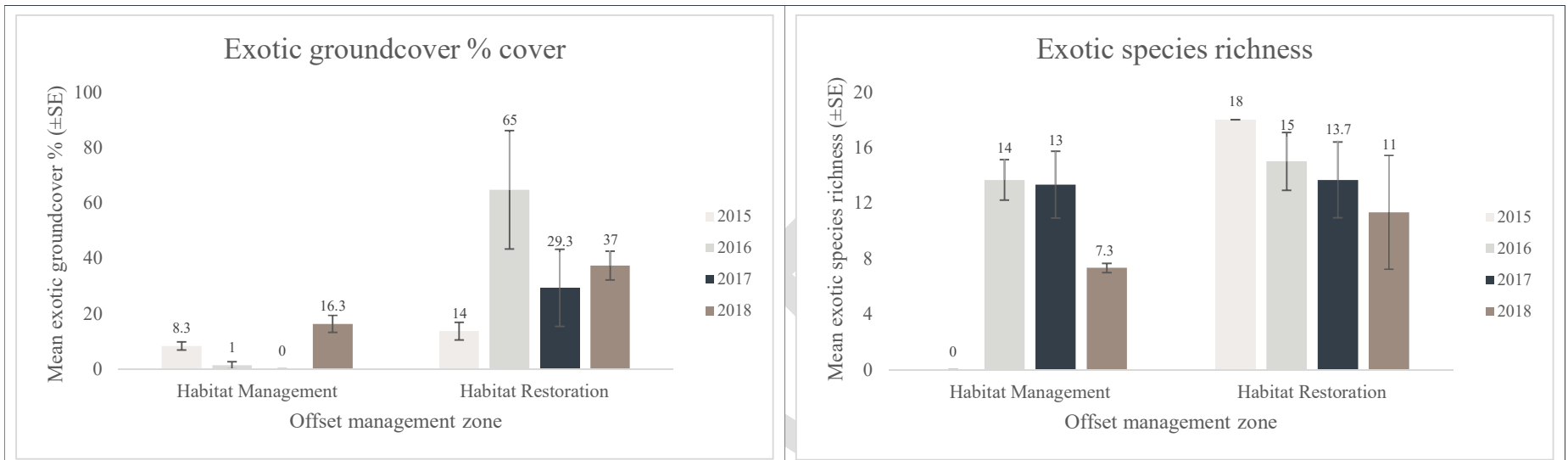
Two Western Offset monitoring locations exceeded the Cypress Pine density threshold (i.e. Me2 and Me3) (Table 6.4). Both these sites also showed no evidence of canopy recruitment however the other vegetation attributes (such as groundcover species composition and cover etc) were generally within or exceeding the BBAM benchmark for their corresponding vegetation type.

It is possible that the germination and establishment of canopy species at these locations may be prohibited by the high density of Cypress Pine present however given that most other vegetation attributes were within or exceeded the BBAM benchmarks they should be monitored further before commencing any thinning activities. As such, these two sites should be continuously monitored in subsequent years to determine whether Cypress Pine thinning is required to promote successful canopy recruitment.

Table 6.4 Western Offset Area – 2018 vegetation attributes and benchmark data (\pm SE)







6.5.2 FAUNA ASSEMBLAGES

6.5.2.1 DIURNAL BIRDS

A total of 71 species of diurnal bird were collectively recorded from the Western Offset Area in 2018 (Table 6.2). This comprised of species common to the region, with Yellow-rumped Thornbill, Eastern Yellow Robin, Rufous Whistler and White-browed Woodswallow the most widespread (Table D.9 in Appendix D). The presence of the large patch of quality woodland habitat associated with the Western Offset supports a range of threatened species, with Speckled Warbler, Dusky Woodswallow, Brown Treecreeper, Turquoise Parrot and Grey-crowned Babbler recorded during the 2018 monitoring event (Table 6.3, Figure 6.2).

Habitat management zones retained the largest diurnal bird species richness during the 2018 monitoring event, with an average of 13.7 birds (Table 6.5). Habitat restoration zones returned a lower mean species richness of 3.5. Replicate monitoring site Me4 (Merriendi BOA) recorded the highest mean species richness at 16.5 (as averaged from duplicate surveys) (Appendix D).

During the 2018 monitoring event, habitat management zones realised a diurnal bird species richness approximately 97 % of the LSF analogue benchmark (Table 6.5). Habitat restoration zones recorded a mean species richness about 25 % of the LSF analogue benchmark.

Mean diurnal bird abundance largely mirrored species richness, with habitat management zones retaining the highest abundance (29.2) during the 2018 monitoring event, followed by habitat restoration zones (11.5) (Table 6.5). Habitat management zones met the LSF benchmark for mean diurnal abundance (28.9), whilst habitat restoration zones recorded approximately 40 % of the LSF benchmark.

6.5.2.2 MICROCHIROPTERAN BATS

A total of 11 species of microchiropteran bat were collectively recorded from the Western Offset in 2018. This comprised species common to dry woodland in the region, with Gould's Wattled Bat, South-eastern Free-tailed Bat, Inland Broad-nosed Bat and Little Broad-nosed Bat the most prevalent (Appendix D). Three threatened species were recorded from the Anabat sample (those active up to two hours after last light), including Eastern False Pipistrelle, Northern Free-tailed Bat and Yellow-bellied Sheath-tail-bat (Appendix D).

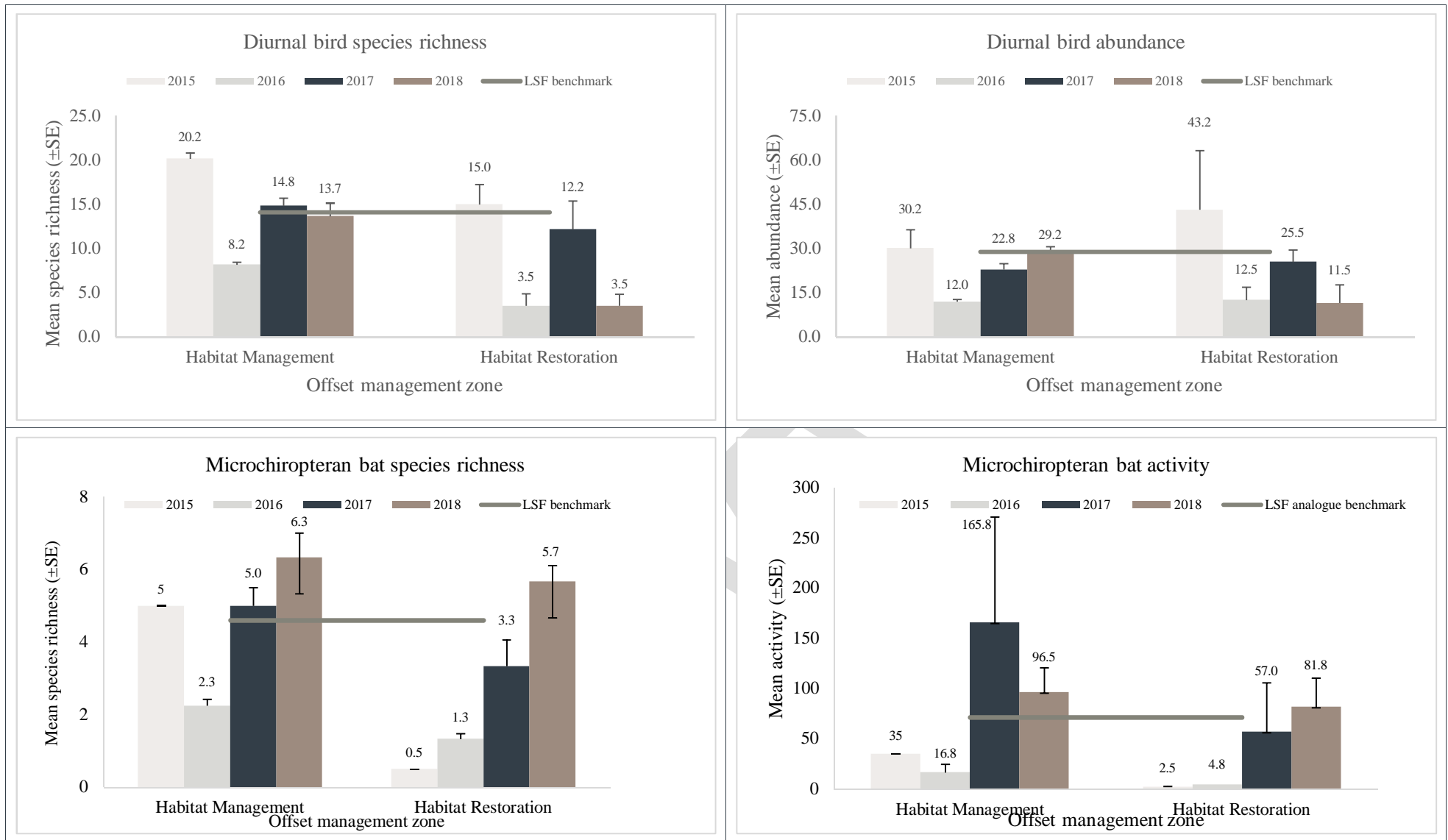
Mean microchiropteran bat species richness was comparable between management zones during the 2018 monitoring event, with habitat management and habitat restoration recording 6.3 and 5.7 respectively. A corollary includes that all six replicate monitoring sites associated with the Western Offset returned a mean species richness between 5.0 and 7.0 (Appendix D). All management zones met (and exceeded) the LSF benchmark (4.6) for mean microchiropteran bat species richness in 2018. Mean species richness has largely been comparable between years for habitat management zones, whilst habitat restoration zones have observed a positive trend of increasing mean species richness from baseline surveys in 2015 (Table 6.5).

Mean microchiropteran bat activity was comparable between habitat management (96.5) and habitat restoration zones (81.8) during the 2018 monitoring event (Table 6.5). Both management zones met the LSF benchmark for mean microchiropteran bat activity of 71.4.

6.5.2.3 NOCTURNAL BIRDS AND MAMMALS

Nocturnal surveys were completed in the Western Offset during the 2018 monitoring event, and comprised call playback and spotlighting methodologies. Species recorded included White-striped Freetailed-bat, Swamp Wallaby and Common Wallaroo.

Table 6.5 Western Offset Area – 2018 fauna attribute and benchmark data (\pm SE)



6.6 STATE OF BOX GUM WOODLAND

The Western Offset Area contains approximately 326.6 ha Box Gum Woodland, which is listed under the BC Act and/or EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This ecological community is generally situated throughout the Western Offset Area on lower slopes and flatter land (Figure 6.2). Within the Western Offset Area, Box Gum Woodland occurs in two states:

- State 1: Woodland – occupies 176.1 ha.
- State 2: Native Pasture (derived native grassland) – occupies approximately 150.5 ha.

Five monitoring sites within the Western Offset Area (two within the habitat management zone and three within the habitat restoration zone) represent the Box Gum Woodland ecological community.

A comparison of these monitoring sites against BBAM vegetation type benchmarks is provided in Table 6.6 and below in Section 6.6.1. An assessment of each Box Gum Woodland Western Offset monitoring site against the EPBC Act Policy Statement 3.5 for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is also provided in Table 6.7 and in Section 6.6.2.

6.6.1 COMPARISON OF BOX GUM WOODLAND AGAINST BBAM BENCHMARK VALUES

An assessment of Box Gum Woodland Western Offset monitoring locations against the respective BBAM vegetation type benchmarks for the White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregion vegetation type (Table 6.6) identified the following:

- All monitoring sites, except for one (Me5a), exceeds the native species richness benchmark values (23 native species).
- All monitoring sites failed to meet the native overstorey percentage cover benchmark (i.e. 6–25%).
- All monitoring sites meet, are within or exceeded the native midstorey percentage cover benchmark value (i.e. 0–5%).
- All monitoring sites meet, are within or exceeded the native groundcover (grass) benchmark value (i.e. 30–40%).
- All monitoring sites, except for one (Me5a), meet or exceeded the native groundcover (other) benchmark value (i.e. 3–5%).
- All monitoring sites meet or exceeded the native groundcover (shrub) benchmark value (i.e. 0–0%), all but one Box Gum Woodland monitoring site (Me4 – high cover of shiny bush) have a shrub cover less than 30%.
- All habitat management zone monitoring sites (Me1 and Me4) exceeded the hollow bearing tree benchmark value (1 hollow bearing tree), however all habitat restoration monitoring sites failed to meet the benchmark value as no hollows were recorded.
- All monitoring sites failed to meet the length of fallen timber benchmark value (i.e. 30 m).
- Regeneration was recorded at all habitat management sites but no regeneration was recorded at habitat restoration sites.

Although it is acknowledged that some of these attributes will increase naturally over time, the results indicate that habitat restoration and corridor enhancement zones would benefit from active management. Of particular importance is the management of vegetation attributes that take a long time to form such as canopy cover and fauna habitat resources.

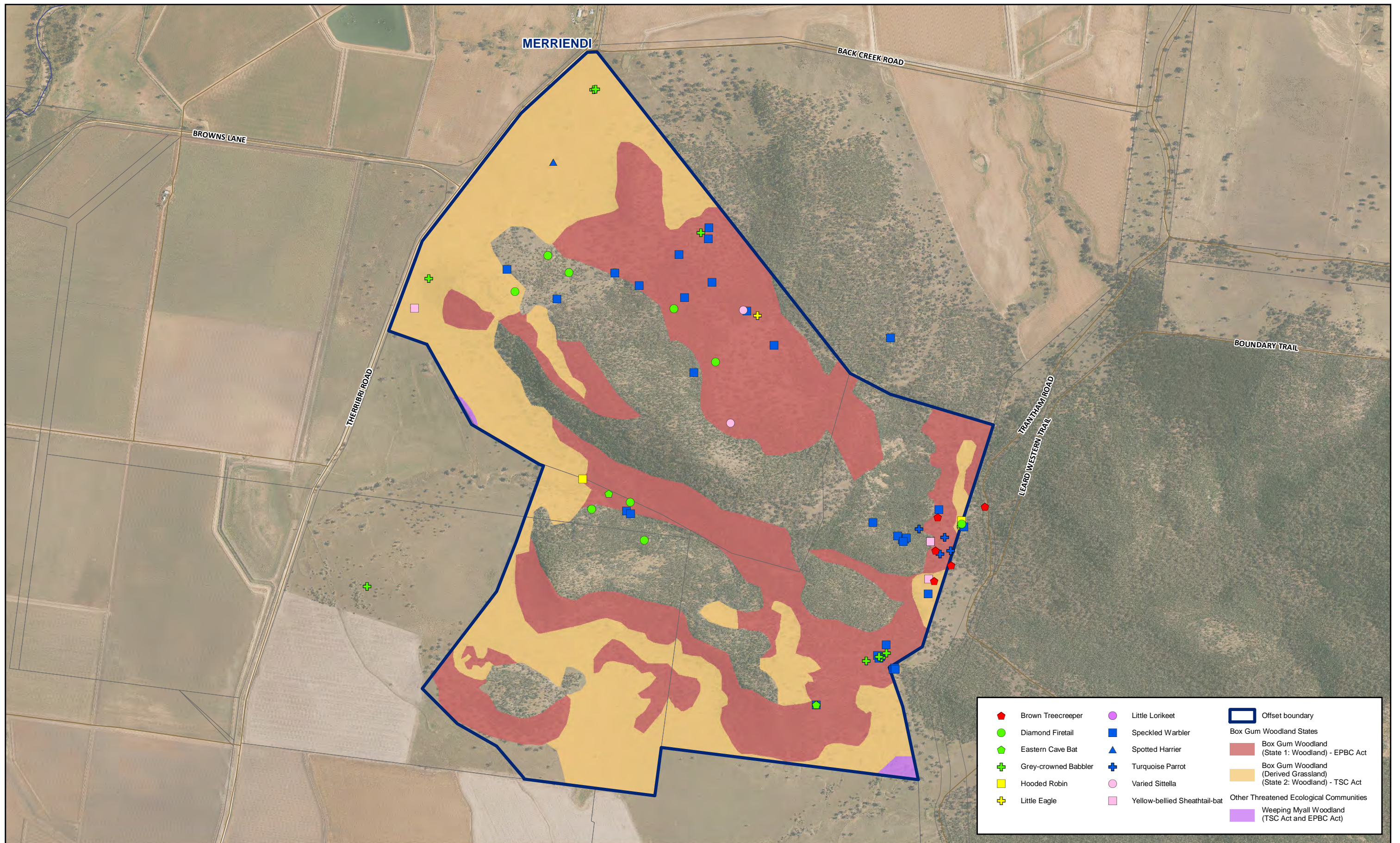
Due to the above, management within these management zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.

6.6.2 EPBC ACT ANALYSIS OF BOX GUM WOODLAND

An assessment of the five Western Offset Box Gum Woodland monitoring sites against the EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland concluded that three monitoring sites meet the EPBC Act listing for this threatened ecological community (Table 6.7).

The Box Gum Woodland monitoring sites which meet the EPBC Act listing for the threatened ecological community included two within habitat management zones (Me1 and Me 4 – both State 1 Grassy Woodlands) and one from within habitat restoration zones (Me2 – State 2 Native Pastures). All remaining sites (Me5a and Me6) failed to listed EPBC Act listed as they did not meet the required native understorey species richness criteria.

DRAFT



Map: PS110420_GIS_BOA004_A1
 Date: 8/03/2019
 Data source: BCOPL (2017)

Author: SuansriR
 Approved by: - N.Cooper



1:15,000

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3



Boggabri Coal Pty Ltd

BIODIVERSITY OFFSET MONITORING

Figure 6.2
 Box Gum Woodland within Merriendi BOA

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Table 6.6 Summary comparison of Box Gum Woodland between 2018 data and biometric data for the Western Offset Area

VEGETATION TYPE	MONITORING SITE	VEGETATION ATTRIBUTES ¹									BOX GUM WOODLAND STATE & GRAZING PRESSURES	CONFORMS WITH PERFORMANCE CRITERIA ²
		NATIVE OVER STOREY PROJECTED FOLIAGE COVER PERCENTAGE	NATIVE MID STOREY COVER PERCENTAGE	NATIVE GROUND COVER (GRASS) PERCENTAGE	NATIVE GROUND COVER (SHRUB) PERCENTAGE	NATIVE GROUND COVER (OTHER) PERCENTAGE	NATIVE PLANT SPECIES RICHNESS	NO. TREES WITH HOLLOWES	TOTAL LENGTH OF FALLEN TIMBER (m)	REGEN PROPORTION		
BBAM Benchmark		6 to 25	0 to 0	30 to 40	0 to 0	3 to 5	23	1	30	n/a	n/a	Native species richness >80% of BBAM benchmark, all other attributes within or above benchmark values. 100% regeneration required across each management zone.
Habitat Management Zone												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Merriendi 1	2.7 X	3 >	62 >	0 ✓	28 >	54 >	2 >	15 X	0.5	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present (Goats and Rabbits).	Native overstorey projected foliage cover and length of fallen timber is below BBAM benchmark values.
	Merriendi 4	3.5 X	36 >	38 ✓	36 >	12 >	42 >	2 >	17 X	1	Box Gum Woodland – State 1 Grassy Woodland Evidence of feral herbivore grazing present (Goats and Rabbits).	Native overstorey projected foliage cover and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Habitat Management Zone					100%					-	Regeneration does not meet performance criteria.	
Habitat Restoration Zone												
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Merriendi 2	0 X	0.8 >	56 >	0 ✓	6 >	38 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Goats and Rabbits).	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Merriendi 5a	0 X	0.3 >	54 >	0 ✓	0 X	19 X	0 X	6 X	0	Box Gum Woodland – State 2 Native Pastures Evidence of feral herbivore grazing present (Goats and Rabbits).	Native overstorey projected foliage cover, native groundcover other percentage, native species richness, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
	Merriendi 6	0 X	0 ✓	38 ✓	14 >	20 >	27 >	0 X	0 X	0	Box Gum Woodland – State 2 Native Pastures	Native overstorey projected foliage cover, number of trees with hollows and length of fallen timber is below BBAM benchmark values.
Percentage of regeneration of Box Gum Woodland within Central Offset Habitat Management Zone					0%					-	Regeneration does not meet performance criteria.	

Note: 1) Red shaded X = variable below benchmark value, Green shaded ✓ = variable within benchmark value, Orange shading > = variable exceeds benchmark. 2) Green shaded = indicates all vegetation attributes meet performance criteria and therefore maintenance is only required, Red shaded = indicates that although some vegetation attributes meet or are within benchmark values some fail to meet benchmarks.

Table 6.7 2018 Western Offset BOA monitoring data assessment against EPBC Act Box Gum Woodland determining criteria

CRITERIA	HABITAT MANAGEMENT ZONE		HABITAT RESTORATION ZONE		
	Me1	Me4	Me2	Me5a	Me6
Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Rd Gum?	Yes – overstorey species are or where previously dominated by either <i>Eucalyptus albens</i> (White Box)				
Does the patch have a predominantly native understorey?	Yes – all monitoring locations contained a predominantly native understorey (>50% native)				
Is the patch 0.1 ha or greater in size?	Yes – all patches exceed 0.1 ha in size				
There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	Yes – 21 native understorey species (excluding grasses) and 11 important species were recorded	Yes – 14 native understorey species (excluding grasses) and 9 important species recorded.	Yes – 13 native understorey species (excluding grasses) and 4 important species recorded.	No – 3 native understorey species (excluding grasses) recorded, no important species recorded.	Yes – 6 native understorey species (excluding grasses) and 5 important species were recorded.
Meet EPBC Act listing criteria?	Yes, does meet criteria			No, do not meet criteria	

Note: Analysis based on 0.04 ha (20 X 20 m) vegetation quadrat undertaken as part of 2018 annual BOA monitoring.

7 TARGETED SWIFT PARROT AND REGENT HONEYEATER SURVEY

7.1 BACKGROUND

The key objective of winter bird surveys was to determine if threatened bird species are using winter blossom resources within the Boggabri Coal BOAs. *Eucalyptus albens* (White Box) is an important source of winter blossom resources in the western slopes region of NSW and it occurs widely across the BOAs and throughout Leard State Forest surrounding Boggabri Coal Mine. Of particular importance is the distribution of two threatened blossom nomads, the Swift Parrot and Regent Honeyeater. The Swift Parrot and Regent Honeyeater are both listed as Critically Endangered under the EPBC Act; the Regent Honeyeater is also Critically Endangered under the NSW BC Act and the Swift Parrot is listed as Endangered under the BC Act.

While the presence of Regent Honeyeaters and/or Swift Parrots at a site is often an indicator that good habitat is present, their absence from areas, which appear to otherwise have good resources, is not always due to a lack of quality habitat at a site; since both species are unlikely to have sufficient population numbers to be well distributed throughout their range at any one time. In relation to their distribution in any given season there are many areas throughout NSW that may provide them with suitable foraging resources, and which may prevent them from visiting other sites where blossom resources are present.

7.2 METHODS

Both species are not obvious amongst the foliage of trees and when in very low numbers can be almost impossible to locate. The predominantly green plumage of Swift Parrots blend with foliage making them almost invisible and the mottled black and yellow plumage of the Regent Honeyeater merges easily with shadows of foliage and creamy tones of blossom. Both species exhibit limited response to call playback techniques and so other methods must be adopted to locate them when present.

Both species have distinctive calls when vocal, but when present are usually associated with an inflated density and diversity of other nectarivorous bird species, particularly so with the Regent Honeyeater. The Swift Parrot is not always associated with blossom resources when present as much of its diet is made up of lerps.

The survey methodology adopted surveys of stands of suitable blossom producing tree species for nectarivorous bird species, especially loud and vocal species, such as friarbirds and those bird species that are somewhat nomadic in response to changing blossom distribution, such as White-naped Honeyeaters, Yellow-faced Honeyeaters, lorikeets and the friarbirds and wattlebirds. More resident nectarivorous birds are also usually present at blossom resources, but they are not generally a good indicator that the more nomadic species, such as Swift Parrots and Regent Honeyeaters may be present.

7.3 RESULTS

Surveys were conducted over a two-week period occurring from 18–22 June and 13–17 August 2018.

A total of 87 bird species were observed across the BOAs during this survey period. Threatened species that were recorded across the BOAs are listed below (Table 7.1) and depicted in Table 7.1.

Table 7.1 Threatened species observed during the 2018 Swift Parrot and Regent Honeyeater surveys

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	BC ACT	BIODIVERSITY OFFSET AREA
Black-chinned Honeyeater	<i>Melithreptus gularis</i>		V	Leard State Forest
Brown Treecreeper	<i>Climacteris picumnus</i>		V	Central Offsets, Leard State Forest, Eastern Offsets
Dusky Woodswallow	<i>Artamus cyanopterus</i>		V	Leard State Forest, Central Offsets, Eastern Offsets
Little Lorikeet	<i>Glossopsitta pusilla</i>		V	Leard State Forest
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>		V	Western Offset, Namoi Offsets, Eastern Offsets, Leard State Forest, Central Offsets
Turquoise Parrot	<i>Neophema pulchella</i>		V	Eastern Offsets, Leard State Forest
Varied Sittella	<i>Daphoenositta chrysoptera</i>		V	Eastern Offsets, Namoi Offset
Grey-crowned Babbler	<i>Pomatostomus superciliosus</i>		V	Central Offsets, Leard State Forest, Namoi Offsets, Eastern Offsets
Hooded Robin	<i>Melanodryas cucullata</i>		V	Eastern Offsets

7.3.1 BLOSSOM RESOURCES

JUNE

During the winter bird surveys, conducted in the June 2018, there was an overall lull in the appearance of blossom resources across the BOA's. The region was still experiencing a sustained dry period, which may, to some extent, account for the relatively low percentages of trees exhibiting blossom or new growth.

The Boggabri region's key winter blossoming tree species, White Box (*Eucalyptus albens*), showed low occurrences of blossom, with a very low number of trees flowering well. A low number of trees, estimated at roughly 1 in 100, were carrying blossom on <1% of their canopy cover and perhaps 1 in 100, of trees carrying any blossom at all, was carrying >20% of their canopy cover. The result was a very low number of trees flowering well, estimated at <0.01% or <1 in 10,000.

Of those individual trees carrying very small amounts of blossom, <5% of remaining canopy foliage was holding bud that was of sufficient maturity to flower this season. Approximately 50% of trees were observed to be growing new foliage despite the dry conditions.

AUGUST

During the August 2018 winter bird surveys, the appearance of blossom resources across the BOA's was improved overall in comparison to the blossom status observed in the June survey. The region continued to experience a sustained dry period, and the prolonged dry conditions were evidenced by hilltop vegetation exhibiting stress symptoms manifested by the loss of chlorophyll from the leaves of many canopy trees. Trees on the plains, surrounding hilly habitats, were

far from surprisingly well, with many individuals displaying new foliage growth and occasional blossoming individuals. The robust canopy condition of lowland woodland communities, despite the sustained dry, evidence the importance of lowland woodland habitats in sustaining local ecology through difficult climatic spells.

The Boggabri region's key winter blossoming tree species, White Box (*Eucalyptus albens*), again showed a relatively low occurrence of blossom, with a low number of trees flowering well, although more blossom was present than observed in June 2018. A low number of trees, estimated at roughly 1 in 100, were carrying blossom on >20% of their canopy cover. The result was a relatively low number of trees flowering well, estimated at <0.1% or <1 in 100.

In contrast to the June survey period, there were occasional groupings of trees flowering together, which were attractive to resident and local nectarivorous birds.

7.3.2 NECTARIVOROUS BIRD ACTIVITY AND DIVERSITY

JUNE

The very poor numbers of nectarivorous birds encountered during the June 2018 survey were a strong indication of the low blossom values observed across the entirety of the BOAs and canopies throughout Leard State Forest. A strong indication of conditions, which are suitable for Swift Parrots and Regent Honeyeaters in each surveyed area, are inflated numbers of other nomadic nectarivorous bird species. Whilst the presence of Yellow-faced Honeyeaters, White-naped Honeyeaters, Scarlet Honeyeaters and Noisy Friarbirds across the BOAs is no indication that a blossoming season is out of the ordinary, their presence in large numbers indicates that birds from distant areas have been attracted by inflated food resources locally.

AUGUST

The very poor numbers of nectarivorous birds encountered during the June 2018 survey were improved upon during the August surveys, although by no means indicating a strong showing of blossom values within the BOAs and canopies throughout Leard State Forest. Strong indications of good conditions, which are suitable for Swift Parrots and Regent Honeyeaters in each surveyed area, that is, inflated numbers of other nomadic nectarivorous bird species, was still absent. There was a complete lack of friarbird activity across all areas surveyed and apart from three birds observed in June the region was showing a very poor showing of these birds. The almost complete lack of Noisy Friarbirds across the BOAs during the 2018 winter blossom period, and taking into account reports of Regent Honeyeaters and Swift Parrots throughout NSW during that same time period, strongly suggests that blossom resources in the Boggabri locality were poor and incapable of attracting nectarivorous birds species from outside the region. Neither June or the August 2018 survey periods were characterised by indications that conditions locally were sufficient for attracting nomadic nectarivorous birds from other regions.

7.3.3 EASTERN OFFSET AREA

NIOKA NORTH JUNE

The Nioka North BOA's primary winter blossom resource species is White Box, although there are good stands of Yellow Box (*Eucalyptus melliodora*) on the lower flats in association with Mihi Creek. Although the major blossoming season for Yellow Box is spring into summer, early blossom events begin in August, which represent late season resources for nomadic nectarivorous birds. White Box occurs across all wooded areas of Nioka North including the Mihi Creek gully, where with the availability of additional water the trees reach large dimensions. Despite their good condition generally, White box blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of trees carrying very small amounts of blossom were present at this location as were recorded across the region generally. Nectarivorous birds present at Nioka North were limited to a low diversity of resident nectarivorous birds, including Noisy Miner, Fuscous Honeyeater and White-plumed Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Relatively low numbers of pardalote species indicated that lerp densities across the Nioka North BOA were low during the survey period.

NIOKA NORTH AUGUST

White Box occurs across all wooded areas of Nioka North including the Mihi Creek gully, where with the availability of additional water the trees reach large dimensions. Despite their good condition generally, due to the reliability of water in Mihi Creek, White box blossom resources were very low across the BOA areas surveyed, and blossom was lacking throughout the locations surveyed in this BOA. Nectarivorous birds present at Nioka North were limited to a resident nectarivorous birds, including Noisy Miner, Fuscous Honeyeater, White-plumed Honeyeater, Brown-headed Honeyeater, Striped Honeyeater and Yellow-faced Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Relatively low numbers of pardalote species indicated that lerp densities across the Nioka North BOA were low during the survey period.

BRAEFIELD JUNE

The primary winter blossom resource species at the Braefield BOA is White Box, although there are occurrences of Yellow Box (*Eucalyptus melliodora*) along lower sections of its drainage lines. White Box also occurs on the lowland flats and associated hillocks, and on the tops of ridges and associated with broader drainage line valleys in the ranges to its north. Again, White box blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of trees carrying very small amounts of blossom were present at this location as were recorded across the region generally. Nectarivorous birds present at Rocklea were represented by normal numbers of resident nectarivorous birds, such as Noisy Miner, Fuscous Honeyeater, Singing Honeyeater, Spiny-checked Honeyeater, Striped Honeyeater, White-eared Honeyeater, White-plumed Honeyeater and Yellow-faced Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Nevertheless, a small group of four (4) Musk Lorikeets were observed flying through, appearing to be in transit to scan for blossom resources. Moderate numbers of pardalote species indicated that lerp densities across the Braefield BOA were at normal levels during the survey period.

BRAEFIELD AUGUST

Again, White box blossom resources were low across the BOA areas surveyed, and the small pockets of blossom were present at this location as was recorded across most of the region generally. Nectarivorous birds present at Braefield were represented by normal numbers of resident nectarivorous birds, such as Singing Honeyeater, Spiny-checked Honeyeater, Striped Honeyeater and White-plumed Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Moderate numbers of pardalote species indicated that lerp densities across the Braefield BOA were at normal levels during the survey period.

7.3.4 CENTRAL OFFSET AREA

GOONBRI JUNE

The primary winter blossom resource species at the Goonbri BOA is White Box, which occurs on the western rises of the Goonbri BOA, while for the most part, the flats of Goonbri are dominated by Yellow Box and Red Gums. During the June survey, a single White Box was flowering well toward the property's western boundary where the vegetation communities are largely dominated by White Cypress Pine (*Callitris glaucophylla*). Blossom was attended by Spiny-checked and White-plumed Honeyeaters, and no other honeyeater species were observed during the survey. There was an absence of key nectarivorous bird species that indicate that blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters and concentrations of higher than normal resident nectarivorous birds.

GOONBRI AUGUST

The primary winter blossom resource species at the Goonbri BOA is White Box, which occurs on the western rises of the Goonbri BOA. For the most part the flats of Goonbri are dominated by Yellow Box and Red Gums. During the August survey, White Box along the toe of the property's western slopes was carrying blossom, attracting Fuscous and White-plumed Honeyeaters. Nectarivorous birds present at Goonbri were represented by low numbers of resident nectarivorous birds, such as Spiny-cheeked Honeyeater. Again, there was an absence of key nectarivorous bird species that indicate that blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters and concentrations of higher than normal resident nectarivorous birds.

WIRRILAH JUNE

The primary winter blossom resource species at the Wirrilah BOA is White Box, which occurs on the lower slopes and flats around the rocky central range. White box blossom resources were again generally low across the Wirrilah BOA. A single White Box carrying a good showing of blossom was attended by Musk Lorikeets, although resident species, including Noisy Miner, Spiny-cheeked Honeyeater, White-plumed Honeyeater and Striped Honeyeaters were only encountered in normal numbers. Again, key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. A low showing of pardalote species indicated that lerp densities across the Wirrilah BOA were low during the survey period, but Musk Lorikeets loafing in the vicinity of the single flowering White Box were observed foraging amongst Narrow-leaved Ironbark (*Eucalyptus crebra*) foliage, suggesting there may have been some lerp available locally.

WIRRILAH AUGUST

White box blossom resources were generally low across the Wirrilah BOA. White Box in the eastern valley were carrying an occasional showing of blossom attended by Noisy Miners. Spiny-cheeked Honeyeater, and Blue-faced Honeyeater were encountered and a flock of eight (8) Musk Lorikeets were observed flying through, without alighting in the BOA. White-plumed Honeyeater and Striped Honeyeaters were only encountered in normal numbers. The western flanks of the central range was surveyed, but White Box in this location lacked blossom and the low showing of resident honeyeaters indicated, again, that key nectarivorous bird species, which suggest that blossom resources in the locality are inflated, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. A low showing of pardalote species indicated that lerp densities across the Wirrilah BOA were not above normal concentrations.

MYALL PLAINS JUNE

White Box is the primary winter blossom resource species at the Myall Plains BOA. White Box occurs on the flats and footslopes on the BOA's western forest boundary and the flats between its western range and the main Nandewar Range to its east. White box blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of trees carrying very small amounts of blossom were present at this location as were recorded across the region generally. Nectarivorous birds present at Myall Plains were represented by normal numbers of resident nectarivorous birds, such as Noisy Miner, Spiny-cheeked Honeyeater and Fuscous Honeyeater. One key nectarivorous bird species, which indicates that blossom resources in the locality may be significant was present, being a single group of three Noisy Friarbirds. The observed friarbird group was in transit mode and appeared to be on the move scouting for blossom resources. No significant blossoming events from White Box or other blossom producing trees were observed at Myall Plains or its vicinity. Other nomadic nectarivorous birds, such as Little Friarbirds, inflated numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Low numbers of pardalote species indicated that lerp densities across the Myall Plain BOA were low during the survey period.

MYALL PLAINS AUGUST

White box blossom resources were very low in the west of the BOA areas surveyed, and there was poor attendance of nectarivorous birds at Myall Monitoring site 4. In contrast a patch of widely spread White Box was blossoming near the central valley dam, and were attracting a much higher than normal number of Fuscous Honeyeaters. Their occurrence in this patch of White Box is notable, as open habitats are usually avoided by this species and the birds would have moved some distance from the closest continuous woodland habitats to access the trees. Other more nomadic nectarivorous birds, such as Noisy Friarbird, Little Friarbirds, inflated numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Low numbers of pardalote species indicated that lerp densities across the Myall Plain BOA were low during the survey period.

MALLEE JUNE

As with all the BOA areas, the primary winter blossom resource species at the Mallee BOA is White Box. The Nandewar Range canopies, across which much of the Mallee BOA occurs, is dominated by Narrow-leaved Ironbark and patchy distributions of Silver-leaved Ironbark (*E. melanophloia*), with White Box forests only occurring on western flats of the BOA. White box blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of trees carrying very small amounts of blossom were present at this location as were recorded across the region generally. Nectarivorous birds present at Mallee were represented by normal numbers of resident nectarivorous birds, such as Noisy Miner, Spiny-cheeked Honeyeater, Striped Honeyeater, White-plumed Honeyeater, Yellow-faced Honeyeater and White-naped Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Low numbers of pardalote species indicated that lerp densities across the Mallee BOA were low during the survey period.

MALLEE AUGUST

White box blossom resources were again very low across the BOA areas surveyed, with no blossom recorded at this location. Nectarivorous birds present at Mallee were represented by normal numbers of resident nectarivorous birds, such as Fuscous Honeyeater and White-plumed Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality were present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Low numbers of pardalote species indicated that lerp densities across the Mallee BOA were low during the survey period.

7.3.5 NAMOI OFFSET AREA

ROCKLEA JUNE

The primary winter blossom resource species at the Rocklea BOA is White Box, although there are scattered occurrences of Yellow Box (*Eucalyptus melliodora*) on the peripheral and central flats. White Box also occurs on the flats surrounding the Rocklea ranges and grassy areas on the flanks and top of the hills. Despite their good condition generally, White box blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of trees carrying very small amounts of blossom were present at this location as were recorded across the region generally. Nectarivorous birds present at Rocklea were represented by normal numbers of resident nectarivorous birds, such as Noisy Miner, Blue-faced Honeyeater, Spiny-cheeked Honeyeater, Striped Honeyeater and White-eared Honeyeater. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Relatively low numbers of pardalote species indicated that lerp densities across the Rocklea BOA were low during the survey period.

ROCKLEA AUGUST

White Box trees within the Rocklea BOA exhibited good condition generally, and small groupings of White box carrying blossom were observed. Nectarivorous birds present at Rocklea showed slightly inflated numbers of resident nectarivorous birds, such as Blue-faced Honeyeater, Spiny-cheeked Honeyeater, Striped Honeyeater, Singing Honeyeater, White-plumed Honeyeater and White-eared Honeyeater, with Brown Honeyeater and small groups of Yellow-faced Honeyeater suggesting that resources were higher than surrounding areas. Despite a good showing of local nectarivorous birds, key nectarivorous bird species that indicate higher than normal blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Normal numbers of pardalote species indicated that lerp densities across the Rocklea BOA were not abnormal during the survey period.

DAISYMEDE JUNE

The primary winter blossom resource species at the Daisymede BOA is White Box, although it is not the dominant tree species across much of the BOA, especially the rocky uplands. White Box also occurs on the flats surrounding the Rocklea hills. White box were sparse and blossom resources were very low across the BOA areas surveyed, and the same low numbers (<1%) of blossoming trees were present at this location as were recorded across the region generally. Nectarivorous birds present at Rocklea were represented by normal numbers of a low diversity of resident nectarivorous birds, with only White-plumed Honeyeater observed. Key nectarivorous bird species that indicate blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters, and concentrations of higher than normal resident nectarivorous birds were lacking. Low numbers of pardalote species suggested that lerp densities across the Daisymede BOA were low.

7.3.6 WESTERN OFFSET AREA

JUNE

The primary winter blossom resource species at the Merriendi BOA is White Box, which occurs on the flanks of Merriendi's central range area and associated elevated flats. White Box blossom resources were very low with a single tree observed to be flowering well and low numbers (<1%) of trees carrying very small amounts of blossom. Trees noted as carrying blossom were found to be holding very little bud that was of sufficient maturity to blossom in the 2018 flowering season. Nectarivorous birds present at Merriendi were represented by normal numbers of resident nectarivorous birds, such as Noisy Miner, Blue-faced Honeyeater, Spiny-cheeked Honeyeater, Striped Honeyeater, White-eared Honeyeater, White-plumed Honeyeater and Yellow-faced Honeyeater. Of note, was the absence of key nectarivorous bird species that indicate that blossom resources in the locality are present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters and concentrations of higher than normal resident nectarivorous birds.

AUGUST

The very low White Box blossom resources observed in June were spent in the August survey period with the lack of nectarivorous birds in the woodlands indicating the paucity of blossom resources. Nectarivorous birds present at Merriendi were represented by low numbers of resident nectarivorous birds, such as Spiny-cheeked Honeyeater, White-eared Honeyeater and White-plumed Honeyeater. Again, there was an absence of key nectarivorous bird species, which would indicate that blossom resources in the locality were present, including Noisy Friarbirds, Little Friarbirds, high numbers of White-naped Honeyeaters and Yellow-faced Honeyeaters and concentrations of higher than normal resident nectarivorous birds.

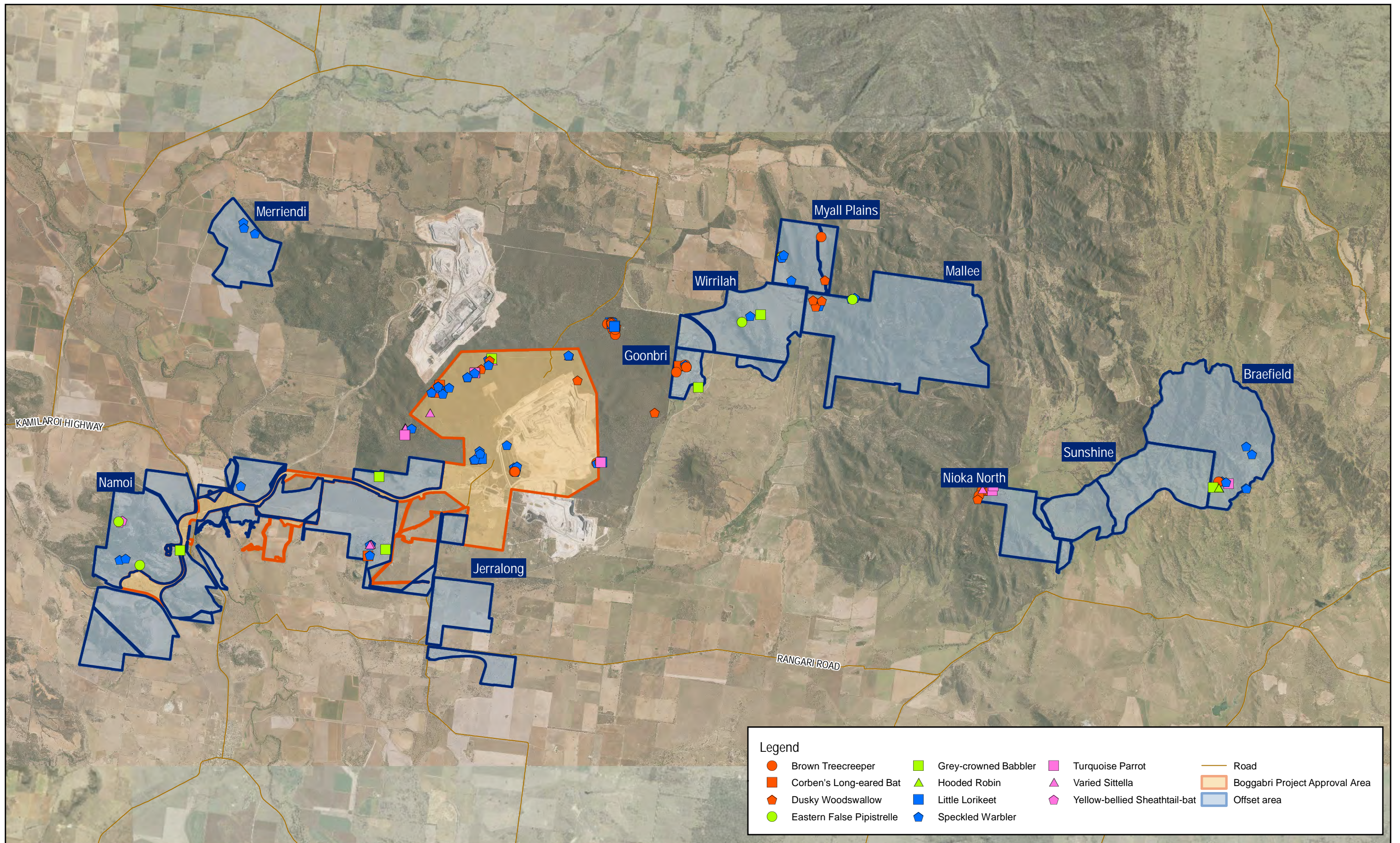
7.3.7 LEARD STATE FOREST

JUNE

Initial surveys were conducted at Leard State Forest BACI monitoring site 2, due to sustained occurrences of Swift Parrots at this site in August 2012, as a means of determining the status of blossom and potential Swift Parrot/Regent Honeyeater occurrences in the locality. The site was subject to the same low blossom occurrences as characterised the region generally. There were small amounts of blossom present, attended by Little Lorikeets, which are regularly recorded at this site. The site was also attended by a number of resident honeyeaters, including, Fuscous Honeyeater, Striped Honeyeater and Spiny-cheeked Honeyeater. Both Striated and Spotted Pardalotes were present in relatively low numbers suggesting lerp numbers in the forest were low.

AUGUST

During the August survey Leard SF monitoring site 2 exhibited a moderate flush of White Box blossom. There were small amounts of blossom present, attended by a low number of Little Lorikeets, which are regularly recorded at this site. Of note though was a good showing of resident honeyeaters, including, inflated numbers of Fuscous Honeyeater, Spiny-cheeked Honeyeaters and at least two Black-chinned Honeyeaters. There was no evidence of friarbirds or inflated numbers of extra-regional nectarivorous birds, other than resident species, suggesting resources were not of sufficient magnitude to attract nectarivorous birds from outside the locality.



Legend

Brown Treecreeper	Grey-crowned Babbler	Turquoise Parrot	Road
Corben's Long-eared Bat	Hooded Robin	Varied Sittella	Boggabri Project Approval Area
Dusky Woodswallow	Little Lorikeet	Yellow-bellied Sheath-tail-bat	Offset area
Eastern False Pipistrelle	Speckled Warbler		

Map: PS110420_GIS_BOA005_A1	Author: SuansriR		
Date: 8/03/2019	Approved by: - N.Cooper		
<small>Data source: Imagery Atlas-Aeromatrix (via BCOPL 2018). Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community</small>			
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BIODIVERSITY OFFSET MONITORING
 Figure 7.1
 Targeted Regent Honeyeater and Swift Parrot survey

8 TARGETED CORBEN'S LONG EARED BAT SURVEY

8.1 BACKGROUND

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

Although this species has a relatively broad distribution in south-eastern Australia, capture rates for this species are relatively low in comparison with those of other microbat species. In the western slopes and plains region of NSW its capture rate is only 1.4% of the total number of bat captures.

8.2 SURVEY TIMINGS AND LOCATIONS

Corben's Long-eared Bat surveys were timed during the warmer months (specifically November, December 2018 and January 2019) to coincide with the period of greatest microchiropteran bat activity when ambient temperatures are warmer and insect populations are at their peak. A total of 40 harp trap nights was recorded from 20 locations encompassing the Eastern, Central and Namoi Offset Areas (Table 8.1, Figure 8.1).

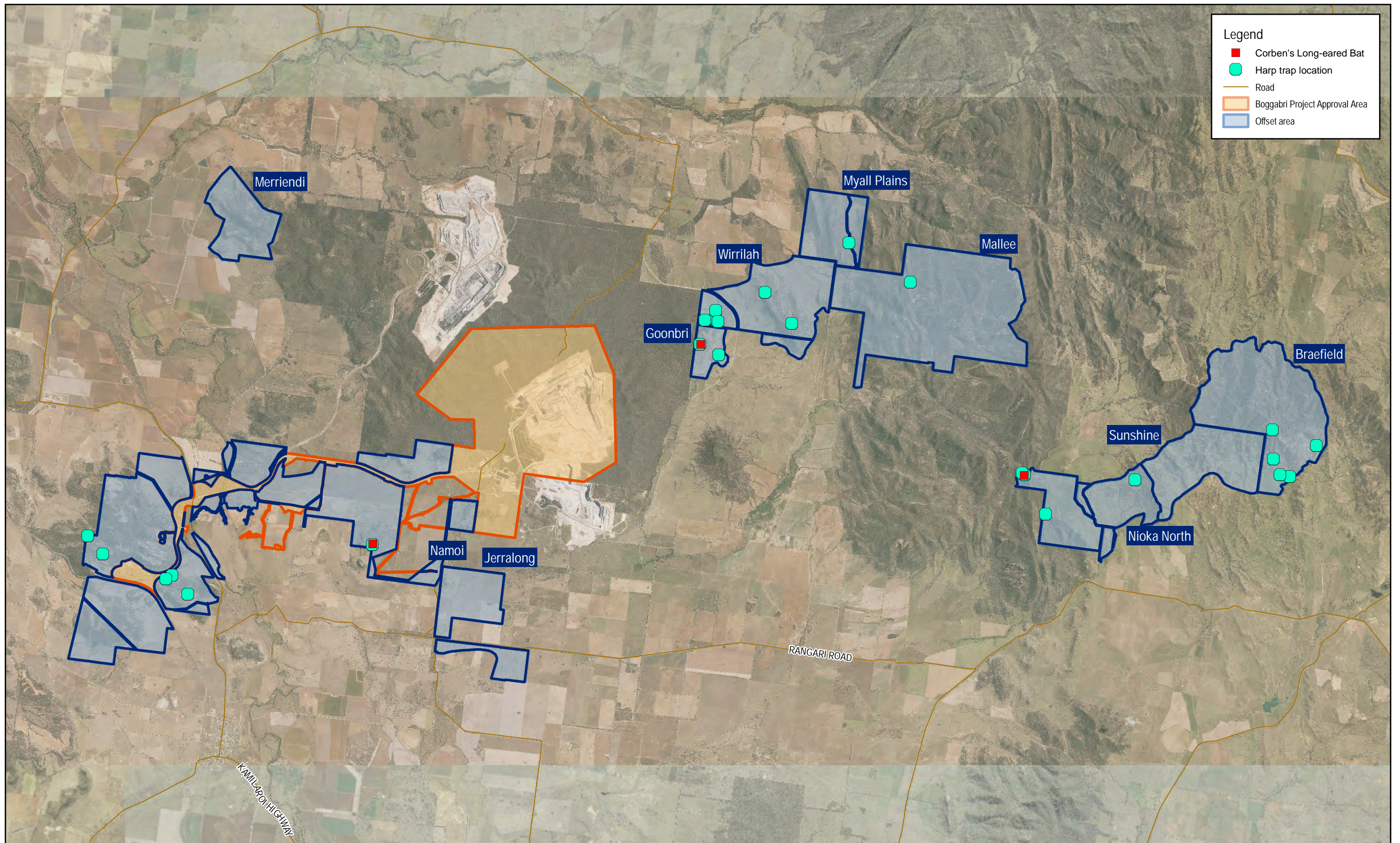
8.3 RESULTS

A total of nine species of microbat were recorded during targeted harp trapping surveys, including species common to dry woodlands of the western slopes and plains of NSW (Table 8.1). Corben's Long-eared Bat was captured across all offset areas.

Table 8.1 Corben's Long-eared Bat survey effort

LOCATION	NUMBER OF HARP TRAP LOCATIONS	HARP TRAP NIGHTS	DATE	CAPTURES
Eastern Offset Area				
Braefield BOA	5	8	23/01/19-24/01/19	Little Forest Bat Chocolate Wattled Bat Lesser Long-eared Bat
Nioka North BOA	4	8	25/01/19-26/01/19	Corben's Long-eared Bat Little Forest Bat Lesser Long-eared Bat Gould's Long-eared Bat Gould's Wattled bat Inland Broad-nosed Bat

LOCATION	NUMBER OF HARP TRAP LOCATIONS	HARP TRAP NIGHTS	DATE	CAPTURES
Central Offset Area				
Mallee BOA	1	2	03/12/18-04/12/18	Little Forest Bat Lesser Long-eared Bat
Myall Plains BOA	1	2	03/12/18-04/12/18	Gould's Wattled bat Little Forest Bat
Wirrilah BOA	4	8	03/12/18-06/12/18	Inland Broad-nosed Bat Lesser Long-eared Bat
Goonbri BOA	2	4	05/12/18-06/12/18	Corben's Long-eared Bat Inland Broad-nosed Bat Mormopterus planiceps species 3 Little Forest Bat Little Broad-nosed Bat
Namoi Offset Area				
Victoria Park property	1	2	28/11/18-29/11/18	Corben's Long-eared Bat Chocolate Wattled Bat Gould's Long-eared Bat Lesser Long-eared Bat
Rocklea property	5	6	28/11/18-29/11/18	Lesser Long-eared Bat Chocolate Wattled Bat Little Broad-nosed Bat



Legend

- Corben's Long-eared Bat
- Harp trap location
- Road
- ▭ Boggabri Project Approval Area
- ▭ Offset area

Map: PS110420_GIS_BOA001_A1	Author: SuansriR		 1:118,579 Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3
Date: 8/03/2019	Approved by: - N. Cooper		
<small>Data source: Imagery Atlas-Aeromex (via BCOP 2018). Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community</small>			
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Boggabri Coal Pty Ltd

BIODIVERSITY OFFSET MONITORING

Figure 8.1
Targeted Corben's Long-eared Bat survey

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9 CONCLUSION

The 2018 monitoring event represents the fourth year of annual biodiversity offset monitoring for the Boggabri Coal project. Boggabri Coal's ten Biodiversity Offset Areas are separated into four management areas, including:

- Eastern Offset Area (Braefield BOA, Sunshine BOA, Nioka North BOA)
- Central Offset Area (Mallee BOA, Myall Plains BOA, Wirrilah BOA, Goonbri BOA)
- Namoi Offset Area (Namoi BOA, Jerralong BOA)
- Western Offset Area (Merriendi BOA).

Boggabri Coal's biodiversity offsets are sampled from 60 replicate monitoring locations, which (as far as practicable) was selected to represent each vegetation community, condition class and management zone. Data collected provides valuable information on vegetation condition and flora and fauna assemblages within the four management areas and management zones. Importantly, the data will enable Boggabri Coal to measure the progress of habitat management and restoration works towards achieving the completion criteria outlined in the BMP (WSP | Parsons Brinckerhoff 2015) and Leared State Forest Regional Biodiversity Strategy Stage 2 - Strategy Report (Umwelt 2017).

9.1 OBSERVABLE BIODIVERSITY TRENDS

9.1.1 HABITAT MANAGEMENT ZONES

9.1.1.1 FLORA

Vegetation data collected as part of the 2018 monitoring session suggests that the vegetation types within habitat management zone across the four management areas are in good condition overall and typical of large relatively undisturbed patches of native vegetation in the locality. Ecosystem health and ecosystem structure are good.

Although still higher than the 2015 baseline monitoring some vegetation attributes showed a decrease in value compared to the 2016 and 2017 monitoring period. This is likely attributed to the higher than average rainfall received prior to the 2016 monitoring survey (WSP | Parsons Brinckerhoff 2017) and drought conditions experienced preceding the 2018 monitoring event. Of particular note, there was severe canopy dieback of Eucalypt species observed throughout the BOAs which may have resulted in the lower overstorey cover recorded during 2018.

Despite these climatic seasonal variations, the monitoring sites established in the habitat management zones provide good analogue sites for which to compare the progress of habitat restoration zones against.

Key findings identified within the habitat management zones in 2018 included:

- One threatened flora species was recorded during the 2018 monitoring session from two habitat management zone monitoring sites (Wi1 and My3).
- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2018 as discussed above.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2018 as discussed above.
- Livestock grazing still occurs within the Eastern Offset BOAs, removed from other management areas.
- Some monitoring locations contained Cypress Pine densities which exceed the 650 stems/per hectare threshold. Although, they exceeded this threshold most vegetation attributes meet, are within or exceed the BBAM benchmark values for their corresponding vegetation type. Recommended that monitoring of these locations continue in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment etc prior to undertaking Cypress Pine thinning.

- Most Box Gum Woodland monitoring sites within habitat management zones meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands (exception to this is S3).
- Box Gum Woodland monitoring sites within habitat management zones largely meet, are within or exceed BBAM benchmarks. Exceptions to this include some sites which do not meet fallen timber or hollow bearing tree benchmarks.
- *Alternanthera pungens* recorded at one habitat management zone site (S3) – although not a priority weed under the *Biosecurity Act 2015* this species is highly invasive and control of this species should be considered. Furthermore, it is recommended that biosecurity measures should be introduced to avoid the spread of this weed into other BOA properties. For example, vehicles should remain on tracks and avoid driving in paddocks where this species occurs and brush down of tyres should be completed when leaving and entering any other BOAs.

9.1.1.2 FAUNA

Habitat management zones across the BOAs provide habitat for a range of threatened species and the intact and semi-intact habitats remain in good condition. The association of habitat management zones with areas of high quality extant vegetation with a diversity of woodland structural forms are key to the diversity this zone supports; as illustrated by the presence of 14 threatened species recorded in areas of suitable habitat.

Key findings identified in habitat management zones during the 2018 monitoring event included:

- The presence of 15 threatened fauna species, including Brown Treecreeper, Diamond Firetail, Grey-crowned Babbler, Hooded Robin, Little Eagle, Little Lorikeet, Painted Honeyeater, Speckled Warbler, Turquoise Parrot, Varied Sittella, Corben’s Long-eared Bat, Eastern Cave Bat, Eastern False Pipistrelle, South-eastern Free-tailed Bat, Yellow-bellied Sheath-tail-bat.
- 2018 represents the first year that Northern Free-tailed Bat was recorded from the BOAs.
- Diurnal bird species richness was typical of relatively undisturbed woodland and open forest habitats in the region. Comparatively, mean diurnal bird species richness in 2018 was comparable to the previous two years of monitoring data. Mean diurnal bird species richness in habitat management zones achieved between 82 % and 97 % of the Leard State forest analogue benchmark.
- Mean microchiropteran bat species richness in 2018 was comparable to data acquired in 2017 and baseline surveys completed in 2015. Mean species richness during the 2018 monitoring event met or exceeded the Leard State Forest analogue benchmark for microchiropteran bats.
- Call playback and spotlight methodologies for nocturnal birds and mammals were employed during the 2018 monitoring event. Call playback techniques did not elicit a response from targeted threatened nocturnal bird or mammal species. Three nocturnal birds, being Australian Owllet-nightjar, Tawny Frogmouth and Southern Boobook were recorded via call recognition during night works. The Common Brush-tailed Possum, Eastern Grey Kangaroo, Swamp Wallaby and Common Wallaroo were also recorded during spotlighting.
- The perceived lack of large forest owls (particularly Barking Owl) or arboreal mammals (Koala and Squirrel Glider) from the BOAs are likely an artefact of survey effort rather than actual absence from the BOAs. Indeed, suitable habitat in the form of high quality and contiguous wooded areas containing old growth forms with numerous tree hollows interspersed with clearings and ecotones, provide suitable breeding substrates and adequate foraging areas.
- Several introduced species were recorded during the 2018 monitoring period, including Fox, Brown Hare, Goat, Pig and Cattle.

Measures to manage existing vegetation and habitat in habitat management zones will continue to maintain the current high quality and structural complexity of extant vegetation across the BOAs. Future monitoring will track the progress of works completed. Where restoration works are proposed at the ecotone of habitat restoration and habitat management zones, it may be reasonable to assume that habitat quality and species richness may improve for a range of fauna species.

9.1.2 HABITAT RESTORATION ZONES

9.1.2.1 FLORA

The habitat restoration zone is predominantly comprised of derived native grassland communities. Ecosystem health and ecosystem structure are generally poor. As such, the monitoring sites generally fall below the BBAM vegetation type benchmarks for a range of attributes. However, due to the general lack of canopy, midstorey, fallen logs and the presence of grazing pressure, native grass cover is generally high and exceeds benchmark conditions. To date, restoration works are limited to revegetation trials within the Namoi and Wirrilah BOAs. The restoration works planned for the habitat restoration zones will result in an overall improvement in the attributes over time.

Key findings identified within the habitat management zones in 2018 included:

- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2018 as discussed above.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2018 as discussed above.
- Livestock grazing still occurs within the Eastern Offset BOAs, removed from other management areas.
- Restoration efforts to date show a survival rate of between 78% and 100% of tube stock plantings which occurred within the Namoi and Wirrilah BOAs in 2016 to 2018.
- One monitoring locations contained Cypress Pine densities which exceed the 650 stems/per hectare threshold (Wi3). Although, it exceeded this threshold most vegetation attributes meet, are within or exceed the BBAM benchmark values for its corresponding vegetation type. Recommended that monitoring of this location continues in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment etc prior to undertaking Cypress Pine thinning.
- Most Box Gum Woodland monitoring sites within habitat restoration zones do not meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands (exception to this area sites Wi3, G2 and Me2).
- Box Gum Woodland monitoring sites within habitat restoration zones largely fail to meet BBAM benchmark values especially for attributes relating to the number of hollow bearing trees, length of fallen timber and native overstorey percentage cover. Furthermore, most sites showed no or limited evidence of regeneration of canopy species.
- Due to the above, management within habitat restoration zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.
- *Alternanthera pungens* recorded at one habitat restoration zone site (S2) – although not a priority weed under the *Biosecurity Act 2015* this species is highly invasive and control of this species should be considered. Furthermore, it is recommended that biosecurity measures should be introduced to avoid the spread of this weed into other BOA properties. For example, vehicles should remain on tracks and avoid driving in paddocks where this species occurs and brush down of tyres should be completed when leaving and entering any other BOAs.

9.1.2.2 FAUNA

Habitat restoration zones generally possessed a moderate to low fauna species assemblage during the 2018 monitoring event. This can be expected as these areas are typically historically disturbed areas that have long been dedicated to grazing of cattle. Such areas are structurally simplified, contain few habitat features and are generally devoid of canopy and understorey cover; attributes that may otherwise encourage a diverse woodland fauna.

Key findings identified in habitat restoration zones in 2018 included:

- Bird species common to habitat restoration zones included disturbance tolerant species and common open country species, including Galah, Sulphur-crested Cockatoo, Australian Magpie, Australian Raven, Pied Butcherbird, Eastern Rosella and Crested Pigeon.
- Mean diurnal bird species richness was observed in 2018 to be largely consistent with the previous three years monitoring data. Habitat restoration zones possessed a low diurnal bird species richness, typically achieving between 25 % and 40 % of the Leard State Forest analogue benchmark for bird species richness.
- Despite most habitat restoration zones being disturbed, they do provide habitat (particularly foraging habitat) for threatened species such as Speckled Warbler and Grey-crowned Babbler; particularly along ecotones, where regenerating shrubs provide adequate cover close to open foraging grounds.
- Similarly to diurnal birds, habitat restoration zones generally possessed a reduced microchiropteran bat species richness compared to habitat management zones. Mean species richness during the 2018 monitoring event for the Eastern, Central and Namoi Offsets achieved approximately 89 %, 80 % and 47 % of the Leard State Forest analogue benchmark for microchiropteran bats respectively. The Western Offset (Merriendi BOA) exceeded the Leard State Forest benchmark during the 2018 monitoring period.
- Despite the restoration zones being disturbed, they do provide foraging habitat for threatened species of microchiropteran bat; particularly where such replicate monitoring sites occur adjacent to ecotones, where remnant canopy paddock trees occur, or where sites occur in movement pathways from roost location to preferred foraging grounds. Several threatened species of microchiropteran bat were recorded from replicate monitoring sites consistent with habitat restoration zones, including Eastern False Pipistrelle, Northern Free-tailed Bat and Yellow-bellied Sheath-tail-bat.
- Several introduced species were recorded opportunistically in habitat restoration zones during the 2018 monitoring period, including Fox, Brown Hare, Goat, Pig and Cattle.

The proposed restoration works in these areas should result in an increase in diurnal bird and microchiropteran bat species richness over time and a change in the overall species composition to that of woodland species. Future monitoring will track the species richness of these areas as it progresses towards that of the habitat management zones.

9.1.3 CORRIDOR ENHANCEMENT ZONE

The corridor enhancement zone has been significantly disturbed by past land use practices, including clearing, cropping, pasture improvement and heavy grazing. The lack of canopy, midstorey and altered groundlayer composition recorded during baseline monitoring supports this assumption. Likewise, the paucity of fauna species proves how disturbed this area currently is. The planned supplementary canopy planting and some targeted weed and pest management activities should serve to increase woody canopy cover and build on adjoining existing wildlife corridors. A considerable improvement in habitat value should be seen in this area over the coming years.

Key findings identified within the habitat management zones in 2018 included:

- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2018 as discussed above.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2018 as discussed above.
- Livestock grazing still occurs within the Eastern Offset BOAs, removed from other management areas.
- Restoration efforts to date show a survival rate of 78% of tube stock plantings which occurred within the Wirrilah BOA in 2017 (Wi7).

- Box Gum Woodland monitoring sites within habitat restoration zones do not meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands.
- Box Gum Woodland monitoring sites within habitat restoration zones largely fail to meet BBAM benchmark values especially for attributes relating to the number of hollow bearing trees, length of fallen timber and native overstorey percentage cover. Furthermore, most sites showed no or limited evidence of regeneration of canopy species aside from restoration tube stock planting.
- Due to the above, management within habitat restoration zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc to increase connectivity. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.
- *Alternanthera pungens* recorded at one corridor zone site (S5) – although not a priority weed under the *Biosecurity Act 2015* this species is highly invasive and control of this species should be considered. Furthermore, it is recommended that biosecurity measures should be introduced to avoid the spread of this weed into other BOA properties. For example, vehicles should remain on tracks and avoid driving in paddocks where this species occurs and brush down of tyres should be completed when leaving and entering any other BOAs.
- Mean diurnal bird species richness was observed in 2018 to be largely consistent with the 2017 monitoring data. Corridor enhancement zones possessed a low diurnal bird species richness, typically achieving between 26 % and 40 % of the Leard State Forest analogue benchmark for bird species richness.
- Mean microchiropteran bat species richness in the Eastern Offset was found to be consistent with the 2017 monitoring data; achieving approximately 70 % of the Leard State Forest analogue benchmark. In the Central Offset Area, mean microchiropteran bat species richness exceeded the Leard State Forest benchmark in 2018. One possible explanation, includes the establishment of an additional monitoring site in the Wirrilah BOA, which is positioned in proximity to the eastern extent of the Leard State Forest remnant.

9.2 TARGETED SWIFT PARROT AND REGENT HONEYEATER SURVEY

Targeted Swift Parrot and Regent Honeyeater surveys were conducted over two separate one week sampling periods occurring in June and August 2018.

A total of 87 diurnal species of bird were recorded during the survey periods, including nine threatened species of bird. The Swift Parrot and Regent Honeyeater were not recorded during these targeted surveys with blossom values in the Boggabri locality generally suggesting that these species were not likely to be present.

During the June surveys, there was very low occurrences of blossom resources, namely White Box (*Eucalyptus albens*) across the BOA’s. The region was experiencing a sustained dry period, which may, to some extent, account for the relatively low percentages of trees, exhibiting blossom or new growth. There was slight increase in the occurrence of blossom resources during the August survey, however still in very low numbers.

The distribution of resources across the BOAs during June and August 2018, was not of significant proportions and this was evident in the generally subdued presence of nomadic nectarivorous birds in the Boggabri area. Of note was the absence of key nectarivorous bird species like Little Friarbirds and Noisy Friarbirds during the surveys Little Friarbirds are usually ubiquitous when good blossoming events take place.

Swift Parrots and Regent Honeyeaters were not observed during the 2018 survey period. However, the small number of Friarbirds and relatively subdued numbers of other nomadic nectarivores suggest that the 2018 densities of blossom would be unlikely to attract Regent Honeyeaters or Swift Parrots even if their numbers were still relatively robust.

9.3 TARGETED CORBEN'S LONG-EARED BAT SURVEY

A total of 40 harp trap nights targeting Corben's Long-eared Bat was completed across 20 locations encompassing the Eastern, Central and Namoi Offset Areas. A total of Nine different species of microchiropteran bat were recorded across the BOAs. Three individual Corben's Long-eared Bat were captured from three disparate locations: Namoi BOA (Victoria Park Property, where this species has been recorded annually), one recorded from the Eastern Offset Area (Nioka North- same location as 2017) and the Central Offset Area (Goonbri- recorded for the first time in 2018).

9.4 PROGRESSIVE RESTORATION WORKS

Restoration works continued in the BOAs in 2018 with approximately 651.6 ha of habitat restoration zones associated with the Namoi BOA planted along the Namoi and Nagero Creek floodplain either side of the haul road from Merriown Mountain to the Kamilaroi Highway. A relatively small area was also revegetated west of the Kamilaroi Highway, in association with Ginns Leap. The 2018 restoration works included approximately 103.7 ha of State 2 Box Gum Woodland (native pastures). Revegetation activities involved weed management, site preparation and hikos planting with species determined in the BMP. Additionally, approximately 29.3 km of rural fencing repairs and construction was completed in the BOAs.

10 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (WSP) for Boggabri Coal Operations Pty Limited (Client) in response to specific instructions from the Client and in accordance with WSP's proposal dated 25 May 2018 and agreement with the Client dated 28 May 2018 (Agreement).

PERMITTED PURPOSE

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (Permitted Purpose).

QUALIFICATIONS AND ASSUMPTIONS

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and / or recommendations in the Report (Conclusions) are based in whole or in part on information provided by the Client and other parties identified in the report (Information), those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

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ENVIRONMENTAL CONCLUSIONS

Within the limitations imposed by the scope of services, the surveys and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made. The conclusions in this report are based upon data acquired for the site and are, therefore,

merely indicative of the biodiversity values at the time of completing field surveys, including the presence or otherwise of species.

During the 2018 monitoring event, multiple storm cells were active in the north-west slopes and plains region from 17 – 21 October 2018. These systems affected the delivery of the field monitoring program by delaying access to BCOPL on some days, resulting in some surveys being completed during unfavourable time periods; limiting access to BOAs due to condition of access tracks and mine site workplace health and safety requirements; and restricting the rotation of field equipment (Anabats), resulting in some replicate monitoring sites collecting a single night in lieu of duplicate data.

DISCLAIMER

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APPENDIX A

SUMMARY OF REPLICATE MONITORING SITES



A1 SUMMARY OF REPLICATE MONITORING SITES

Table A.1 Monitoring site Biometric vegetation type, management zone and location

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
Eastern Offsets				
Nioka North BOA				
Ni1	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Management Zone	244269	6608377
Ni2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	245166	6608128
Ni3	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	244650	6606905
Ni4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	247329	6608009
Ni5	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	246476	6607377
Ni6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	246349	6606455
Sunshine BOA				
S1	Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	Habitat Management Zone	250767	6609721
S2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	251225	6608917
S3	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	248561	6608585
S4	Miscellaneous ecosystem (i.e. cultivation, exotic/improved pasture)	Corridor Enhancement Zone	249168	6607850
S5	Miscellaneous ecosystem (i.e. cultivation, exotic/improved pasture)	Corridor Enhancement Zone	249467	6608406

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
Braefield BOA				
B1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252555	6608212
B2	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252402	6608993
B3	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	252121	6610268
B4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	253434	6609545
B5	Tea-tree shrubland of drainage areas of the slopes and tablelands	Habitat Management Zone	253819	6609322
B6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	253727	6609808
Central Offsets				
Goonbri BOA				
G1	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Management Zone	233537	6612249
G2	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Restoration Zone	233186	6611997
Mallee BOA				
Ma1	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Restoration Zone	237554	6614686
Ma2	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	238099	6615066
Ma3	Heathy shrublands on rocky outcrops of the western slopes	Habitat Management Zone	240138	6614143
Ma4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	240089	6615068
Ma5	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	237632	6615124
Myall Plains BOA				
My1	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Restoration Zone	237527	6617491
My2	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Restoration Zone	238176	6617113

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
My3	White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	238468	6617070
My4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	236598	6616595
My5	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	237186	6616278
My6	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	238100	6615660
Wirrilah BOA				
W1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	233578	6613593
W2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Corridor Enhancement Zone	234038	6613773
W3	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	234087	6614354
W4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	235211	6614321
W5	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	236213	6613858
W6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	236163	6615156
W7	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Corridor Enhancement Zone	233111	6614234
Namoi Offsets				
Namoi BOA				
N1	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	224258	6604738
N2	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Restoration Zone	224022	6603124
N3	River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)	Habitat Management Zone	216617	6607184
N4	White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Habitat Management Zone	217235	6608516

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
N5	River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)	Habitat Restoration Zone	218073	6607591
N6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	218646	6608224
N7	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Management Zone	226625	6602296
N8	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Management Zone	221789	6608285
N9	Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson 27)	Habitat Restoration Zone	222169	6608662
N10	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	222615	6606501
N11	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Restoration Zone	224575	6607157
N12	White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	214113	6605257
N13	Tea-tree shrubland of drainage areas of the slopes and tablelands	Habitat Management Zone	214957	6604856
N14	Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion (Benson 187)	Habitat Management Zone	214961	6604262
N15	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Habitat Management Zone	217675	6603969
N16	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	223488	6608443
N17	Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)	Habitat Restoration Zone	220243	6608402
Western Offsets				
Merriendi BOA				
Me1	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	217519	6617933
Me2	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	216281	6617618
Me3	Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion (Benson 187)	Habitat Management Zone	218378	6616634

SITE ID	BIOMETRIC VEGETATION TYPE	MANAGEMENT ZONE	EASTING	NORTHING
Me4	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Management Zone	218279	6616132
Me5a	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (Low)	Habitat Restoration Zone	218482	6616444
Me6	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Habitat Restoration Zone	217049	6618557

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APPENDIX B

FIELD SURVEY WEATHER CONDITIONS



B1 FIELD SURVEY WEATHER CONDITIONS

Table B.1 2018 flora and fauna field survey weather conditions

DATE	TEMPERATURE		RAIN (mm)	9:00 AM			3:00 PM		
	Min (°C)	Max (°C)		Temp (°c)	Relative humidity (%)	Wind speed (km/h/ direction)	Max (°c)	Relative humidity (%)	Wind speed (km/h/ direction)
Biodiversity Offset Area monitoring (flora and fauna survey inclusive of call playback and nocturnal survey)									
15/10/18	12.1	29.7	0	19.6	52	26 SE	28.4	31	26 E
16/10/18	12.7	30.6	0	21.3	56	17 ESE	28.7	27	13 ENE
17/10/18	16.7	27.5	8	17.3	90	15 SE	25.8	53	6 NNE
18/10/18	16.7	28.4	6.2	22.1	70	19 NE	28	39	17 NW
19/10/18	17.1	28.5	3.8	21.2	74	6 SSE	27.3	46	15 NNW
20/10/18	15.9	31	0	23.3	64	6 SSE	30.4	35	13 NNW
21/10/18	15.7	25.2	17.6	16.1	89	7 N	23.8	50	13 NNW
22/10/18	14.7	29.1	0	20.2	72	13 ESE	27.4	34	9 NNE
23/10/18	14.8	30.5	0	21.9	59	Calm	29.3	32	20 NNW
24/10/18	14.3	33.8	0	24.8	52	4 E	33.3	24	24 NNW
25/10/18	14.4	33.8	0	20.9	61	17 SE	32.2	24	24 NNW

DATE	TEMPERATURE		RAIN (mm)	9:00 AM			3:00 PM		
	Min (°C)	Max (°C)		Temp (°c)	Relative humidity (%)	Wind speed (km/h/ direction)	Max (°c)	Relative humidity (%)	Wind speed (km/h/ direction)
Targeted Swift Parrot and Regent Honeyeater survey									
18/06/18	6.1	16	0	8.4	79	15 WNW	15.1	41	22 SW
19/06/18	0.9	16.1	0	8.5	71	6 NW	15.1	48	31 S
20/06/18	4.3	19.3	0	13.2	67	17 SE	17.4	40	19 S
21/06/18	1.6	19.4	0	9.7	76	15 SE	19	29	6 SE
22/06/18	3.2	19.7	0	10.8	71	13 ESE	19.1	27	11 W
13/08/18	-2.5	18	0	7.8	51	11 NW	17.5	28	22 SW
14/08/18	-2.1	21.3	0	8.9	63	9 E	20.1	26	11 NW
15/08/18	-1.4	22.3	0	10.9	49	Calm	21.8	12	22 NW
16/08/18	-0.4	24.7	0	13.7	31	Calm	23.2	15	28 W
17/08/18	0.9	20.2	0	11.3	43	Calm	19.5	22	13 WSW
Targeted Corben's Long-eared Bat survey									
26/11/18	9.5	30.1	0	21.2	37	7 WNW	29.6	15	22 W
27/11/18	14.7	31.6	0	22.5	39	13 SE	27.3	25	31 NW
28/11/18	17.2	24.6	2.6	18.8	84	22 W	18.7	66	35 W
29/11/18	12.9	26.5	4.4	19.0	57	20 SSE	24.0	41	15 SE
3/12/18	11.7	31.1	0	21.8	25	6 E	30.2	14	19 W
4/12/18	13.7	31.8	0	22.8	32	15 SE	29.9	16	9 NNE

DATE	TEMPERATURE		RAIN (mm)	9:00 AM			3:00 PM		
	Min (°C)	Max (°C)		Temp (°c)	Relative humidity (%)	Wind speed (km/h/ direction)	Max (°c)	Relative humidity (%)	Wind speed (km/h/ direction)
5/12/18	17.2	32.0	0	24.9	47	22 ESE	30.8	27	17 E
6/12/18	14.7	29.9	12.0	22.4	48	19 E	29.3	28	20 E
23/01/19	21.3	35.8	10.2	23.6	81	Calm	32.3	39	11 WNW
24/01/19	22.0	38.6	0.6	27.7	55	19 SE	37.7	26	19 E
25/01/19	22.0	40.1	0	29.6	48	7 E	37.9	25	13 N
26/01/19	23.4	41.1	0	31.6	36	9 W	39.4	22	11 NW

Source: Temperature, humidity, wind, pressure and rainfall observations are from Gunnedah Airport AWS.

APPENDIX C

2018 FLORA SURVEY DATA



C1 EASTERN OFFSET AREA

Table C.1 Plant species recorded within the Nioka North BOA during the 2018 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery	Exotic	0.1	0.1		0.1	0.1	
Asteraceae	<i>Bidens subalternans</i> *	Greater Beggar's Ticks	Exotic	0.1					
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic		8	0.2	2	2	3
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic	2	5		4	4	2
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic	0.2	0.1			0.4	0.2
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	Exotic	0.1			0.5		
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane	Exotic	0.2			5		
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic						8
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.2	2	0.5		0.2	0.5
Asteraceae	<i>Silybum marianum</i> *	Varigated Thistle	Exotic	0.2					
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic	0.1	0.1	0.1	0.1		0.1
Brassicaceae	<i>Capsella bursa-pastoris</i> *	Shepherd's Purse	Exotic		0.3		1	0.2	0.5
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic	0.1	1		0.1		
Brassicaceae	<i>Lepidium bonariense</i> *		Exotic		1				
Brassicaceae	<i>Sisymbrium orientale</i> *	Indian Hedge Mustard	Exotic	2					
Brassicaceae	<i>Sisymbrium officinale</i> *	Hedge Mustard	Exotic	2	0.1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic			0.1			
Caryophyllaceae	<i>Paronychia brasiliana</i> *	Chilean Whitlow Wort	Exotic		0.1				
Caryophyllaceae	<i>Petrorhagia nanteuilii</i> *	Childling Pink	Exotic	1		0.2	0.1	0.1	1
Caryophyllaceae	<i>Polycarpon tetraphyllum</i> *	Four-leaved Allseed	Exotic				0.2		
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic	0.2		0.1	0.1		
Fabaceae (Faboideae)	<i>Medicago polymorpha</i> *	Burr Medic	Exotic		0.5				5
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic			0.5	0.5	5	
Fabaceae (Faboideae)	<i>Trifolium arvense</i> *	Haresfoot Clover	Exotic	0.2	0.2			1	1
Fabaceae (Faboideae)	<i>Trifolium glomeratum</i> *	Clustered Clover	Exotic					0.2	
Fabaceae (Faboideae)	<i>Trifolium repens</i> *	White Clover	Exotic	0.4	0.2				
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic		5		0.1	10	8
Geraniaceae	<i>Geranium molle</i> *	Cranesbill Geranium	Exotic	0.2					
Iridaceae	<i>Sisyrinchium rosulatum</i> *	Scourweed	Exotic					0.1	
Lamiaceae	<i>Marrubium vulgare</i> *	White Horehound	Exotic	0.5				0.1	
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic	0.5	0.2		0.5	0.2	
Malvaceae	<i>Malva parviflora</i> *	Small-flowered Mallow	Exotic	0.1	0.1			0.1	
Malvaceae	<i>Sida spinosa</i> *		Exotic		0.1		0.1	0.1	0.1
Oxalidaceae	<i>Oxalis pes-caprae</i> *		Exotic				0.1		
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1		0.1	0.1	0.1	0.1
Poaceae	<i>Bromus molliformis</i>	Soft Brome	Exotic	4			2		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Poaceae	<i>Hordeum vulgare*</i>	Barley	Exotic		1				
Poaceae	<i>Lolium perenne*</i>	Perennial Ryegrass	Exotic						3
Poaceae	<i>Phalaris paradoxa*</i>	Paradoxa Grass	Exotic					0.5	
Poaceae	<i>Vulpia muralis*</i>		Exotic	0.4					
Poaceae	<i>Vulpia myuros*</i>	Rats Tail Fescue	Exotic		0.1			2	
Polygonaceae	<i>Polygonum aviculare*</i>	Wireweed	Exotic		0.2			0.1	
Primulaceae	<i>Lysimachia arvensis*</i>	Scarlet/Blue Pimpernel	Exotic	0.2		0.1		0.1	0.2
Rubiaceae	<i>Galium aparine*</i>	Goosegrass	Exotic	0.3					
Total exotic species richness				25	21	10	19	22	15
Acanthaceae	<i>Rostellularia adscendens</i>		Native			0.1			
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native	0.1	0.1				
Anthericaceae	<i>Arthropodium milliflorum</i>	Pale Vanilla-lily	Native			0.1	0.1		
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Native			0.1			0.2
Anthericaceae	<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily	Native		0.1				
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.2	0.2	0.1	0.1	0.2	0.2
Araliaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Native	0.1			0.1	0.1	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.5		2			
Asteraceae	<i>Calotis scabiosifolia var. scabiosifolia</i>	Rough Burr-daisy	Native		0.2				
Asteraceae	<i>Cassinia laevis</i>	Cough Bush	Native			4			
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native			1			0.1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Native	0.1	0.1	0.1		0.2	
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native			0.1			
Asteraceae	<i>Olearia elliptica</i>	Viscid Daisy Bush	Native			1			
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Native			0.1	0.1		
Asteraceae	<i>Sigesbeckia australiensis</i>		Native			4			
Asteraceae	<i>Solenogyne bellioides</i>		Native		0.1	0.2			
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	Native			0.1			
Asteraceae	<i>Vittadinia muelleri</i>		Native			1		5	3
Asteraceae	<i>Vittadinia sp.</i>		Native	0.1			0.1		
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Wonga Vine	Native				0.2		
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native	0.1				0.1	
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell	Native						0.1
Chenopodiaceae	<i>Dysphania pumilio</i>	Small Crumbweed	Native		0.1				
Chenopodiaceae	<i>Einadia polygonoides</i>		Native	0.1	0.2		0.1	0.1	0.1
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Native	0.1					
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native					0.1	0.1
Crassulaceae	<i>Crassula colorata</i>		Native	0.1					
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native			0.5			
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native	5	5	0.1	0.5	0.3	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	0.2	8	0.2	2		0.1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	Native		0.1				
Euphorbiaceae	<i>Euphorbia drummondii</i>	Caustic Weed	Native	0.1				0.1	0.1
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native			1	0.2		
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.1		0.1	0.1	0.1	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native	0.2	0.2	0.2	0.2	0.2	0.1
Fabaceae (Faboideae)	<i>Swainsona reticulata</i>	Kneed Swainson-pea	Native			0.1			
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native		0.1				4
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native		0.1	0.1	0.1	0.1	0.2
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Native	0.1			0.1		
Haloragaceae	<i>Haloragis heterophylla</i>	Rough Raspwort	Native			0.1			
Hypericaceae	<i>Hypericum gramineum</i>	Small St. John's Wort	Native			0.1			
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	Native			0.1		2	
Lamiaceae	<i>Teucrium betchei</i>		Native	2		0.8	0.2		
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>		Native			0.1			
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native			0.1			
Loranthaceae	<i>Amyema miquelii</i>		Native			0.2			
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.1	0.1	0.1	0.2		0.1
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native			15	3		
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Native			2			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0.1	0.1		0.1	0.1	0.1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native				5		
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1		0.4	0.2		
Phormiaceae	<i>Dianella revoluta</i>	Blue Flax-lily	Native			0.1			
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native			0.1		0.2	0.1
Plantaginaceae	<i>Plantago debilis</i>		Native				0.1		
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	4	4	6	1	6	10
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	1	2		1		4
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo grass	Native	30			30		
Poaceae	<i>Bothriochloa macra</i>	Red-leg Grass	Native					1	1
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native		2		4	6	3
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native				8		
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native			8	10		
Poaceae	<i>Cynodon dactylon</i>	Couch	Native		4				
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native	2		5		2	
Poaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.1	0.1	0.2	0.1	0.1	0.1
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native					0.1	1
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native	3	2				
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native		8			2	2
Poaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native	5	0.1				
Poaceae	<i>Panicum effuseum</i>	Hariy Panic	Native	1	0.5	1		3	1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native			0.1			
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Native			6			
Poaceae	<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass	Native			1			
Poaceae	<i>Rytidosperma racemosum subsp. racemosum</i>		Native		4				
Poaceae	<i>Rytidosperma sp.</i>		Native	0.5					
Poaceae	<i>Rytidosperma tenuius</i>		Native		6		2		
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Native			0.5		1	
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	Native			0.2			
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native			0.1	1	3	5
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native	0.1			0.1	0.1	0.1
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Native		0.1				
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native			0.1			
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.1	0.4	2		1	0.1
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	Native				0.2	0.1	
Rubiaceae	<i>Galium leptogonium</i>		Native			0.1	0.1		
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolium</i>	Sticky Hop-bush	Native			50	4		
Stackhousiaceae	<i>Stackhousia viminea</i>	Slendwer Stackhousia	Native			0.1			
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native			0.3	1		0.5

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				NN1	NN2	NN3	NN4	NN5	NN6
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Native	2			0.5		
Zygophyllaceae	<i>Tribulus sp.</i>	Caltrop	Native		0.1				0.1
Native plant species richness in ground layer				31	29	44	32	28	27
Native ground cover percentage				53.3	48	43.2	63.7	34.3	36
Total native species richness				32	30	52	36	28	28
Total species richness				57	51	62	55	50	43

Table C.2 Plant species recorded within the Sunshine BOA during the 2018 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Amaranthaceae	<i>Alternanthera pungens</i> *	Khaki Weed	Exotic		0.2	2		0.2
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery	Exotic	1				
Apocynaceae	<i>Gomphocarpus fruticosus</i> *	Narrow-leaved Cotton Bush	Exotic	0.1	2		0.2	
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed	Exotic					
Asteraceae	<i>Bidens subalternans</i> *	Greater Beggar's Ticks	Exotic		0.1			
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic	0.1	1	4	3	0.2
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic		2	1	3	0.2
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic	0.1	0.5	0.1	0.2	
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	Exotic	0.1				
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.1		0.1	0.1	
Asteraceae	<i>Lactuca serriola</i> *	Prickly Lettuce	Exotic		0.1		0.2	
Asteraceae	<i>Silybum marianum</i> *	Varigated Thistle	Exotic		0.1	1	3	1
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	Exotic	0.2				
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	Exotic			0.1	0.1	0.1
Boraginaceae	<i>Amsinckia intermedia</i> *	Common Fiddlestick	Exotic					0.1
Boraginaceae	<i>Buglossoides arvensis</i> *	Sheepweed	Exotic			0.1	1	
Brassicaceae	<i>Capsella bursa-pastoris</i> *	Shepherd's Purse	Exotic	0.4	0.5	5	4	3
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic	0.4	0.2	0.1	0.1	2
Brassicaceae	<i>Lepidium bonariense</i> *		Exotic			0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Brassicaceae	<i>Rapistrum rugosum</i> *	Turnip Weed	Exotic	0.1	2			
Brassicaceae	<i>Sisymbrium orientale</i> *	Indian Hedge Mustard	Exotic	2	1	4	5	4
Brassicaceae	<i>Sisymbrium officinale</i> *	Hedge Mustard	Exotic			1	2	2
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic		0.2			
Caryophyllaceae	<i>Petrorhagia nanteuilii</i> *	Childling Pink	Exotic	0.1				
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic	5				
Fabaceae (Faboideae)	<i>Medicago polymorpha</i> *	Burr Medic	Exotic	0.4	0.5	3	25	30
Fabaceae (Faboideae)	<i>Trifolium arvense</i> *	Haresfoot Clover	Exotic		0.2	0.1	0.5	
Fabaceae (Faboideae)	<i>Trifolium repens</i> *	White Clover	Exotic		0.2	4	4	
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic			3	0.1	4
Geraniaceae	<i>Geranium molle</i> *	Cranesbill Geranium	Exotic	0.1				
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic	0.2	0.2	1	4	
Malvaceae	<i>Malva parviflora</i> *	Small-flowered Mallow	Exotic	0.1		30	0.5	10
Malvaceae	<i>Sida spinosa</i> *		Exotic	0.2	2	0.1	0.2	0.1
Oxalidaceae	<i>Oxalis pes-caprae</i> *		Exotic			0.1		
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1				
Poaceae	<i>Bromus molliformis</i> *	Soft Brome	Exotic	0.1				
Poaceae	<i>Hordeum vulgare</i> *	Barley	Exotic			4	15	6
Poaceae	<i>Lolium perenne</i> *	Perennial Ryegrass	Exotic	1			25	5
Poaceae	<i>Vulpia bromoides</i> *	Silver Grass	Exotic	0.1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Polygonaceae	<i>Polygonum aviculare</i> *	Wireweed	Exotic			0.2	0.1	1
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet/Blue Pimpernel	Exotic	0.2	0.1			
Verbenaceae	<i>Verbena officinalis</i> *	Common Verbena	Exotic	0.1	0.1			
Total exotic species richness				25	20	24	23	14
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native		0.1			
Araliaceae	<i>Hydrocotyle sibthorpioides</i>		Native	0.5	0.1		0.1	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native		0.1			
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native		0.2			
Asteraceae	<i>Cotula australis</i>	Common Cotula	Native			0.2	0.1	0.1
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Native	0.4				
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	Native	2	0.2			
Asteraceae	<i>Solenogyne bellioides</i>		Native		0.1			
Asteraceae	<i>Vittadinia cervicularis var. subcervicularis</i>		Native		0.3			
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native		0.1			
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell	Native		0.1			
Chenopodiaceae	<i>Einadia nutans</i>		Native	0.1	0.1	0.2	0.1	0.1
Chenopodiaceae	<i>Dysphania pumilio</i>	Small Crumbweed	Native		10	0.1	0.1	0.1
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native	0.1				
Chenopodiaceae	<i>Microlaena stipoides</i>	Weeping Grass	Native	50				
Commelinaceae	<i>Commelina cyanea</i>		Native	0.1	0.2			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Native	1				
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native	3	0.2	4	4	3
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	1	5	0.5	0.2	
Euphorbiaceae	<i>Euphorbia drummondii</i>	Caustic Weed	Native		0.1			
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native	0.2	0.3			
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native		0.1			
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native	0.2	1			
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native	0.4	0.1			
Fabaceae (Mimosoideae)	<i>Acacia implexa</i>	Hickory Wattle	Native	1				
Fabaceae (Mimosoideae)	<i>Acacia salicina</i>	Cooba	Native	2	1			
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native	0.1	0.1		0.1	
Hypericaceae	<i>Hypericum gramineum</i>	Small St. John's Wort	Native		0.1			
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	Native	0.1	0.1		3	
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native		0.2			
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native			0.1		
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	Native	35				
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native		3			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native		0.1		0.1	0.1
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native	2				
Oxalidaceae	<i>Oxalis perennans</i>		Native	1			0.1	0.1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Plantaginaceae	<i>Plantago debilis</i>		Native	0.5				
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	3	8	1	6	4
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native		5			
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Native		1	4	8	2
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native		1			
Poaceae	<i>Cynodon dactylon</i>	Couch	Native			6	1	10
Poaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native		0.1		0.1	2
Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	Native		0.5			
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native		0.5			
Poaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native			2		
Poaceae	<i>Panicum effusum</i>	Hairy Panic	Native		0.1		0.1	0.5
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native		0.5			
Poaceae	<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass	Native	2				
Poaceae	<i>Rytidosperma racemosum var. obtusatum</i>		Native	4				
Poaceae	<i>Rytidosperma racemosum var. racemosum</i>		Native		2			
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Native					1
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native	0.4	0.2	0.2	1	0.1
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native		0.3			
Rosaceae	<i>Acaena novae-zelandiae</i>	Bidgee-widgee	Native	0.2				
Rubiaceae	<i>Galium leptogonium</i>		Exotic	0.1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				S1	S2	S3	S4	S5
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolia</i>	Sticky Hop-bush	Native	10				
Solanaceae	<i>Solanum cinereum</i>	Narrawa Burr	Native	0.4				
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	0.4	0.2			
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Native				5	
Zygophyllaceae	<i>Tribulus sp.</i>	Caltrop	Native		0.1	0.1	0.1	0.1
Native plant species richness in ground layer				23	36	11	18	14
Native ground cover percentage				70.7	38.1	16.4	29.2	23.2
Total native species richness				31	43	12	18	17
Total species richness				56	63	36	41	31

Table C.3 Plant species recorded within the Braefield BOA during the 2018 monitoring session

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery	Exotic					0.1	
Apocynaceae	<i>Gomphocarpus fruticosus</i> *	Narrow-leaved Cotton Bush	Exotic					0.2	1
Asteraceae	<i>Bidens subalternans</i> *	Greater Beggar's Ticks	Exotic					0.1	
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic	2			5		1
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic						0.5
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic				0.1		0.1
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.2	0.1				0.1
Asteraceae	<i>Onopordum acanthium</i> *	Scotch Thistle	Exotic				0.2		0.1
Asteraceae	<i>Senecio sp.</i> *		Exotic				0.1		
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic	0.1				0.1	
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	Exotic						0.1
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic		0.1	0.1			
Caryophyllaceae	<i>Petrorhagia nanteuilii</i> *	Childling Pink	Exotic				0.2		0.2
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic		0.2			4	
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	0.5			1	0.2	0.2
Fabaceae (Faboideae)	<i>Trifolium arvense</i> *	Haresfoot Clover	Exotic	0.1					0.1
Fabaceae (Faboideae)	<i>Trifolium campestre</i> *	Hop Clover	Exotic					0.1	
Fabaceae (Faboideae)	<i>Trifolium repens</i> *	White Clover	Exotic						0.1
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic	0.2			0.2		0.2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Geraniaceae	<i>Geranium molle</i> *	Cranesbill Geranium	Exotic					0.1	
Iridaceae	<i>Sisyrinchium rosulatum</i> *	Scourweed	Exotic	0			0.1		
Lamiaceae	<i>Marrubium vulgare</i> *	Whire Horehound	Exotic	0.1			0.1		
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic					0.2	
Malvaceae	<i>Sida spinosa</i> *		Exotic				0.1	0.1	0.1
Oxalidaceae	<i>Oxalis pes-caprae</i> *		Exotic					0.1	
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1					0.1
Plantaginaceae	<i>Misopates orontium</i> *	Lesser Snapdragon	Exotic	1					
Poaceae	<i>Vulpia myuros</i> *	Rats Tail Fescue	Exotic	0.2					
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet/Blue Pimpernel	Exotic					0.1	
Rubiaceae	<i>Galium sp.</i> *		Exotic			0.1		0.2	
Total exotic species richness				11	3	2	10	13	14
Acanthaceae	<i>Rostellularia adscendens</i>		Native	0.4					
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native	0.2				0.1	0
Anthericaceae	<i>Arthropodium milliflorum</i>	Pale Vanilla-lily	Native		0.2	0.1		0.1	
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Native	0.1				0.1	
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.1			0.1	0.1	0.1
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Native			0.1		0.2	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1					0.1
Asteraceae	<i>Cassinia leavis</i>	Cough Bush	Native	1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Asteraceae	<i>Cotula australis</i>	Common Cotula	Native					0.1	
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Native	0.1	0.1	0.1	0.2		0.1
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native	0.1		0.1	0.1		0.1
Asteraceae	<i>Olearia elliptica</i>	Sticky Daisy Bush	Native		80	45		2	
Asteraceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	3	1	0.3	0.1	5	0.2
Asteraceae	<i>Sigesbeckia australiensis</i>		Native						0.1
Asteraceae	<i>Solenogyne bellioides</i>		Native	0.1		0.1			0.1
Asteraceae	<i>Veronica calycina</i>	Hairy Speedwell	Native		0.1			0.1	
Asteraceae	<i>Vittadinia muelleri</i>		Native		0.1	0.1	4		1
Asteraceae	<i>Vittadinia sp.</i>		Native			0.1	0.1		0.1
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native				0.2	0.3	
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Native	0.1	0.2				0.1
Chenopodiaceae	<i>Einadia nutans</i>		Native	0.1	0.1		0.1	0.2	0.1
Chenopodiaceae	<i>Einadia polygonoides</i>		Native				0.1		
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native				0.1		
Commelinaceae	<i>Commelina cyanea</i>		Native					0.1	
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native			0.1			
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.3	0.2	0.1	0.2	1	0.2
Crassulaceae	<i>Crassula colorata</i>		Native				0.1		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	0.5	3	10			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native		3			0	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	2	5	0.2	0.1	5	0.1
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Native	0.1			0.1		0.2
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native	0.1	2	0.5			0.1
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.4	0.1	0.1	0.2	0.1	0.3
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining Glycine	Native			0.1			
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native	0.5	0.2	0.2	0.1	0.1	
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native	0.2	0.1	0.3			
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native						8
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native	0.2	0.1	0.1	0.1	0.3	0.1
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Native	0.1			0.1		
Lamiaceae	<i>Teucrium junceum</i>		Native					0.1	
Linaceae	<i>Linum marginale</i>	Native Flax	Native						0.1
Lomandraceae	<i>Lomandra filiformis subsp. filliformis</i>	Wattle Matt-rush	Native	0.1	1	0.1			
Loranthaceae	<i>Amyema miquelii</i>		Native	1					
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native		0.1	0.5			
Malvaceae	<i>Malva parviflora</i>	Small-flowered Mallow	Native				0.1		
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.3	0.1	0.1	0.3		0.1
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	Native					10	
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native	12	35	35			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum	Native					6	
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea-tree	Native					30	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native				0.1		0.1
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native	0.5	5	4		10	
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1	0.1		0.1		0.1
Plantaginaceae	<i>Plantago debilis</i>		Native			0.1		0.1	
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow plantain	Native					0.1	
Poaceae	<i>Anthosachne scabra</i>	Wheatgrass	Native		3				
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	5	3	5	0.1	0.2	4
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	9	4	4	1	0.2	3
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Native		1				
Poaceae	<i>Bothriochloa macra</i>	Red-leg Grass	Native	1			1		0.1
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	2			8		4
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native	1				2	
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	2	2	0.1			
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native	7	2		3		5
Poaceae	<i>Digitaria brownii</i>	Cotton panic Grass	Native	1					
Poaceae	<i>Digitaria diffusa</i>	Open Summer-grass	Native		0.1				
Poaceae	<i>Ennaepogon gracilis</i>	Slender Bottle-washers	Native	1			1		
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native	2			1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	Native					20	
Poaceae	<i>Panicum effuseum</i>	Hairy Panic	Native	1			8		
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native		1				
Poaceae	<i>Paspalidium sp.</i>		Native				1		
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Native		5	4			
Poaceae	<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass	Native	1	1				
Poaceae	<i>Rytidosperma racemosum var. obtusatum</i>	Native		1	3	2	1		
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Native	1	1		0.2		
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native			0.1	0.5		
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native	0.2			0.2	0.2	0.2
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native			0.1			
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	1	0.1	0.2	0.1		
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard	Native					1	
Ranunculaceae	<i>Clematis microphylla</i>	Small-leaved Clematis	Native			0.1			
Ranunculaceae	<i>Ranunculus pumilio var. pumilio</i>		Native					0.1	
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native					2	
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolium</i>	Sticky Hop-bush	Native		3	5	0.1		2
Thymelaeaceae	<i>Teucrium betchei</i>		Native	0.2	0.8	0.2		0.3	
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle	Native					0.2	
Native plant species richness in ground layer				39	32	30	36	28	28
Native ground cover percentage				43	39.8	19	32.8	32.4	19.8

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				B1	B2	B3	B4	B5	B6
Total native species richness				45	38	37	37	35	31
Total species richness				56	41	39	47	48	45

C2 CENTRAL OFFSET AREA

Table C.4 Plant species recorded within the Mallee BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic	2	0.1			
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic	0.1				
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic	2				
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.1		0.1		0.1
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic				0.1	0.1
Brassicaceae	<i>Lepidium sp.</i> *		Exotic					0.1
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic					0.2
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	2	1			
Fabaceae (Faboideae)	<i>Trifolium arvensis</i> *	Haresfoot Clover	Exotic	0.1				
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic	0.1				
Malvaceae	<i>Sida spinosa</i> *		Exotic	0.1				
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Polygonaceae	<i>Polygonum aviculare*</i>	Wireweed	Exotic	0.1				
Primulaceae	<i>Anagallis arvensis*</i>	Scarlet/Blue Pimpernel	Exotic	0.1				
Rubiaceae	<i>Galium leptogonium*</i>		Exotic					0.1
Zygophyllaceae	<i>Tribulus terrestris*</i>	Caltrop	Exotic	0.1				
Total exotic species richness				12	2	1	1	5
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native	0.1	0.1			0
Anthericaceae	<i>Arthropodium milliflorum</i>	Pale Vanilla-lily	Native					1
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Native				0.1	
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.1				0.1
Apocynaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Native			0.1	0.1	
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	Native			0.1		0.2
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1	0.2			
Asteraceae	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	Native				1	
Asteraceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge	Native			5		
Asteraceae	<i>Sigesbeckia australiensis</i>		Native			0.1		0.1
Asteraceae	<i>Solenogyne bellioides</i>		Native				0.1	
Asteraceae	<i>Vittadinia muelleri</i>		Native	1	1			
Asteraceae	<i>Vittadinia sp.</i>		Native	0.1				0.1
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Native				0.1	0.2
Caryophyllaceae	<i>Gypsophila tubulosa</i>	Annual Chalkwort	Native			0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native					0.1
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	0.2			0.1
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Native					0.1
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native		2			
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native	0.1				
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native	0.1				
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.1	0.1		0.1	2
Crassulaceae	<i>Crassula colorata</i>		Native			0.1		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native		0.1	10	20	5
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native	0.5				
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	0.1	0.3		0.1	0.4
Cyperaceae	<i>Schoenus kennyi</i>		Native			0.1		
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood	Native			6	40	1
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Native	0.1	0.1			
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides subsp. zygophylla</i>		Native		0.4			
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native				0.1	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native					0.2
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native		0			
Fabaceae (Mimosoideae)	<i>Acacia triptera</i>	Spurwing Wattle	Native			4		
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native	0.1	0.1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native					0.1
Juncaceae	<i>Juncus usitatus</i>		Native	0.1				
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	Native					0.1
Lamiaceae	<i>Scutellaria humilis</i>	Dwarf Skullcap	Native				0.3	
Lamiaceae	<i>Teucrium betchei</i>		Native		0.2			0.1
Linaceae	<i>Linum marginale</i>	Native Flax	Native			0.1		
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>		Native				0.1	
Lomandraceae	<i>Lomandra filiformis subsp. filliformis</i>	Wattle Matt-rush	Native		0.1			
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native		0.1		0.1	
Loranthaceae	<i>Amyema miquelii</i>		Native					1
Malvaceae	<i>Abutilon oxycarpum</i>	Lantern Bush	Native		0.3			
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native					0.1
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.1	0.1			
Myrtaceae	<i>Calytrix tetragona</i>	Common Fringe-myrtle	Native			5		
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native		8			
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakelys Red Gum	Native					5
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Native			1	6	6
Myrtaceae	<i>Eucalyptus dealbata</i>	Tumbledown Red Gum	Native			10	8	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	Native				2	
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea-tree	Native					40

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0.1	0.1			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native			1	0.4	15
Oxalidaceae	<i>Oxalis chnoodes</i>		Native			0.1		
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1	0.1		0.1	0.1
Phormiaceae	<i>Dianella revoluta</i>	Blue Flax-lily	Native			3		
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native		0.1			
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native					0.1
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	8	6	4		6
Poaceae	<i>Aristida sp.</i>		Native				0.1	1
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	2	15	5	4	4
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Native					8
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Native	4	2			
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	3	1	0.5		
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native	0.1	1			
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	2	3	3	3	4
Poaceae	<i>Cynodon dactylon</i>	Common Couch	Native		4			
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native	0.1				
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native				4	
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native	0.1				0.1
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native	0.1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Poaceae	<i>Eragrostis sp.</i>		Native					0.5
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native		1	1	0.5	
Poaceae	<i>Leptochloa asthenes</i>		Native					4
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	Native					10
Poaceae	<i>Panicum effuseum</i>	Hairy Panic	Native	1				
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native			0.5	0.2	
Poaceae	<i>Paspalidium distans</i>		Native					1
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native		2	1	1	1
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Native				2	
Poaceae	<i>Rytidosperma fulvum</i>	Wallaby Grass	Native			2	5	0.2
Poaceae	<i>Rytidosperma racemosum</i>		Native				4	
Poaceae	<i>Rytidosperma pallidum</i>	Silvertop Wallaby Grass	Native			2		
Poaceae	<i>Sporobolus creber</i>	Slender Rats Tail Grass	Native	3				
Poaceae	<i>Sporobolus sp.</i>		Native				0.4	
Poaceae	<i>Tragus australianus</i>	Small Burrgrass	Native			0.1		
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native			0.1	0.1	
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native	0.1				
Portulacaceae	<i>Calandrinia eremaea</i>		Native			0.1		
Portulacaceae	<i>Portulaca bicolor var. purpurea</i>		Native			0.1		
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Native		0.1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %				
				MA1	MA2	MA3	MA4	MA5
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native	0.1	0.1	0.5	0.3	0.4
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.1	0.1	0.1	0.1	0.1
Rubiaceae	<i>Galium gaudichaudii subsp. gaudichaudii</i>	Rough Bedstraw	Native			0.1	0.1	
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native					1
Sapindaceae	<i>Dodonaea viscosa subsp a</i>	Sticky Hop-bush	Native		2		8	6
Solanaceae	<i>Solanum parvifolium</i>		Native		0.1			1
Thymelaeaceae	<i>Pimelea curviflora</i>		Native			0.5		
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native		0.4	0.1	1	3
Native plant species richness in ground layer				31	34	28	28	35
Native ground cover percentage				26.7	42.1	29.5	28.1	46.6
Total native species richness				31	37	35	35	45
Total species richness				43	39	36	36	50

Table C.5 Plant species recorded within the Myall Plains BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic	0.2	0.3				
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic		0.1				
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic		0.1				
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic						0.1
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic						0.1
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic		0.1				
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic	0.1		0.1	0.1	0.1	0.1
Fabaceae (Faboideae)	<i>Medicago polymorpha</i> *	Burr Medic	Exotic	0.1	1				
Lamiaceae	<i>Linaria arvensis</i> *		Exotic		0.1				
Malvaceae	<i>Malva parviflora</i> *	Small-flowered Mallow	Exotic		0.1				
Malvaceae	<i>Sida spinosa</i> *		Exotic	0.1			0.1		
Plantaginaceae	<i>Misopates orontium</i> *	Lesser Snapdragon	Exotic		2				
Poaceae	<i>Vulpia myuros</i> *	Rats Tail Fescue	Exotic		0.1				
Polygonaceae	<i>Acetosella vulgaris</i> *	Sorrel	Exotic		0.1				
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet Pimpernel	Exotic						0.1
Total exotic species richness				4	10	1	2	1	4
Anthericaceae	<i>Arthropodium milliflorum</i>	Pale Vanilla-lily	Native				0.2	0.1	0.1
Anthericaceae	<i>Arthropodium sp.</i>		Native	0.1					
Anthericaceae	<i>Rostellularia adscendens</i>		Native				0.2		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native					0.1	
Apocynaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Native			0.1	0.1	0.1	
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	Native	0.2		0.1	0.1		
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1	0.1				
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native	1	2				0.1
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native	0.1					
Asteraceae	<i>Olearia elliptica</i>	Sticky Daisy-bush	Native				0.2	5	1
Asteraceae	<i>Sigesbeckia australiensis</i>		Native						0.1
Asteraceae	<i>Solenogyne bellioides</i>		Native	0.1					
Asteraceae	<i>Vittadinia dissecta var. hirta</i>	Dissected New Holland Daisy	Native		0.1				
Asteraceae	<i>Vittadinia muelleri</i>		Native	0.1	0.1				
Asteraceae	<i>Vittadinia pustulata</i>		Native		0.1				
Asteraceae	<i>Vittadinia sp.</i>		Native				0.1	0.1	0.1
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Native		0.1				
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native		0.1				
Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Native			0.1	0.1	0.1	0.1
Celastraceae	<i>Denhamia cunninghamii</i>		Native				2	0.4	
Chenopiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native			0.1		0.2	0.5
Chenopiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	0.1		0.1		0.1
Chenopiaceae	<i>Einadia polygonoides</i>		Native				0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Chenopiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Native	0.1			0.2		
Chenopiaceae	<i>Euphorbia drummondii</i>	Caustic Weed	Native		0.1				
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0	0.1	0.1	0.1	0.1	0.1
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	5		20	7	10	16
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	0.1	0.1	0.1	2	0.1	0.1
Cyperaceae	<i>Schoenus kennyi</i>		Native			0.1			
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood	Native			6	15	10	1
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush	Native					2	
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides subsp. zygophylla</i>		Native				0.4		
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native			0.1			0.1
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.1					
Fabaceae (Faboideae)	<i>Glycine canescens</i>	Silky Glycine	Native				0.1		
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	Small-leaf Glycine	Native				0.1		
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native				0.1	0.1	0.1
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native		0.1		0.2	0.1	0.1
Fabaceae (Mimosoideae)	<i>Acacia deanei subsp. deanei</i>	Green Wattle	Native	8					
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native			0.2	1	2	
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native		0.2				
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native		0.1			0.1	0.1
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Native	0.3		0.2	0.3	0.1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Lamiaceae	<i>Scutellaria humilis</i>	Dwarf Skullcap	Native					0.3	0.3
Linaceae	<i>Linum marginale</i>	Native Flax	Native		0.1	0.1			
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>		Native	0.1				0.1	
Lomandraceae	<i>Lomandra filiformis subsp. filliformis</i>	Wattle Matt-rush	Native			0.1		0.4	
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native	0.1		0.4	0.1	0.1	0.1
Loranthaceae	<i>Amyema miquelii</i>		Native	3				2	
Malvaceae	<i>Abutilon oxycarpum</i>	Lantern Bush	Native				0.1		
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native						0.1
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.1			0.1		
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native			8	30	14	4
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Native	10	1	4			15
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	Native			5			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native				0.5		
Oxalidaceae	<i>Oxalis perennans</i>		Native		0.2		0.1	0.1	0.1
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	0.1					0.1
Pittosporaceae	<i>Pittosporum angustifolium</i>	Weeping Pittosporum	Native				1		
Plantaginaceae	<i>Plantago debilis</i>		Native						0.1
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native				0.1	0.2	1
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	8	10	8	8	4	2
Poaceae	<i>Aristida personata</i>	Purple Wire-grass	Native				3	5	10

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	5	4	4	10	3	5
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	Native				1		
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Native	1	4		1	0.1	1
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	1	1		1		
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native	1					2
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	2	3	1	5	5	2
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native		3				
Poaceae	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	Native					0.1	
Poaceae	<i>Digitaria sp.</i>		Native					0.1	
Poaceae	<i>Digitaria breviglumis</i>		Native			1			1
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native	1	1	1	3	1	
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native			0.3	1		
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native	1					
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native	2			2		0.5
Poaceae	<i>Panicum decompositum</i>	Native Millet	Native					0.1	
Poaceae	<i>Panicum effusum</i>	Hairy Panic	Native		1		1		
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native						3
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native				1	1	
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Native					3	2
Poaceae	<i>Rytidosperma racemosum var. obtus</i>		Native				1	1	1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				MY1	MY2	MY3	MY4	MY5	MY6
Poaceae	<i>Rytidosperma sp.</i>		Native			0.5		2	5
Poaceae	<i>Sporobolus sp.</i>		Native	1		0.2	0.2		2
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native		0.1				
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native	0.2		0.2	0.1	0.3	0.3
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.1	0.5		0.1	0.1	0.1
Ranunculaceae	<i>Clematis microphylla</i>	Small-leaved Clematis	Native				0.1		
Rubiaceae	<i>Galium gaudichaudii subsp. gaudichaudii</i>	Rough Bedstraw	Native						0.1
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native				1	5	
Sapindaceae	<i>Dodonaea viscosa subsp. angustifoli</i>	Sticky Hop-bush	Native	3		2	15	10	20
Solanaceae	<i>Solanum parvifolium</i>		Native					0.1	
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Native	0.1		0.1		0.1	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	1		1	2	0.3	2
Zygophyllaceae	<i>Tribulus micrococcus</i>	Yellow Vine	Native		0.2				
Native plant species richness in ground layer				30	27	23	38	35	36
Native ground cover percentage				26.2	31.5	18.9	43.1	28.5	40.5
Total native species richness				36	28	30	50	46	43
Total species richness				40	38	31	52	47	47

Table C.6 Plant species recorded within the Wirralah BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				WI1	WI2	WI3	WI4	WI5	WI6	WI7
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed	Exotic							0.1
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic	0.1	1				4	6
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic		2				0.2	
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	Exotic						0.1	
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic		0.3				1	8
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.2	0.2					0.1
Asteraceae	<i>Schkuhria pinnata</i> var. <i>abrotanoides</i> *		Exotic							6
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic	0.1	0.1				0.1	
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic	0.1	0.1	0.1	0.1		0.1	
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic	0.2				0.1		0.1
Fabaceae (Faboideae)	<i>Medicago laciniata</i> *	Cut-leaved Medic	Exotic		0.1					
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	0.1	5		0.1		1	2
Fabaceae (Faboideae)	<i>Trifolium arvense</i> *	Haresfoot Clover	Exotic		0.1					
Malvaceae	<i>Sida spinosa</i> *		Exotic						0.2	
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1						
Plantaginaceae	<i>Misopates orontium</i> *	Lesser Snapdragon	Exotic					0.1		0.2
Poaceae	<i>Lolium perenne</i> *	Perennial Ryegrass	Exotic		1				1	5
Poaceae	<i>Vulpia myuros</i> *	Rats Tail Fescue	Exotic		0.1					
Polygonaceae	<i>Fallopia convolvulus</i> *	Black Bindweed	Exotic						0.1	0.2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				W11	W12	W13	W14	W15	W16	W17
Total exotic species richness				7	11	1	2	2	10	10
Acanthaceae	<i>Rostellularia adscendens</i>		Native	0.3				0.1		
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native		0.1					0.1
Amaranthaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Native			0.1				
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.1			0.1			
Apocynaceae	<i>Alstonia constricta</i>	Quinine Bush	Native					2		
Apocynaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Native			0.1	0.2	0.2		
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	Native				0.2	0.2		
Apocynaceae	<i>Tylophora linearis</i>		Native	0.1						
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1		0.1	0.3			
Asteraceae	<i>Cassinia leavis</i>	Cough Bush	Native				1	35		
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native	0.2		0.2	0.2	0.3		
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native	0.1			0.1	0.2		
Asteraceae	<i>Solenogyne bellioides</i>		Native			0.1		0.1		
Asteraceae	<i>Vittadinia cervicularis var. subcervicularis</i>		Native	0.2						
Asteraceae	<i>Vittadinia muelleri</i>		Native		2	0.1	1		0.1	1
Asteraceae	<i>Vittadinia pustulata</i>		Native							0.1
Asteraceae	<i>Vittadinia sp.</i>		Native		0.1	0.1		0		
Brassicaceae	<i>Lepidium fasciculatum</i>		Native		0.1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				W11	W12	W13	W14	W15	W16	W17
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native	0.1	0.1	0.1			0.2	
Campanulaceae	<i>Wahlenbergia stricta</i>	Tall Bluebell	Native			0.1				
Capparaceae	<i>Capparis mitchellii</i>	Wild Orange	Native	0.2						
Caryophyllaceae	<i>Gypsophila tubulosa</i>	Annual Chalkwort	Native				0.1			
Celastraceae	<i>Denhamia cunninghamii</i>		Native					0.5		
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native				0.2			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	0.2	0.1	0.1	0.1		0.2
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native		3	1	0.1		0	1
Chenopodiaceae	<i>Salsola australis</i>		Native		0.2					
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native	0.2	1	1	1	0.1	0.1	1
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.2		0.1	0.2	0.1	0.1	
Crassulaceae	<i>Crassula colorata</i>		Native				0.1			
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	7		40	35			
Cyperaceae	<i>Cyperus betchei subsp. betchei</i>		Native				0.1			
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	2		0.1	0.5	0.1	0.1	
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush	Native					1		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Native				0.1	0.1		
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native	0.2		0.1	0.3	0.2		
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.1				0.1	0.1	
Fabaceae (Faboideae)	<i>Glycine canescens</i>	Silky Glycine	Native	0.1						

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %							
				W11	W12	W13	W14	W15	W16	W17	
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Silver Wattle	Native								0.3
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native								0.3
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Silver Wattle	Native								
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native				0.1				
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Native	0.5							
Lamiaceae	<i>Teucrium betchei</i>		Native	1		2	0.2	0.5			
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native	0.5							
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>		Native	0.2							
Malvaceae	<i>Abutilon oxycarpum</i>	Lantern Bush	Native				0.1				
Malvaceae	<i>Hibiscus sturtii var. sturtii</i>	Hill Hibiscus	Native			1					
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native			0.1	0.1	0.1			
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Native	0.1			0.1				
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native						0.5	5	
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Native	35			11	20	0.2	0.1	
Myrtaceae	<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	Native				1				
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0.1		0.1	0.1	0.1			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native			1	3	8			
Oxalidaceae	<i>Oxalis chnoodes</i>		Native	0.1							
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1	0.1		0.1				0.1
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	0.1		0.1	0.1		0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				W11	W12	W13	W14	W15	W16	W17
Plantaginaceae	<i>Plantago debilis</i>		Native	0.1						
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow Platain	Native		0.1					
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native				1			
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	5		15		6	10	3
Poaceae	<i>Aristida personata</i>	Purple Wire-grass	Native				8	1		
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	6	8	8		4	4	
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo grass	Native			1				
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Native	1	4			0.1	15	5
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native		8					8
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native					1		
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	7		2	5	10	2	1
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native		8				4	8
Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	Native	0.1						
Poaceae	<i>Digitaria breviglumis</i>		Native	0.5			4	1		
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass	Native		0.2				1	1
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native	1				1	1	
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native				1		1	
Poaceae	<i>Eragrostis sp.</i>		Native	2						0.1
Poaceae	<i>Eragrostis sp.</i>		Native							2
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native			1		1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				WI1	WI2	WI3	WI4	WI5	WI6	WI7
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native		1	0.4			1	
Poaceae	<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass	Native		3					5
Poaceae	<i>Panicum queenslandicum</i> var. <i>queenslandicum</i>	Coolibah Grass	Native			1				
Poaceae	<i>Panicum effusum</i>	Hairy Panic	Native				0.2		0.3	
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native			3		4		
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native	4						
Poaceae	<i>Rytidosperma racemosum</i> var. <i>obtusatum</i>	Native		1						
Poaceae	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Native						1		
Poaceae	<i>Rytidosperma</i> sp.	Native			1					
Poaceae	<i>Sporobolus</i> sp.	Native		8		2	3	5		
Poaceae	<i>Sporobolus caroli</i>	Fairy Grass	Native		0.5					
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Native		1					
Poaceae	<i>Tragus australianus</i>	Small Burrgrass	Native		0.1					0.1
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native				1			
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native			0.1				
Portulacaceae	<i>Calandrinia eremaea</i>		Native				0.1			
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Native		0.2					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %						
				W11	W12	W13	W14	W15	W16	W17
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native	0.1		0.1	0.1	0.1		
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.1	0.1	0.1	0.1	0.1	0.2	
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	Native				3			
Rubiaceae	<i>Psyrdrax odorata</i>	Shiny-leaved Canthium	Native				1			
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native	0.1		0.5	7	5		
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolia</i>	Sticky Hop-bush	Native					0.5		
Solanaceae	<i>Solanum parvifloia</i>		Native				1	0.1		
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	Native					1	0.1	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	0.5		1		0.1		
Zygophyllaceae	<i>Tribulus sp.</i>	Caltrop	Unknown							0.1
Native plant species richness in ground layer				38	24	33	36	33	18	18
Native ground cover percentage				42.6	42.1	41.4	29.2	39	40.3	36.8
Total native species richness				43	24	36	47	42	24	22
Total species richness				50	35	37	49	44	34	32

Table C.7 Plant species recorded within the Goonbri BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	Foliage cover %	
				G1	G2
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed	Exotic		5
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic		1
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic		0.2
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic		8
Asteraceae	<i>Schkuhria pinnata</i> var. <i>abrotanoides</i> *		Exotic		0.2
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic	0.1	
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	0.1	
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic		0.1
Malvaceae	<i>Malvastrum americanum</i> *	Spiked Malvestrum	Exotic		0.1
Malvaceae	<i>Sida spinosa</i> *		Exotic		0.1
Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidate</i> *	African Olive	Exotic	0.1	
Plantaginaceae	<i>Misopates orontium</i> *	Lesser Snapdragon	Exotic		0.1
Poaceae	<i>Vulpia myuros</i> *	Rats Tail Fescue	Exotic		0.2
Total exotic species richness				3	10
Acanthaceae	<i>Rostellularia adscendens</i>		Native	0.1	
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native		0.2
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1	
Asteraceae	<i>Calotis scabiosifolia</i> var. <i>scabiosifolia</i>	Rough Burr-daisy	Native		0.1
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native		0.2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	Foliage cover %	
				G1	G2
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native		0.1
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Native		0.1
Asteraceae	<i>Vittadinia muelleri</i>		Native	0.1	3
Asteraceae	<i>Vittadinia pustulata</i>		Native	0.1	
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native		0.1
Celastraceae	<i>Denhamia cunninghamii</i>		Native	0.1	
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native		0.1
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native	0.4	4
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native	0.1	3
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native		0.2
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Native	0.2	
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	3	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	0.3	2
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Native		0.2
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.1	
Fabaceae (Faboideae)	<i>Glycine microphylla</i>		Native	0.1	
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native	0.4	
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	Native	0.3	
Goodeniaceae	<i>Goodenia sp.</i>		Native	0.1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	Foliage cover %	
				G1	G2
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native	0.1	
Lomandraceae	<i>Lomandra filiformis subsp. coriacea</i>		Native	0.1	
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.1	0.1
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Native	0.1	
Myrtaceae	<i>Eucalyptus melliodora</i>	Yellow Box	Native	20	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0	
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native	0.1	
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1	
Phormiaceae	<i>Dianella longifolia</i>	Blueberry Lily	Native	0.1	
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	0.1	0.2
Poaceae	<i>Anthosachne scabra</i>	Wheatgrass	Native		0.1
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native	2	
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	5	5
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	10	
Poaceae	<i>Bothriochloa macra</i>	Red-leg Grass	Native		5
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	5	6
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	10	
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native		2
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native	5	
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native	1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	Foliage cover %	
				G1	G2
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native		5
Poaceae	<i>Panicum effusum</i>	Hairy Panic	Native	1	3
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native	5	
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Native		1
Poaceae	<i>Tragus australianus</i>	Small Burrgrass	Native		0.2
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native		0.1
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native	4	
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Native	0.1	
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	1	
Native plant species richness in ground layer				30	23
Native ground cover percentage				46.5	34
Total native species richness				38	25
Total species richness				41	35

C3 NAMOI OFFSET AREA

Table C.8 Plant species recorded within the Namoi BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %																		
				NA1A	NA2A	NA3	NA4	NA5	NA6	NA7A	NA8A	NA9	NA10	NA11	NA12	NA13	NA14	NA15A	NA16	NA17		
Aizoaceae	<i>Trianthema triquetra</i> *	Red Spinach	Exotic		0.1							0.1										
Alliaceae	<i>Nothoscordum borbonicum</i> *	Onion Weed	Exotic			3																
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery	Exotic		0.1			0.1										0.1	0.2			
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed	Exotic											0.1								
Asteraceae	<i>Bidens subalternans</i> *	Greater Beggar's Ticks	Exotic			0.2									0.2							
Asteraceae	<i>Carduus tenuiflorus</i> *	Winged Slender Thistle	Exotic			0.2																
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic		0.1				0.2				4	1					6	0.1		
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic		0.1						0.1	0.1	0.1	1	0.1				0.4	1		
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic					0.1	0.1				1		0.2							
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	Exotic			0.1			0.1													
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic		0.3						0.1	0.5	2		0.3					4	0.5	
Asteraceae	<i>Hypochaeris glabra</i> *	Smooth Catsear	Exotic				0.1															
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic	0.1			0.4	0.1	0.1			0.2	0.1	0.1	0.1	0.1					0.2	
Asteraceae	<i>Lactuca serriola</i> *	Prickly Lettuce	Exotic			0.1			0.1										0.2	0.2	0.1	
Asteraceae	<i>Schkuhria pinnata</i> var. <i>abrotanoides</i> *		Exotic					0.1	0.1												0.3	1
Asteraceae	<i>Silybum marianum</i> *	Varigated Thistle	Exotic			3		0.1	0.1													
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic		0.1	0.2	0.1	0.1	0.4			0.1	0.2	0.1	0.1	0.2	0.2			1	0.1	0.8
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	Exotic		0.1																	
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	Exotic			0.1														0.2		
Boraginaceae	<i>Buglossoides arvensis</i> *	Sheepweed	Exotic										0.2								2	
Boraginaceae	<i>Echium plantagineum</i> *	Pattersons Curse	Exotic					0.2	1													
Brassicaceae	<i>Capsella bursa-pastoris</i> *	Shepherd's Purse	Exotic		0.1																	
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic		0.1			0.5	0.5			0.1		0.1	0.1						0.1	
Brassicaceae	<i>Lepidium didymum</i> *	Lesser Swinecress	Exotic		0.1								0.1								0.1	
Brassicaceae	<i>Rapistrum rugosum</i> *	Turnip Weed	Exotic		0.2	30		1	5											20	3	10
Brassicaceae	<i>Sisymbrium officinale</i> *	Hedge Mustard	Exotic		0.1								0.5	0.1								
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic					0.2			0.1	0.1	0.5			0.1	0.1	0.2				
Caryophyllaceae	<i>Polycarpon tetraphyllum</i> *	Four-leaved Allseed	Exotic	0.1			0.2							0.1								

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %																
				NA1A	NA2A	NA3	NA4	NA5	NA6	NA7A	NA8A	NA9	NA10	NA11	NA12	NA13	NA14	NA15A	NA16	NA17
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic											0.1	0.1					
Fabaceae (Faboideae)	<i>Medicago polymorpha</i> *	Burr Medic	Exotic		0.2	0.5		1	1	0.1					0.1		0.2		3	
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	0.1			0.1						0.5	0.1					1	
Fabaceae (Faboideae)	<i>Trifolium arvense</i> *	Haresfoot Clover	Exotic				0.1	0.5						0.1						
Fabaceae (Faboideae)	<i>Trifolium campestre</i> *	Hop Clover	Exotic											0.1						
Fabaceae (Faboideae)	<i>Vicia villosa subsp. eriocarpa</i> *	Russian Vetch	Exotic			2											1			
Fumariaceae	<i>Fumaria capreolata</i> *	Fumitory	Exotic			0.3														
Geraniaceae	<i>Erodium cicutarium</i> *	Common Storksbill	Exotic		0.1								0.5	0.1					0.5	
Iridaceae	<i>Romulea rosea var. australis</i> *	Onion Grass	Exotic															2		
Lamiaceae	<i>Marrubium vulgare</i> *	White Horehound	Exotic										1							
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic	0.1	0.1	1							0.2		0.1			1		
Malvaceae	<i>Malva parviflora</i> *	Small-flowered Mallow	Exotic			0.5		0.2											0.2	
Malvaceae	<i>Sida spinosa</i> *		Exotic		0.1			0.1	0.1											
Moraceae	<i>Morus nigra</i> *	White mulberry	Exotic			1														
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1			0.2						0.2	3		0.1				
Plantaginaceae	<i>Misopates orontium</i> *	Lesser Snapdragon	Exotic	0.1			0.1							4		0.1				
Poaceae	<i>Avena fatua</i> *	Wild Oats	Exotic			1		60	50										15	
Poaceae	<i>Bromus catharticus</i> *	Prairie Grass	Exotic			3														
Poaceae	<i>Bromus molliformis</i> *	Soft Brome	Exotic					0.2	0.5										3	
Poaceae	<i>Hordeum vulgare</i> *	Barley	Exotic					1	2					1					1	
Poaceae	<i>Lamarckia aurea</i> *	Goldentop Grass	Exotic				0.5													
Poaceae	<i>Lolium perenne</i> *	Perennial Ryegrass	Exotic		5	6		3	15					1				5	2	8
Poaceae	<i>Phalaris paradoxa</i> *	Paradoxa Grass	Exotic																4	
Poaceae	<i>Vulpia myuros</i> *	Rats Tail Fescue	Exotic	0.1				0.1	0.5		0.1		0.1	0.2					1	
Polygonaceae	<i>Polygonum aviculare</i> *	Wireweed	Exotic					0.3	0.2										2	
Primulaceae	<i>Anagallis arvensis</i> *	Scarlet/Blue Pimpernel	Exotic					0.1	0.1						0.2					
Rubiaceae	<i>Galium aparine</i> *	Goosegrass	Exotic			2														
Solanaceae	<i>Datura ferox</i> *	Fierce Thornapple	Exotic			0.1														
Solanaceae	<i>Lycium ferocissimum</i> *	African Boxthorn	Exotic	0.5						0.1	1					4			0.5	
Verbenaceae	<i>Phyla canescens</i> *	Fog-fruit	Exotic		0.3	1												15		
Total exotic species richness				8	18	21	9	21	20	24	9	11	15	12	10	6	1	11	20	12
Acanthaceae	<i>Brunonia australis</i>	Blue Pincushion	Native							0.1	0.3						0.2			

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				NA1A	NA2A	NA3	NA4	NA5	NA6	NA7A	NA8A	NA9	NA10	NA11	NA12	NA13	NA14	NA15A	NA16	NA17
Acanthaceae	<i>Rostellularia adscendens</i>		Native	0.1										0.3		0.1				
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	Native	0.2	0.1		0.1				0.1	0.3		0.1				0.1		
Amaranthaceae	<i>Atriplex semibaccata</i>	Creeping Saltbush	Native		0.1			0.2	1											
Anthericaceae	<i>Arthropodium minus</i>	Small Vanilla Lily	Native				0.1							0.1						
Anthericaceae	<i>Arthropodium milleflorum</i>	Pale Vannilla-lily	Native				0.1									0.2	0.2			
Anthericaceae	<i>Tricoryne elatior</i>	Yellow Autumn-lily	Native				0.1													
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.1	0.1	0.1	0.1					0.1	0.1	0.1	0.1	0.1	0.1		0.4	
Apocynaceae	<i>Alstonia constricta</i>	Quinine Tree	Native												3					
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	Native	0.3												0.1	0.2			
Asclepiadaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>	Native Pear	Native											0.2		3				
Asphodelaceae	<i>Bulbine sp.</i>		Native				0.1													
Asteraceae	<i>Aster sp.</i>		Native		0.1															
Asteraceae	<i>Brachyscome gracilis subsp. gracilis</i>		Native	0.1			0.1												0.2	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.1				0.1		0.1			2	0.5	4			0.4		
Asteraceae	<i>Calotis scabiosifolia var. scabiosifolia</i>	Rough Burr-daisy	Native				0.2				0.2		0.1						0.5	
Asteraceae	<i>Cassinia laevis</i>	Cough Bush	Native														0.1			
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow buttons	Native											0.1						
Asteraceae	<i>Cotula australis</i>	Common Cotula	Native		0.1															
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Native					0.2		0.1						0.1			0.3	
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native									0.1	0.1	0.1						
Asteraceae	<i>Leiocarpa tomentosa</i>	Woolly Plover-daisy	Native		0.1				0.1										2	
Asteraceae	<i>Olearia elliptica</i>	Sticky Daisy Bush	Native											3						
Asteraceae	<i>Sigesbeckia australiensis</i>		Native				3										0.1			
Asteraceae	<i>Solenogyne bellioides</i>		Native	0.1						0.1	0.1									
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Native				0.1				0.1			0.1						
Asteraceae	<i>Vittadinia muelleri</i>		Native							0.1	0.1	0.5	0.1						1	
Asteraceae	<i>Vittadinia pustulata</i>		Native										0.1							
Asteraceae	<i>Vittadinia sulcata</i>	Furrowed New Holland Daisy	Native													0.1				
Asteraceae	<i>Vittadinia cervicalis</i>		Native					0.1	0.1				0.1		0.1				0.1	0.4
Boraginaceae	<i>Ehretia membranifolia</i>	Peach Bush	Native						0.1											
Campanulaceae	<i>Lobelia concolor</i>	Poison Pratia	Native		0.1															
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native					0.1	0.5		0.1	2		0.5	0.1				0.1	

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Campanulaceae	<i>Wahlenbergia sp.</i>	Bluebell	Native				0.1			0.1			0.1			0.1				
Caryophyllaceae	<i>Gypsophila tubulosa</i>	Annual Chalkwort	Native				0.1						0.1							
Casuarinaceae	<i>Casuarina cristata</i>	Belah	Native					0.1								25			0.2	
Chenopodiaceae	<i>Dysphania pumilio</i>	Small Crumbweed	Native	0.1			0.1						0.1	0.1					0.1	
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	Native	0.1										0.1			0.3			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	0.2		0.1	0.4	0.2	0.2	0.1		0.1	0.1		0.1	0.1	1	0.1	
Chenopodiaceae	<i>Einadia polygonoides</i>		Native	0.1		1							0.1							
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Native													0.1				
Chenopodiaceae	<i>Maireana enchylaenoides</i>	Wingless Bluebush	Native							0.3	0.3									
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf Bluebush	Native									1							0.2	
Chenopodiaceae	<i>Salsola australis</i>		Native					0.1	0.1											
Chenopodiaceae	<i>Scleolaena muricata subsp. villosa</i>	Black Rolypoly	Native					1	3	0.4										
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native		2			0.2	0.2	2	0.5		0.1	0.5			0.3		0.2	
Chenopodiaceae	<i>Sclerolaena muricata subsp. muricata</i>	Black Rolypoly	Native		4					1		0.4							6	
Commelinaceae	<i>Murdannia graminea</i>	Grass Lily	Native				0.1													
Convolvulaceae	<i>Convolvulus graminetinus</i>		Native		0.1			0.1	0.1		0.2	0.1								
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native													0.5			0.1	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Native		0.1													0.1		
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.1			0.1			0.1			0.1		10	0.2	0.1			
Crassulaceae	<i>Crassula colorata</i>		Native	0.1			0.2						0.1	0.1						
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	28			10					3	2	4	0.1		0.1		0.2	
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native		10		0.2	3	2	0.1	0.4								0.5	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native	0.5			20						0.2	0.1	0.1	0.1	0.2			
Cyperaceae	<i>Cyperus sp.</i>		Native			3														
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	Native				0.1						0.1							
Cyperaceae	<i>Schoenus kennyi</i>		Native				0.1						0.1		0.1		0.1			
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood	Native														40			
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	Native	0.1	0.1								0.1	0.1						
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native				0.2						0.2		1		0.5			
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native				0.1				0.1	0.1	0.4		0.1					
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining Glycine	Native									0.1				0.1				
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native				0.1			0.1		0.2	0.2		0.1	0.2	0.1			

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Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native					0.1							0.4					
Fabaceae (Faboideae)	<i>Templetonia stenophylla</i>	Leafy Templetonia	Native												0.1					
Fabaceae (Mimosaceae)	<i>Acacia sp.</i>	Wattle	Native																0.2	
Fabaceae (Mimosoideae)	<i>Acacia cheelii</i>	Motherumbah	Native				1													
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Silver Wattle	Native						0.1										0.1	
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native														4			
Fabaceae (Mimosoideae)	<i>Acacia pendula</i>	Weeping Myall	Native		1															
Fabaceae (Mimosoideae)	<i>Acacia salacina</i>	Cooba	Native					0.1												
Fabaceae (Mimosoideae)	<i>Neptunia gracilis</i>	Native Sensitive Plant	Native		0.1														0.1	
Fabaceae (Mimosoideae)	<i>Vachellia farnesiana</i>	Mimosa Bush	Native			1														
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native	0.1	0.1					1	0.4	0.5	0.1						0.5	
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native				0.1								0.1				0.1	
Goodeniaceae	<i>Goodenia fascicularis</i>		Native		0.2						0.1								2	0.1
Haloragaceae	<i>Haloragis heterophylla</i>	Rough rapswort	Native										0.1							
Hypericaceae	<i>Hypericum gramineum</i>	Small St John's Wort	Native									0.1								
Juncaceae	<i>Juncus usitatus</i>		Native		0.1			0.3	0.1											
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	Native				0.1								3					
Lamiaceae	<i>Teucrium betchei</i>		Native	0.4									3			0.1	0.2			
Lamiaceae	<i>Teucrium junceum</i>		Native													0.4				
Linaceae	<i>Linum marginale</i>	Native Flax	Native	0.1			0.4						0.1	0.1						
Lomandraceae	<i>Lomandra filiformis subsp. filliformis</i>		Native									2			0.2	0.1				
Lomandraceae	<i>Lomandra multiflora subsp. multiflora</i>	Many-flowered Mat-rush	Native	0.1													0.1			
Lomandraceae	<i>Lomandra confertifolia</i>	Mat-rush	Native							0.1										
Loranthaceae	<i>Amyema miquelii</i>		Native												1					
Malvaceae	<i>Abutilon fraseri</i>	Dwarf Lantern-flower	Native										0.1							
Malvaceae	<i>Abutilon oxycarpum</i>	Lantern Bush	Native							1			0.1			0.2				
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native																0.1	
Malvaceae	<i>Hibiscus sturtii var. sturtii</i>	Hill Hibiscus	Native	0.1																
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	0.2							0.2	0.2	0.8	0.2	0.1			0.2		
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Native	0.1			0.1			0.1	0.1	0.4		0.2						
Marsileaceae	<i>Marsilea drummondii</i>	Common Nardoo	Native		0.2													0.2		
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	Native					0.2												

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Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native										2	10		8		1		
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Red Gum	Native			25		1									15			
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Native				0.1													
Myrtaceae	<i>Eucalyptus dwyeri</i>	Dwyers Red Gum	Native				3									10				
Myrtaceae	<i>Eucalyptus pilligaensis</i>	Narrow-leaved Grey Box	Native									2								
Myrtaceae	<i>Eucalyptus pilligaensis?</i>	Narrow-leaved Grey Box	Native						0.8										0.8	
Myrtaceae	<i>Eucalyptus populnea?</i>	Poplar Box	Native						0.4											
Myrtaceae	<i>Homoranthus flavescens</i>		Native				0.2													
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea-tree	Native					0.1							65					
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0.1	0.1		0.2	0.1	0.1	0.1	2		0.2	0.1	0.1		0.1		0.1	
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native				3							15	15	3				
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.1	0.1	0.5		0.3	1			0.1	0.1	0.1	0.1	0.1	0.1	2	0.2	2
Phyllanthaceae	<i>Breynia oblongifolia</i>	Coffee bush	Native											0.4						
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	0.1			0.1					0.1	0.1	0.1						
Pittosporaceae	<i>Pittosporum angustifolium</i>	Weeping Pittosporum	Native													0.5				
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain	Native		0.1		0.1					0.1				0.2			0.2	
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native	0.1	0.1						0.3				1	1	1		3	
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	2				2	3	1	0.3	15	5	25	4		2		15	
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	Native										3							
Poaceae	<i>Aristida personata</i>	Purple Wire-grass	Native				2										1			
Poaceae	<i>Austrostipa aristiglumis</i>	Plains Grass	Native		40	2			0.2										1	
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	4			1		0.1	2	20	5	20	0.1	4	0.2	8		2	
Poaceae	<i>Austrostipa setacea</i>	Corkscrew Grass	Native									15								
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo grass	Native								0.2				1	0.2				
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Native	2		1		1	1		1		1	2						
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	1	1						2			2					3	
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	Native							1	4		1	0.1						
Poaceae	<i>Chloris gayana</i>	Rhodes Grass	Native															5		
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native	1			0.2					5		3	4					
Poaceae	<i>Cynodon dactylon</i>	Couch	Native			0.5														
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native	1				1	12	0.5		4			1				3	2
Poaceae	<i>Digitaria breviglumis</i>		Native	0.1																

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Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	Native									0.1		1	0.1							
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass	Native					0.5	6			1			0.1			1		2	2	
Poaceae	<i>Digitaria sp.</i>		Native															2				
Poaceae	<i>Digitaria diffusa</i>	Open Summer Grass	Native										1	1							1	
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native	0.5								1	1	5	0.2			1				
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native	1	3			10	5	4	4	5	2	5		0.5	1					
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native	4			1									1		1				
Poaceae	<i>Eragrostis elongata</i>	Clustered Lovegrass	Native											0.1								
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	Native	1							3	1	2		5							
Poaceae	<i>Eragrostis parviflora</i>	Weeping Lovegrass	Native														1					
Poaceae	<i>Eragrostis sp.</i>		Native									1										
Poaceae	<i>Eriochloa procera</i>	Spring Grass	Native			1																
Poaceae	<i>Leptochloa digitata</i>	Umbrella Canegrass	Native			1																
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	Native													10						
Poaceae	<i>Panicum effusum</i>	Hariy Panic	Native				0.3	0.5	2		0.4	2		5							15	
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native										1					1				
Poaceae	<i>Paspalidium distans</i>		Native			2														10		
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native				0.2					1	1			0.4		0.5				
Poaceae	<i>Poa sieberiana</i>	Grey Tussock-grass	Native													7	5	1				
Poaceae	<i>Rytidosperma longifolium</i>	Long-leaved Wallaby Grass	Native						2	1											0.1	
Poaceae	<i>Rytidosperma racemosum subsp obt</i>		Native				0.1						1		3							
Poaceae	<i>Rytidosperma sp.</i>		Native												1	2	1				3	
Poaceae	<i>Sporobolus caroli</i>	Fairy Grass	Native		0			1														
Poaceae	<i>Thyridolepis mitchelliana</i>	Mulga Mitchell Grass	Native	3																		
Poaceae	<i>Tragus australianus</i>	Small Burrgrass	Native											0.1								
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native	0.5			0.2					0.2	0.4	0.1					0.1			
Poaceae	<i>Vulpia muralis</i>		Native											0.2								
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native			2					0.1			0.1	0.1			0.1		0.1		
Portulacaceae	<i>Calandrinia eremaea</i>		Native	0.3			0.1															
Portulacaceae	<i>Portulaca bicolor var. purpurea</i>		Native	0.1			0.1															
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Native	0.1							0.1	0.1	0.1								0.1	
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native	0.3			3							0.4								

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Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.1			1	0.1			0.1	0.2	0.1	0.1	0.2						
Ranunculaceae	<i>Clematis aristata</i>	old man's beard	Native													0.1					
Ranunculaceae	<i>Clematis microphylla</i>	Small-leaved Clematis	Native												0.4	0.1	0.2				
Ranunculaceae	<i>Ranunculus pumilio var. politus</i>	Ferny Buttercup	Native		0.1																
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	Native										1								
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	Native		0.2															0.1	
Rubiaceae	<i>Galium leptogonium</i>		Native													0.1					
Rubiaceae	<i>Galium gaudichaudii</i>	Rough Bedstraw	Native				0.1														
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native													8					
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	Native													3					
Sapindaceae	<i>Dodonaea viscosa subsp. angusti</i>	Sticky Hop-bush	Native												25	1	6				
Scrophulariaceae	<i>Eremophila deserti</i>	Turkey Bush	Native	1																	
Solanaceae	<i>Solanum sp.</i>		Native													0.2					
Solanaceae	<i>Solanum esuriale</i>	Quena	Native		0.2															0.3	4
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Native										0.1								
Thymelaeaceae	<i>Pimelea micrantha</i>	Silky Rice-flower	Native										0.8								
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native												0.2	0.2					
Zygophyllaceae	<i>Tribulus micrococcus</i>	Yellow Vine	Native		0.1			0.1												0.1	0.1
Native plant species richness in ground layer				44	29	11	45	29	20	31	39	31	49	34	32	32	40	8	28	21	
Native ground cover percentage				25.7	56.9	14.1	36.1	29	35.7	19.2	43.8	65.9	49.9	54.8	43.6	24.4	71.9	18.5	47.8	27.9	
Total native species richness				46	32	13	50	29	27	33	39	32	53	37	39	40	45	9	30	21	
Total species richness				54	50	34	59	50	47	57	48	43	68	49	49	46	47	20	50	33	

C4 WESTERN OFFSET AREA

Table C.9 Plant species recorded within the Merriendi BOA during the 2018 monitoring season

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed	Exotic		0.2				0.1
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	Exotic		3			0.1	0.2
Asteraceae	<i>Centaurea melitensis</i> *	Cockspur Thistle	Exotic	0.1	0.2			0.1	4
Asteraceae	<i>Chondrilla juncea</i> *	Skeleton Weed	Exotic		0.1				
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	Exotic		0.1				
Asteraceae	<i>Hedypnois rhagadioloides</i> *	Cretan Weed	Exotic		0.2				0.1
Asteraceae	<i>Hypochaeris glabra</i> *	Smooth Catsear	Exotic	0.1					
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear	Exotic		0.2	0.1			
Asteraceae	<i>Lactuca serriola</i> *	Prickly Lettuce	Exotic		0.1				
Asteraceae	<i>Silybum marianum</i> *	Variegated Thistle	Exotic		0.1				
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle	Exotic		0.3	0.1	0.1		0.1
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	Exotic		0.1				
Boraginaceae	<i>Buglossoides arvensis</i> *	Sheepweed	Exotic					0.2	
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppergrass	Exotic	0.1					0.1
Brassicaceae	<i>Rapistrum rugosum</i> *	Turnip Weed	Exotic	1	5			8	3
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear	Exotic		0.2	1	0.2		0.2

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Caryophyllaceae	<i>Stellaria media</i> *	Common Chickweed	Exotic			0.2			
Fabaceae (Faboideae)	<i>Medicago minima</i> *	Woolly Burr Medic	Exotic	0.2	0.3	0.2	0.2	1	0.1
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic			0.1			
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	Exotic		0.2		0.1		
Malvaceae	<i>Malvastrum americanum</i> *	Spiked Malvastrum	Exotic				0.1		
Plantaginaceae	<i>Linaria arvensis</i> *		Exotic	0.1	0.1	0.2	0.1		
Plantaginaceae	<i>Misopates ordatum</i> *	Lesser Snapdragon	Exotic	0.3		0.2			
Poaceae	<i>Bromus catharticus</i> *	Prairie Grass	Exotic		0.1				
Poaceae	<i>Hordeum vulgare</i> *	Barley	Exotic		0.1				0.1
Poaceae	<i>Vulpia myuros</i> *	Rat's Tail Fescue	Exotic				0.1		
Verbenaceae	<i>Verbena officinalis</i> *	Common Verbena	Exotic		0.1				
Total exotic species richness				7	19	8	7	5	10
Anthericaceae	<i>Arthropodium milliflora</i>	Pale Vanilla-lily	Native			0.1	0.2		
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot	Native	0.1	0.1			0.1	0.1
Asphodelaceae	<i>Bulbine bulbosa</i>	Native Leek	Native						0.1
Asteraceae	<i>Asteraceae sp.</i>		Native					0.1	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Native	0.2		0.1			
Asteraceae	<i>Calotis scabiosifolia var. scabiosifolia</i>	Rough Burr-daisy	Native	0.1		0.1			
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	Native	2					
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear	Native		0.1		0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Asteraceae	<i>Glossocardia bidens</i>	Cobbler's Tack	Native	0.1			0.1		
Asteraceae	<i>Leiocarpa tomentosa</i>	Woolly Plover-daisy	Native						0.2
Asteraceae	<i>Sigesbeckia australiensis</i>		Native	0.1		4			
Asteraceae	<i>Triptilodiscus pygmaeus</i>	Common sunray	Native			0.1			
Asteraceae	<i>Vittadinia cervicalis var. subcervicularis</i>		Native	0.1	0.1		0.1		
Asteraceae	<i>Vittadinia muelleri</i>		Native	0.1					
Asteraceae	<i>Vittadinia pustulata</i>		Native						0.1
Bignoniaceae	<i>Pandorea pandorana subsp. pandorana</i>		Native			0.2			
Campanulaceae	<i>Lobelia concolor</i>	Poison Pratia	Native		2				
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	Native	0.1	0.5				
Campanulaceae	<i>Wahlenbergia sp.</i>		Native				0.1		
Capparaceae	<i>Apophyllum anomalum</i>	Currant Bush	Native				0.1		
Capparaceae	<i>Capparis mitchellii</i>	Wild Orange	Native					0.1	
Chenopodiaceae	<i>Einadia polygonoides</i>		Native					0.1	
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	Native			0.1			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	Native	0.1	0.1	0.1	0.1	0.1	0.1
Chenopodiaceae	<i>Eniadia hastata</i>	Berry Saltbush	Native	0.1					
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	Native	0.3	0.1				2
Chenopodiaceae	<i>Sclerolaena muricata var. villosa</i>	Black Rolypoly	Native					1	6
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing Bindweed	Native		0.1		0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Convolvulaceae	<i>Dichondra sp. A</i>	Kidney Weed	Native	0.1			0.1		0.1
Convolvulaceae	<i>Polymeria calycina</i>		Native				0.1		
Crassulaceae	<i>Crassula colorata</i>		Native			0.1			
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	Native	1		30	9		
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	Native	0.1					
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	Native			0.1	0.1		
Cyperaceae	<i>Schoenus kennyi</i>		Native				0.2		
Euphorbiaceae	<i>Beyeria viscosa</i>	Pinkwood	Native			10	6		
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick-trefoil	Native	0.5	0.3	5	0.4		
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	0.1	0.1		0.1		
Fabaceae (Faboideae)	<i>Glycine canescens</i>	Silky Glycine	Native	0.1	0.1	0.1			
Fabaceae (Faboideae)	<i>Glycine tabacina</i>		Native	0.1			0.2		
Fabaceae (Faboideae)	<i>Indigofera adesmitifolia</i>	Tick Indigo	Native				0.1		
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>	Smooth Darling Pea	Native				0.5		
Fabaceae (Faboideae)	<i>Swainsona reticulata</i>	Kneed Swainson-Pea	Native	0.1	0.1				
Fabaceae (Faboideae)	<i>Zornia dyctiocarpa</i>	Zornia	Native	1					
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	Western Golden Wattle	Native				1		
Fabaceae (Mimosoideae)	<i>Vachellia farnesiana</i>	Mimosa Bush	Native					0.2	
Geraniaceae	<i>Erodium crinitum</i>	Blue Storksbill	Native	2	0.3			0.1	0.3
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	Native		0.2		0.1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Goodeniaceae	<i>Goodenia fascicularis</i>		Native	0.3					
Hypoxidaceae	<i>Hypoxis hygrometrica</i>	Golden Weather-grass	Native			0.1			
Lamiaceae	<i>Mentha satureioides</i>	Creeping Mint	Native		0.1				
Lamiaceae	<i>Teucrium betchei</i>		Native	0.2					
Linaceae	<i>Linum marginale</i>	Native Flax	Native	0.2		0.1			
Loranthaceae	<i>Amyema miquelii</i>		Native	0.2			0.2		
Malvaceae	<i>Abutilon oxycarpum</i>	Straggly Lantern-bush	Native	0.1					
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	Native			1	0.1		
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida, Variable Sida	Native	1					0.1
Malvaceae	<i>Sida cunninghamii</i>	Ridges Sida	Native		0.1				
Malvaceae	<i>Sida trichopoda</i>	Hairy Sida	Native		0.1				0.1
Myrtaceae	<i>Eucalyptus albens</i>	White Box	Native	5			10		
Myrtaceae	<i>Eucalyptus dealbata</i>	Tumbledown Red Gum	Native	5					
Myrtaceae	<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	Native			12			
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	Native	0.2	0.1	0.1			
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	Native	4		2	2		
Oxalidaceae	<i>Oxalis perennans</i>		Native	0.2	0.1	0.1	0.1	0.1	0.1
Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	0.1	0.1				0.1
Plantaginaceae	<i>Plantago debilis</i>	Shade Plantain	Native	0.1					
Poaceae	<i>Anthosachne scabra</i>	Wheatgrass	Native				1	1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	Native		3		1	1	4
Poaceae	<i>Aristida ramosa</i>	Cane Wire-grass	Native	5	40	5	8	3	2
Poaceae	<i>Aristida personata</i>	Purple Wire-grass	Native			1			
Poaceae	<i>Austrostipa ramosissima</i>	Stout Bamboo Grass	Native	0.3	0.2				
Poaceae	<i>Austrostipa scabra</i>	Speargrass	Native	8	4	5	5		6
Poaceae	<i>Austrostipa setacea</i>	Corkscrew Grass	Native					4	
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	Native	0.1	1				
Poaceae	<i>Chloris truncata</i>	Windmill Grass	Native	2	2				4
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	Native		3	2	1	6	
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Native		2		1		2
Poaceae	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	Native				2		
Poaceae	<i>Digitaria breviglumis</i>		Native	0.1					
Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	Native	0.1	1				
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass	Native						2
Poaceae	<i>Enneapogon gracilis</i>	Slender Nineawn	Native	0.8	3	1			
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass	Native			2	1		6
Poaceae	<i>Panicum effuseum</i>	Hariy Panic	Native		3				2
Poaceae	<i>Panicum queenslandicum</i> var. <i>queenslandicum</i>	Coolabah Grass	Native		4				2
Poaceae	<i>Paspalidium constrictum</i>	Knottybutt Grass	Native	1	0.2	1	1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Poaceae	<i>Paspalidium gracile</i>	Slender Panic	Native					2	
Poaceae	<i>Rytidosperma racemosum var. obtusatum</i>	Native		0.1			1		
Poaceae	<i>Rytidosperma bipartitum</i>	Wallaby Grass	Native					1	8
Poaceae	<i>Sporobolus caroli</i>	Fairy Grass	Native						3
Poaceae	<i>Tragus australianus</i>	Small Burrgrass	Native	0.1		0.1			
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass	Native	0.1		1			0.1
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	Native		0.1				
Polygonaceae	<i>Rumex stenoglottis</i>		Native		0.1				
Portulacaceae	<i>Calandrinia eremaea</i>		Native	0.1					
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	Native						0.1
Pteridaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	Native	0.2		3	1		
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	Native	0.3	0.1	3			
Ranunculaceae	<i>Clematis microphylla</i>	Small-leaved Clematis	Native				0.1		
Rubiaceae	<i>Galium gaudichaudii subsp. gaudichaudii</i>	Rough Bedstraw	Native			0.1			
Rutaceae	<i>Geijera parviflora</i>	Wilga	Native	0.2					
Sapindaceae	<i>Alectryon oleifolius</i>	Western Rosewood	Native					0.1	
Sapindaceae	<i>Dodonaea viscosa subsp. angustifolium</i>	Sticky Hop-bush	Native	0.2	0.5	3	20		
Solanaceae	<i>Solanum esuriale</i>	Quena	Native		0.1			0.1	2
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	Native			0.1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NATIVE	FOILAGE COVER %					
				ME1	ME2	ME3	ME4	ME5A	M6
Thymelaeaceae	<i>Pimelea neo-anglica</i>	Poison Pimelea	Native	0.2			1		
Zygophyllaceae	<i>Tribulus minutus</i>		Native				0.1		
Native plant species richness in ground layer				45	36	30	33	17	26
Native ground cover percentage				28.1	71.5	44.8	27.1	18.9	50.6
Total native species richness				54	38	35	42	19	27
Total species richness				61	57	43	49	24	37

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APPENDIX D

2018 FAUNA SURVEY DATA



D1 EASTERN OFFSET AREA

Table D.1 Fauna species recorded within the Braefield BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Birds															
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill			2						1				
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				3						2			
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill										2			
Acanthizidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill			3										
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler			2	1		1				2	1		
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone							2						
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren				2									
Acanthizidae	<i>Smicronis brevirostris</i>	Weebill	2	1	1	1	1	1							
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk													1
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite													1
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher									1				
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck													1
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	20		20										
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow			10										
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow			20			2							
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie								2					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird													
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird									2				
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		1	1	1		1							
Campephagidae	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike		1											
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller		4											
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper				1	1	2							
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove													1
Columbidae	<i>Geopelia striata</i>	Peaceful Dove		1											1
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon									1				
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing									1	3	2		
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo						1							
Cuculidae	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo									1				
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo						1							
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo								2				2	
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	3	1	1	1	1	1	1	1				1	
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher									1	1			
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail								1				1	
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark								2					
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail							1				1		
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail													1

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Estrildidae	<i>Taeniopygia bichenovii</i>	Double-barred Finch													1
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin	3												
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren				1						2			
Maluridae	<i>Malurus lamberti</i>	Variiegated Fairy-wren			1										
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater										1	1		
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird								2					
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater			1	2	1			2		3			
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater													1
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater		2		4									
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater													1
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater	2	1		2									
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater						2		1		2		1	
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	1	1			2		1						
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird		2		1		2			1	1	1		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater													1
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	1	2											
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark	2												
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit								1					
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella					2				2				
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole									2				
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler								1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler					2					1			
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote						1							
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote		1	1	1				1		1			
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin						1			1	2			
Petroicidae	<i>Melanodryas cucullata cucullata</i>	Hooded Robin	1												
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter	1	1											
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin									2				
Phasianidae	<i>Coturnix ypsilophora australis</i>	Brown Quail	1												
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet													1
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet					1								
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	2	1	1										
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella	2	2				4			2	2			
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler								2				2	
Zosteropidae	<i>Zosterops lateralis</i>	Silvereeye						1		1				1	
Diversity			13	13	13	13	8	14	4	8	13	14	5	6	
Abundance			41	20	64	21	11	21	5	13	18	25	6	8	
Microchiropteran Bats															
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	20	2			8	7	7	9	3	2	15	20	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	1			1	2	1	1			1	6	14	T
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle	2				2								
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat													T
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	2									1	3		
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat	17				20	13	3	2			4		T
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat													H
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat	9						6	1		8	1	1	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat	4	4			1	3	5		2				
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	60	9		2	13		25	21	6	26	42	6	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	1						1					1	
Diversity			9	3	0	2	6	4	7	4	3	5	6	5	
Activity			140	15	5	10	111	72	50	36	11	70	84	53	
Mammals															
Bovidae	<i>Bos taurus</i>	Cow													O
Bovidae	<i>Capra hircus</i>	Goat													O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo													O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo													O
Amphibians															
Hylidae	<i>Litoria caerulea</i>	Green Tree Frog									H				

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	B1A	B1B	B2A	B2B	B3A	B3B	B4A	B4B	B5A	B5B	B6A	B6B	OPP
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Frog									H				
Hylidae	<i>Litoria rubella</i>	Little Red Tree Frog									H				
Limnodynastidae	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog									H				
Reptiles															
Agamidae	<i>Pogona barbata</i>	Eastern Bearded Dragon													O
Varanidae	<i>Varanus varius</i>	Lace Monitor													O

Table D.2 Fauna species recorded within the Sunshine BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	S1A	S1B	S2A	S2B	S3A	S3B	S4A	S4B	S5A	S5B	OPP
Birds													
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill								1			
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler	1	1									
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone					2						
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk		1			1						
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle					1			1			
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	3										
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow		3									
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow		72									
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie					1		2				
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird								1			
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		2			3		11			2	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		3									
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller	1	2									
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper		1									
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove								1			
Columbidae	<i>Geopelia striata</i>	Peaceful Dove		1									
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon				1							
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing				2							
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird							10	7			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	S1A	S1B	S2A	S2B	S3A	S3B	S4A	S4B	S5A	S5B	OPP
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	1										
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo						1			1		
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird				1							
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher		2									
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail		1									
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark	2										
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	1	2									
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel								1		1	
Falconidae	<i>Falco berigora</i>	Brown Falcon								1			
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow			1								
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	2										
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	2										
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	2	1									
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	5	2									
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner				1	2	1		2			
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	1	1									
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird	1	3									
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	4										
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark	1										
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	1										
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote		1									

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	S1A	S1B	S2A	S2B	S3A	S3B	S4A	S4B	S5A	S5B	OPP
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin	1										
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot	1										
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet				1							
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	2	1									
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			2	2		2					
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler	3										
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling					1					1	
Diversity			19	18	2	6	7	3	3	8	2	2	
Abundance			35	103	3	8	11	4	23	15	2	2	
Microchiropteran Bats													
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	10	18	13	16	49		13		6	1	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			2	8	5						
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	4	1	13	3							
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat					2		1				
Vespertilionidae	<i>Vespadelus darlingtoni</i>	Large Forest Bat					1						
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat	17		1	2					2		
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat											
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat	2		4	1	3			1	6	2	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat	5	1	1	2	2						
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	14	7	16	6	35		14	8	55	3	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	S1A	S1B	S2A	S2B	S3A	S3B	S4A	S4B	S5A	S5B	OPP
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat									1		
Diversity			6	4	7	7	7	0	3	2	5	3	
Activity			63	33	70	50	167	0	35	17	106	18	
Mammals													
Suidae	<i>Sus scrofa</i>	Pig											O
Bovidae	<i>Bos taurus</i>	Cow											O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit											O
Bovidae	<i>Capra hircus</i>	Goat											O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo											O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo											O
Amphibians													
Hylidae	<i>Litoria rubella</i>	Desert Tree Frog				H							H
Reptiles													
Scincidae	<i>Egernia striolata</i>	Tree Skink											O

Table D.3 Fauna species recorded within the Nioka North BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NI1A	NI1B	NI2A	NI2B	NI3A	NI3B	NI4A	NI4B	NI5A	NI5B	NI6A	NI6B	OPP
Birds															
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill								2					
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	1	2		1									
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill								3					
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler					1	2		2					
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone		1											
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill					2	2	1	2					
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle				1						1			
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher	2	1			1								
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow								2					
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie				1			2						
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird				2									
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird							1		2				
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo				1									
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah	5								7				
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella	1												
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				1									
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller								1					
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper								1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NI1A	NI1B	NI2A	NI2B	NI3A	NI3B	NI4A	NI4B	NI5A	NI5B	NI6A	NI6B	OPP
Columbidae	<i>Geopelia striata</i>	Peaceful Dove	1	2											
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon									1				
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing	1				1								
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough													
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird							10	4					
Corvidae	<i>Corvus coronoides</i>	Australian Raven				2	2								
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo					1								
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	2						2						
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	1	1			1								
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher		1						2					
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	2				1		1	1					
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark				1									
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	2	1							1				
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch	2	3											
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail		2											
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel				1					2				
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin									3	2			
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	2	2											
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	2							1					
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	4	1											
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	8	8			2	2	1						

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NI1A	NI1B	NI2A	NI2B	NI3A	NI3B	NI4A	NI4B	NI5A	NI5B	NI6A	NI6B	OPP
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	25	25											
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	6	4											
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater		2											
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner				2			6		1				
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	2				1								
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird	13	2		1			2						
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	1				1	1							
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	2	2											
Muscicapidae	<i>Cinclorhampus mathewsi</i>	Rufous Songlark	4	1											
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit									2	1			
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella								2					
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		2					1						
Pachycephalidae	<i>Falcunculus frontatus</i>	Crested Shrike-tit	1												
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler								1					
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler					3	3		1					
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote													
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote				1				1			1		
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin					1	4	1						
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter	2			1									
Phasianidae	<i>Coturnix ypsilophora australis</i>	Brown Quail				1									

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NI1A	NI1B	NI2A	NI2B	NI3A	NI3B	NI4A	NI4B	NI5A	NI5B	NI6A	NI6B	OPP
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot		1			1								
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot					1								
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella					1								
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella			4	3		2	2						
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot				1									
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler							2						
Sturnidae	<i>Acridotheres tristis</i>	Common Myna			3						1				
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling			2	5									
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	2				2	1							
Diversity			25	20	3	3	17	8	14	15	6	3	1	0	
Abundance			88	65	9	9	22	17	33	26	16	4	1	0	
Microchiropteran Bats															
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	39	34	7	8			11	4	2				T
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat		1						2					
Vespertilionidae	<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat													T
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat													T
Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat													T
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	10	3					6						T
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	6	11					9	7	3				
Vespertilionidae	<i>Vespadelus darlingtoni</i>	Large Forest Bat								1					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	NI1A	NI1B	NI2A	NI2B	NI3A	NI3B	NI4A	NI4B	NI5A	NI5B	NI6A	NI6B	OPP
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat		3					3	2					T
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat			2				1	1					
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat		2	5				3	4	1				
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat		1					6		8		1		
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	9	50	29	20			10	15	30		3		
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	1	1											
Diversity			5	9	4	2	NA	NA	8	8	5	0	2	0	
Activity			71	142	49	28	NA	NA	77	58	52	0	4	0	
Mammals															
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	O						O						
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Echidna	O												
Canidae	<i>Vulpes vulpes</i>	Red Fox	O												O
Bovidae	<i>Bos taurus</i>	Cow													O
Bovidae	<i>Capra hircus</i>	Goat													O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo													O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo													O

D2 CENTRAL OFFSET AREA

Table D.4 Fauna species recorded within the Mallee BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MA 1A	MA 1B	MA 2A	MA 2B	MA 3A	MA 3B	MA 4A	MA 4B	MA 5A	MA 5B	OPP
Birds													
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill							2				
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			2	2							
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill									5		
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler			1				2				
Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone										1	
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill						1					
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar								1			
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow			4	2							
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow				1						1	
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie				2						6	
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		2		2							
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				1							
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller			1	2							
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper			2	1							
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove				2							
Columbidae	<i>Geopelia striata</i>	Peaceful Dove			1	2					4	1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MA 1A	MA 1B	MA 2A	MA 2B	MA 3A	MA 3B	MA 4A	MA 4B	MA 5A	MA 5B	OPP
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing								1		1	
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo				1							
Cuculidae	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo								1			
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo				1							
Dicruridae	<i>Dicaeum hirundinaceum</i>	Mistletoebird		1	2	2			1	1	1		
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher								1			
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail			3	1			2	2	2	2	
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			1	3							
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		1		1							
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater				2					1		
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater			6	4						1	
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater			2								
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird						1					
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater			3						1		
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater			2	1							
Monarchidae	<i>Myiagra inquieta</i>	Restless Flycatcher			2	2							
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit	1	1									
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark			3						2		
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella				6							
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		1		2							
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler				1					2	1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MA 1A	MA 1B	MA 2A	MA 2B	MA 3A	MA 3B	MA 4A	MA 4B	MA 5A	MA 5B	OPP
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler			4	6			2		2	2	
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote								2			
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail			2	2							
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin			2	3	2			2	2	1	
Petroicidae	<i>Microeca fascians</i>	Jacky Winter			3	2					1		
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet										2	
Zosteropidae	<i>Zosterops lateralis</i>	Silvereeye										1	
Diversity			1	5	19	27	1	1	5	9	11	12	
Abundance			1	6	46	57	2	1	8	13	23	20	
Microchiropteran Bats													
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	4	2	7	17	13	33	1		8	6	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat		2	2			1			3	6	
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat											T
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat						1					
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat				1	1						
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat			23	2	1	6					T
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat					2	5	3				
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat			2	4	7	22			1		
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat									1		
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	9		23	14	24	40	13		9	4	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MA 1A	MA 1B	MA 2A	MA 2B	MA 3A	MA 3B	MA 4A	MA 4B	MA 5A	MA 5B	OPP
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat			24	39					16	4	
Diversity			2	2	6	6	6	7	3	NA	6	4	
Activity			16	7	98	116	57	146	17	NA	56	31	
Mammals													
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo			O								O
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo			O								O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit					O		O				O
Reptiles													
Scincidae	<i>Egernia striolata</i>	Tree Skink											O
Scincidae	<i>Cryptoblepharus pulcher</i>	Elegant Snake-eyed Skink											O

Table D.5 Fauna species recorded within the Myall Plains BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	OPP
Birds															
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill						1					1		
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	2		2	6									
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill													
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill						2			1		2	2	
Acanthizidae	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	Speckled Warbler									2				
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone			1										
Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone	1												
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren							2	2					
Acanthizidae	<i>Smicromnis brevirostris</i>	Weebill	3	2	1			3			1	4			
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow											4		
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow								15					
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow					4			60					
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird							2						
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird		1				1					2		
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		2						1					
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel													
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			1										

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	OPP
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller											3	3	
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper							2	1					
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper					1	1		1		1			
Columbidae	<i>Geopelia striata</i>	Peaceful Dove								1					
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon		2						1					
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing								1					
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird				11									
Corvidae	<i>Corvus coronoides</i>	Australian Raven						1	1						
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird						1		1	2	1	1		
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher									2	2	2		
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	1	1							1	2	2	1	
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark		2											
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail		1	1				1	1		2	1	1	
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	1												
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	2	1		1	1	2							
Meliphagidae	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater					1					1	2	2	
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater	2												
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater							4	6					
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner								1					
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater												1	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	OPP
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater							1	2			1		
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		1									1		
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler										1			
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	1	2				2	2	4	3	4	7	3	
Pachycephalidae	<i>Falcunculus frontatus</i>	Crested Shrike-tit										1			
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote						2							
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote			2	1		4				1		1	
Estrildidae	<i>Taeniopygia bichenovii</i>	Double-barred Finch										3			
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin						2		2	1		1		
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter		2					2	1					
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot											1		
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella		2					1	2					
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot								1					
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella			2										
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye						2			1	1			
Diversity			8	12	7	4	4	13	10	19	9	13	15	8	
Abundance			13	19	10	19	7	24	18	104	14	24	31	14	
Microchiropteran Bats															
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	5	10	3	2			19	41	4	9	12	1	
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle							18	12					
Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat													T

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	MY1A	MY1B	MY2A	MY2B	MY3A	MY3B	MY4A	MY4B	MY5A	MY5B	MY6A	MY6B	OPP
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat							35	25					
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat			2				27	25	1		3	2	
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat								1					T
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat											6	1	
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat	1		2		1		11	3	4		6	1	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat		1						1					
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	7	2	10	11	3		11	3	6	11	13	6	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	2	5		2				9					
Diversity			4	4	4	3	2	0	6	9	4	2	5	5	
Activity			35	23	19	28	16	4	123	134	17	38	62	36	
Mammals															
Camelidae	<i>Camelus dromedarius</i>	Camel			O										O
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby											O		O
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby											O		O
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo													O

Table D.6 Fauna species recorded within the Wirrilah BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B	W7A	W7B	OPP
Birds																	
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill						2	1		2	1					
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill													2	2	
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill					4	2	3	2		2					
Acanthizidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill								2							
Acanthizidae	<i>Chthonicola sagittata</i> (syn. <i>Pyrrholaemus sagittatus</i>)	Speckled Warbler					1		1		2	2					
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill									2	1					
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle									1						
Alaudidae	<i>Mirafra javanica</i>	Horsfield's Bushlark			1	1								1	1	1	
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	1														
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow			25												
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie	2	1												1	
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird	2	2													
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird		2			1					1					
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah	4	2	8						1						
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel			4												

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B	W7A	W7B	OPP
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike						2	1	1							
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper								1							
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	3	3				1									
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		2													
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird	2														
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough	2	1													
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird	3								10						
Corvidae	<i>Corvus coronoides</i>	Australian Raven	2						1								
Corvidae	<i>Corvus orru</i>	Torresian Crow		1	1												
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	2														
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo						1									
Dicruridae	<i>Dicaeum hirundinaceum</i>	Mistletoebird							1	1		1					
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail						1	1	2		1					
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark		1				2									
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail					1				2		1				
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel			1	1											
Falconidae	<i>Falco berigora</i>	Brown Falcon													1		
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren					2										

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B	W7A	W7B	OPP
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren			1	2											
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					3		1	4		1					
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater						2									
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	3	1													
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater					1										
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater								1							
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	2	6			2										
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	1														
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	2									1					
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit			1								2	2	2	1	
Muscicapidae	<i>Cincloramphus mathewsi</i>	Rufous Songlark					2	2	1			1			1		
Muscicapidae	<i>Cincloramphus cruralis</i>	Brown Songlark		1	1	1							1	1			
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush								1							
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler						1		1		2					
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	1														
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin								1	1	1					
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin								1							
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler		3													

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B	W7A	W7B	OPP
Psittacidae	<i>Northiella haematogaster</i>	Blue Bonnet		2													
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella					2										
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird						1									
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye							1								
Diversity			15	14	9	4	10	11	10	12	8	12	3	3	6	4	
Abundance			32	28	43	5	19	17	12	18	21	15	4	4	32	5	
Microchiropteran Bats																	
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	85	10	6	6		4	15	19	13	61		2	6	5	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat									2						
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle	4								2				1		
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	22	15	11	7							5			2	
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	12	6	2	3							3		2	5	
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat															
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat	2	5							4			1	1		
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat	3	7		3			20		4	6	4	1	3	10	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat	4	6		1							1		1	24	
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	33	23	31	62		3	36	8	23	6	8	10	18		
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	55	28		2			1	2					1	5	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	W1A	W1B	W2A	W2B	W3A	W3B	W4A	W4B	W5A	W5B	W6A	W6B	W7A	W7B	OPP
Diversity			9	8	4	7	NA	2	4	3	6	3	5	4	8	6	
Activity			220	106	50	87	NA	7	112	43	82	101	21	14	34	54	
Mammals																	
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo															O
Bovidae	<i>Capra hircus</i>	Goat															O
Suidae	<i>Sus scrofa</i>	Pig															O
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit															O
Reptiles																	
Agamidae	<i>Pogona barbata</i>	Eastern Bearded Dragon															O
Scincidae	<i>Ctenotus robustus</i>	Eastern Striped Ctenotus															O
Scincidae	<i>Tiliqua scincoides</i>	Eastern Blue-Tongue															O

Table D.7 Fauna species recorded within the Goonbri BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	G1A	G1B	G2A	G2B	OPP
Birds							
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill		2			
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone	1				
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk			1		
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher		2			
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie				3	
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	2				
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		2		2	
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	4	2			
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing	3				
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough	4				
Corvidae	<i>Corvus coronoides</i>	Australian Raven	2				
Corvidae	<i>Corvus orru</i>	Torresian Crow	2				
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail		2			
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark	4		3		
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow		2			
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	4	4			
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	4	4			
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater		2			
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	1	1			

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	G1A	G1B	G2A	G2B	OPP
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark	1				
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	1				
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	1				
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)	1	3			
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella	2				
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot	5				
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	2				
Diversity			18	11	2	2	
Abundance			44	26	4	5	
Microchiropteran Bat							
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	14	16	9	6	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	1	4			
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle		2			
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	13	20	5	1	T
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	5	6	1	10	T
Vespertilionidae	<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat					T
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat					T
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat				1	T
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat		17			
Molossidae	<i>Mormopterus lumsdenae</i>	Northern Free-tailed Bat	4	6	6	4	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	G1A	G1B	G2A	G2B	OPP
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat	10	26		4	T
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	17	19	42	43	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	4	3	4	3	
Diversity			8	10	5	7	
Activity			68	119	63	70	
Mammals							
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo					O
Reptiles							
Agamidae	<i>Pogona barbata</i>	Eastern Bearded Dragon					O

D3 NAMOI OFFSET AREA

Table D.8 Fauna species recorded within the Namoi BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP
Birds																																					
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill							2																1												
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	6	4														2		2		1	2														
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill	5	2																					1	2											
Acanthizidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill							2	2																											
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler							2	2															2	1	1	2									
Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone																																			X
Acanthizidae	<i>Gerygone olivacea</i>	White-throated Gerygone																																			X
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren																								2		1									X
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill	2																							2											X
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk																																			X
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle																																1			X
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite																									2							1			
Acrocephalidae	<i>Acrocephalus australis</i>	Australian Reed-Warbler																																			X
Alaudidae	<i>Mirafra javanica</i>	Singing Bushlark (Horsfield's Bushlark)									1	1																					2				
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra					2	2							2							1															
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher						2																													
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck						2							3																						
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck				5									2	4						2										8					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP	
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron				1									3																							
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow					1																															
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow					1																															
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow							12																36													
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow							20																22	8					20							
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird	1		2	2					2				2	1	6	4							2	2					1							
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie	3								3				3	2	1	2												2	2	2	2					
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird														1																						
Artamidae	<i>Strepera graculina</i>	Pied Currawong																							1													
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		1				4							1															2	1							
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		2	4		6	2			3	2			9	2	4	4				2	2			10	2			2	2	4						
Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella									1																											
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel													2																					2		
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	2		1		1								2																							
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller	1																			4																
Charadriidae	<i>Euseyornis melanops</i>	Black-fronted Dotterel					1																															
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing			2																																	
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper																							1					1								
Columbidae	<i>Geopelia cuneata</i>	Diamond Dove																				1																
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove																									1		1									
Columbidae	<i>Geopelia striata</i>	Peaceful Dove							1	1												1					1											

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP		
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	2		3						5				2	1	4				2									2	2								
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing								1																				2									
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird					2	2																		2						1							
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough						27							6	6			6																				
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird			2						10				5	7					4																		
Corvidae	<i>Corvus coronoides</i>	Australian Raven	5	2		2	1	2	1		1						1						3			1	2												
Corvidae	<i>Corvus orru</i>	Torresian Crow								2											1																		
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo																					1																
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo																																				X	
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel																																				X	
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird				1											1							1	2		2			1	1								
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark						2																															
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher							1	1																													
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	1	1																		1			1	1	1	1											
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	2				3	2		1											2		2	2															
Falconidae	<i>Falco berigora</i>	Brown Falcon																			2																		
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel											1																										
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin					4	6																							5	7	18						
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	5	2	2	1	2	3							2	2							3				2												
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren																																					X
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	2					1	12	7							1	4			2							1	2										
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater																																					X

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP				
Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater																	1	2																	X				
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater																																				X			
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater					4	4		2									2																						
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater																		2																					
Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner															4	2	2																						
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner			1	1					2				5	7						2													1	1					
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird			1		1		8		1						5																								
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird		1					2																		2	1		1											
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater									1											2						1													
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater																																					X		
Motacillidae	<i>Anthus australis</i>	Australian (Richards) Pipit									1		2	2																											
Muscicapidae	<i>Cinclorhamphus cruralis</i>	Brown Songlark												1																											
Muscicapidae	<i>Cinclorhamphus mathewsi</i>	Rufous Songlark	1																			1	3	4																	
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella																																						X	
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole																																						X	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush																								1															
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler																																							
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	2	2						2											1				1	1			1												
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote		1						1																															
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	2		4		1				1						2	1				2			1	2				2	1	1									

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP			
Passeridae	<i>Neochmia modesta</i>	Plum-headed Finch																																				X		
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch							2										2																					
Passeridae	<i>Taeniopygia guttata</i>	Zebra Finch	2	2																													20	20				X		
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin								1									1					1		1	1													
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter																																					X	
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin	1	1					2	5																														
Phasianidae	<i>Coturnix ypsilophora australis</i>	Brown Quail																																					X	
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)																				17																		
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot																										1												
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot																	1																					
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck																													1									
Psittacidae	<i>Glossopsitta concinna</i>	Musk Lorikeet					2																				7													
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella	2		4	3					1				2	2						1									2	5			2	2				
Psittacidae	<i>Psephotus haematonotus</i>	Red-rumped Parrot					4									6																								
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird	1	1															1																					
Sturnidae	<i>Acridotheres tristis</i>	Common Myna		1						2			1																											
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling																													4	2								
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill																																					X	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP			
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis					28																																	
Turnicidae	<i>Turnix varia</i>	Painted Button-quail								1												1																		
Zosteropidae	<i>Zosterops lateralis</i>	Silvereeye		1																					4															
Diversity			20	15	11	8	17	14	13	15	13	3	2	3	15	10	11	7	8	4	9	15	6	3	8	12	9	15	4	8	14	12	5	5	2	3				
Abundance			48	24	26	16	64	61	67	31	32	4	3	4	49	34	33	18	17	9	19	38	13	8	65	18	28	23	11	13	50	33	46	27	3	5				
Microchiropteran Bats																																								
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	13					72	4	15	45	12			103		2		2				3		70	19	17	41	15	47	29	16	1		22					
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat					2	9				1			1										2	8	1	6											T	
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle																						1			3			22	154				1					
Vespertilionidae	<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat																																					T	
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat																																					T	
Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat																																					T	
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat											3		3											12	22	58					1							
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	6					1											1				6		5	8		12					33						T	
Vespertilionidae	<i>Vespadelus troughtoni</i>	Eastern Cave Bat																							1		10						1							
Vespertilionidae	<i>Vespadelus vulturinus</i>	Little Forest Bat					4	4		1																					6									
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat								1		1			2										12		1	2	2	1		2								H
Molossidae	<i>Momopterus lumsdenae</i>	Northern Free-tailed Bat							4		1															14	1		5		1									
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat					64	2		6	8				11										6		22	2			21									
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	6					9		24		2	3		2	1									33	46	30		4	11							1			
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	3				1				1								1				1		1		2	5		2										

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	N 1A A	N 1A B	N 2A A	N 2A B	N 3A	N 3B	N 4A	N 4B	N 5A	N 5B	N 6A	N 6B	N 7A A	N 7A B	N 8A	N 8B	N 9A	N 9B	N 10A	N 10B	N 11A	N 11B	N 12A	N 12B	N 13A	N 13B	N 14A	N 14B	N 15A	N 15B	N 16A	N 16B	N 17A	N 17B	OPP	
Diversity			4	NA	NA	NA	3	7	1	6	3	5	2	NA	6	NA	2	NA	3	NA	NA	NA	3	NA	8	9	8	9	3	5	4	7	1	NA	3	NA		
Activity			47	NA	NA	NA	88	326	7	87	81	28	6	NA	167	NA	11	NA	7	NA	NA	NA	15	NA	246	340	206	253	31	81	182	452	1	NA	25	NA		
Mammals																																						
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo																																				O
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby																																				O
Leporidae	<i>Lepus europaeus</i>	Brown Hare																																				O
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum																																				O
		Fox																																				O
Amphibians																																						
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog																																				H
Hylidae	<i>Litoria rubella</i>	Little Red Tree Frog				H																																H
Lymnodynastidae	<i>Limnodynastes tasmanensis</i>	Spotted Marsh Frog			H							H																										H
Myobatrachidae	<i>Crinia parinsignifera</i>	Eastern Sign-bearing Froglet												H																								H
Reptiles																																						
Elapidae	<i>Pseudonaja textilis</i>	Eastern Brown Snake																																				O
Scincidae	<i>Egernia striolata</i>	Tree Skink																																				O

D4 WESTERN OFFSET AREA

Table D.9 Fauna species recorded within the Merriendi BOA during the 2018 monitoring event

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	OPP
Birds															
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill					2		1	1					
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	2	2						4	3	2			
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill					2	2		3					
Acanthizidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill													X
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler		2			2			1					
Acanthizidae	<i>Gerygone fusca</i>	Western Gerygone	1	2											
Acanthizidae	<i>Smicromnis brevirostris</i>	Weebill		2					2	1					
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle													X
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher													X
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow													X
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow		10				5							
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow		20				5		10		4			
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird	2		2										
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie													X
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird													X
Artamidae	<i>Strepera graculina</i>	Pied Currawong													X

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	OPP
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo													X
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah			10										
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel													X
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike													X
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller		1							1				
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing													X
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)													X
Climacteridae	<i>Cormobates leucophaeus</i>	White-throated Treecreeper					1	2	1		1				
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove													X
Columbidae	<i>Geopelia striata</i>	Peaceful Dove							1						
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon			2										
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing													X
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird							1						
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird			20		6								
Corvidae	<i>Corvus coronoides</i>	Australian Raven					3		1						
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo					1								
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	1	1					1	1					
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark													X
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher								1					
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail					1		1						

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	OPP
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail		1						1	2	1			
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel													X
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow											1		
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin											2		
Megaluridae	<i>Cincloramphus mathewsi</i>	Rufous Songlark													X
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater							1	2		2			
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	2					2							
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater					1								
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	2	2					4	3					
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater			2				2	1		1			
Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner													X
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner													X
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater													X
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird													X
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird													X
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater			2				2						
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater													X
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush						1	1	1					
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler					1	1							
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler													X
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	1				2	1	2						

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	OPP
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch													X
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin	2	1			2	2	2	1					
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter	2	2											
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin						1			2	1			
Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)													X
Psittacidae	<i>Alisterus scapularis</i>	Australian King-Parrot													X
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot													X
Psittacidae	<i>Northiella haematogaster</i>	Blue Bonnet				7									
Psittacidae	<i>Platycercus eximius</i>	Eastern Rosella													X
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird			1			1							
Sturnidae	<i>Acridotheres tristis</i>	Common Myna							2						
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling													X
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye						1	1						
Diversity			10	13	7	1	13	13	18	15	5	6	2	0	
Abundance			16	47	39	7	26	27	27	32	9	11	3	0	
Microchiropteran Bats															
Vespertilionidae	<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	49	54	39	1	17	26	8	15		6		1	
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat									1			1	
Vespertilionidae	<i>Falsistrullus tasmaniensis</i>	Eastern False Pipistrelle	5					7							
Vespertilionidae	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	2	13	4	14			7	18	2	9		7	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	ME1A	ME1B	ME2A	ME2B	ME3A	ME3B	ME4A	ME4B	ME5A	ME5B	ME6A	ME6B	OPP
Vespertilionidae	<i>Scotorepens greyii</i>	Little Broad-nosed Bat	27	24	3	14			3	16	68	13	5	3	
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat	2	2					1	1					
Molossidae	<i>Austronomus australis</i>	White-striped Freetail-bat					1	2		1		2			
Molossidae	<i>Momopterus lumsdenae</i>	Northern Free-tailed Bat		4	2	5		4		8		20		1	
Molossidae	<i>Mormopterus petersi</i>	Inland Free-tailed Bat	1					7			3		3	2	
Molossidae	<i>Mormopterus planiceps</i>	South-eastern Free-tailed Bat	14	42	26	71		14	13	50	3	107	2	31	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	12				1	5	1	5	2	10	1		
Diversity			8	6	5	5	3	7	6	8	6	7	4	7	
Activity			150	139	74	105	23	112	35	120	83	171	11	47	
Mammals															
Macropodidae	<i>Macropus robustus</i>	Common Wallaroo													O
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby													O
Reptiles															
Agamidae	<i>Pogona barbata</i>	Eastern Bearded Dragon												O	

APPENDIX E

VEGETATION BENCHMARK DATA



E1 2015 BENCHMARK

Table E.1 2015 baseline monitoring benchmark scores for vegetation attributes

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Eastern Offset Area														
Nioka North BOA														
NN1	Habitat Management Zone	22.5	100	2	13.5	20	0	0	16	64	48	30	8	10
NN2	Habitat Restoration Zone	0	0	0	0.1	14	0	0	12	1	30	20	0	40
NN3	Habitat Management Zone	14	100	1	29.5	39	0	0	6	42	40	30	0	18
NN4	Habitat Management Zone	18	100	0	5.5	34	0	0	21	2.5	32	26	0	30
NN5	Habitat Restoration Zone	0	0	0	0	19	0	0	14	0	24	46	0	20
NN6	Habitat Restoration Zone	0	0	0	0	20	0	0	14	1.5	26	32	0	36
Sunshine BOA														
S1	Habitat Management Zone	29	100	0	22	25	0	0	19	22	32	34	0	24
S2	Habitat Restoration Zone	0	50	0	1.5	22	0	0.5	19	4	40	0	0	54
S3	Habitat Management Zone	0	0	0	0.5	9	0	0	13	1.5	34	10	0	48
S4	Corridor Enhancement Zone	0	0	0	0	11	0	0	15	0	24	20	0	54
S5	Corridor Enhancement Zone	0	0	0	0	7	0	0	12	0	38	12	0	60

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Braefield BOA														
B1	Habitat Management Zone	12.5	0	0	6	33	0	0	4	0	38	14	0	28
B2	Habitat Management Zone	28.5	100	3	37	36	0	0	4	122	44	16	0	6
B3	Habitat Management Zone	26.5	100	0	27.5	34	0	0	4	0	26	36	0	8
B4	Habitat Restoration Zone	0	50	0	0.1	26	0	0	11	7	8	54	0	36
B5	Habitat Management Zone	31.5	50	1	13.5	26	0	4.5	14	58	12	40	0	30
B6	Habitat Restoration Zone	0	0	0	16.5	23	0	0	13	2.5	24	16	0	24
Central Offset Area														
Mallee BOA														
Ma1	Habitat Restoration Zone	0	100	0	6	13	0	0	12	0	38	24	0	46
Ma2	Habitat Management Zone	22	50	1	18	32	12	0	10	17	50	14	0	12
Ma3	Habitat Management Zone	6	30	0	8	22	0	0	1	6	10	6	16	0
Ma4	Habitat Management Zone	32	100	0	8	25	0	0	4	32	36	24	0	4
Ma5	Habitat Management Zone	32	100	2	8	31	0	0	17	54	30	26	0	18
Myall Plains BOA														
My1	Habitat Restoration Zone	6	50	0	20	37	0	0	6	18.2	52	26	0	0
My2	Habitat Restoration Zone	0.1	50	1	3.5	17	0	0	19	0	64	18	0	18
My3	Habitat Management Zone	23	100	1	7.5	31	0	0	8	0	26	22	4	0
My4	Habitat Management Zone	25.5	100	2	31.5	34	0	0	11	3	32	10	0	0

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
My5	Habitat Management Zone	34.5	100	3	32	34	0	0	8	0	80	2	0	18
My6	Habitat Management Zone	34	100	0	24.5	33	0	0	14	0	66	16	0	18
Wirrilah BOA														
W1	Habitat Management Zone	20	0	1	0.2	32	0	0	5	12	62	22	0	0
W2	Corridor Enhancement Zone	0	0	0	0	15	0	0	16	0	50	6	0	18
W3	Habitat Restoration Zone	0.1	100	0	6.5	26	0	0	8	0	62	16	4	2
W4	Habitat Management Zone	8.5	100	0	12.5	42	0	0	5	43	44	14	0	0
W5	Habitat Management Zone	0.3	100	0	17.5	38	0	0	5	19	48	14	2	2
W6	Habitat Restoration Zone	0	0	0	0	15	0	0	14	0	88	0	0	8
Namoi Offsets														
Namoi BOA														
N1	Habitat Management Zone	14.5	100	0	0	29	0	0	13	7.4	44	10	0	42
N2	Habitat Restoration Zone	0	0	0	0	14	0	0	12	0	50	0	0	50
N3	Habitat Management Zone	.5	0	2	0	8	0	0	8	100	0	0	0	100
N4	Habitat Management Zone	12.5	100	1	2.5	25	0	0	8	19	20	24	0	0
N5	Habitat Restoration Zone	0	0	0	0	12	0	0	20	0	28	10	0	62
N6	Habitat Restoration Zone	0	0	0	0	17	0	0	19	0	14	46	0	40
N7	Habitat Management Zone	0	0	0	1.5	24	0	0.5	14	0	70	6	0	16
N8	Habitat Management Zone	0	0	0	0	21	0	0	13	21.7	76	8	0	16

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
N9	Habitat Restoration Zone	0	0	0	0	27	0	0	21	0	60	12	0	18
N10	Habitat Management Zone	0	100	0	0	27	0	0	10	4	72	0	2	24
N11	Habitat Restoration Zone	0	0	0	0	23	0	0	14	0	52	14	0	34
N12	Habitat Management Zone	11.5	0	0	18.5	28	0	0	10	63	50	6	4	0
N13	Habitat Management Zone	30.5	100	5	10.5	26	0	0	9	39	38	16	20	2
N14	Habitat Management Zone	10	100	6	29.5	30	0	0	5	11	12	16	16	0
N15	Habitat Management Zone	0.5	100	0	0	11	0	0	12	7.1	44	22	0	34
Western Offset Area														
Merriendi BOA														
Me1	Habitat Management Zone	3.5	100	1	0	37	0	0	6	18.2	52	26	0	0
Me2	Habitat Restoration Zone	0	0	0	0	25	0	0	19	0	64	18	0	18
Me3	Habitat Management Zone	11.5	100	0	10.5	24	0	0	8	0	26	22	4	0
Me4	Habitat Management Zone	15.5	100	2	24.5	31	0	0	11	3	32	10	0	0
Me5	Habitat Restoration Zone	0	0	0	0	14	0	0	8	0	80	2	0	18
Me6	Habitat Restoration Zone	0	0	0	0	16	0	0	14	0	66	16	0	18

E2 2016 BENCHMARK

Table E.2 2016 monitoring benchmark scores for vegetation attributes

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT-MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Eastern Offset Area														
Nioka North BOA														
NN1	Habitat Management Zone	19.5	100	2	14	41	0	0	32	61	16	32	10	30
NN2	Habitat Restoration Zone	0	0	0	1	24	0	0	20	1	10	18	0	70
NN3	Habitat Management Zone	15	0	0	31	54	0	0	9	0	20	38	0	28
NN4	Habitat Management Zone	17.5	100	0	11	44	0	0	20	3	18	30	0	36
NN5	Habitat Restoration Zone	0	0	0	0.5	26	0	0	18	0	18	42	0	30
NN6	Habitat Restoration Zone	0	0	0	0	22	0	0	16	1.5	24	36	0	40
Sunshine BOA														
S1	Habitat Management Zone	30.5	100	0	13	38	0	0	24	25	18	24	0	44
S2	Habitat Restoration Zone	0	0.5	0	2	24	0	0	17	3	36	2	0	50
S3	Habitat Management Zone	0	0	0	0.5	9	0	0	17	0	24	4	0	64
S4	Corridor Enhancement Zone	0	0	0	0	8	0	0	17	0	14	8	0	72
S5	Corridor Enhancement Zone	0	0	0	0	11	0	0	16	0	6	8	0	82

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Braefield BOA														
B1	Habitat Management Zone	12.5	100	0	7.5	44	0	0	20	61	22	36	0	46
B2	Habitat Management Zone	33.5	100	3	39.5	29	0	0	10	124	20	34	0	12
B3	Habitat Management Zone	28.5	100	3	28.5	47	0	0	9	76	22	42	0	10
B4	Habitat Restoration Zone	0	0.5	0	1.5	31	0	0	20	8	2	56	0	26
B5	Habitat Management Zone	33.5	0.5	1	15.5	35	0	0	24	55	16	38	0	32
B6	Habitat Restoration Zone	3	0	0	16.5	41	0	0	17	2.5	12	28	0	30
Central Offset Area														
Mallee BOA														
Ma1	Habitat Restoration Zone	0	20	0	6.5	51	0	0	15	0	10	30	0	60
Ma2	Habitat Management Zone	8.5	100	1	14	40	0	0	15	14	40	16	0	30
Ma3	Habitat Management Zone	7.5	100	0	10	40	0	0	8	7	14	22	12	8
Ma4	Habitat Management Zone	25.5	100	0	14.5	44	0	0	11	30	30	40	0	6
Ma5	Habitat Management Zone	40	100	0	18.5	46	0	0	13	29	20	48	0	22
Myall Plains BOA														
My1	Habitat Restoration Zone	0.2	50	0	13.5	51	0	0	21	3	30	24	0	36
My2	Habitat Restoration Zone	6	0	1	0.5	24	0	0	19	6	34	32	0	42
My3	Habitat Management Zone	20	100	4	15.5	46	0	0	7	14	26	54	2	4
My4	Habitat Management Zone	20.5	100	3	20.5	42	0	0	11	50	44	32	0	2

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
My5	Habitat Management Zone	18	100	4	41.5	29	0	0	8	61	48	42	0	2
My6	Habitat Management Zone	29.5	100	0	28.5	41	0	0	9	87	50	38	0	4
Wirrilah BOA														
W1	Habitat Management Zone	21	100	1	3	62	0	0	14	33	48	56	0	8
W2	Corridor Enhancement Zone	0	0	0	0	24	0	0	22	0	50	18	8	34
W3	Habitat Restoration Zone	0	0	0	24.5	49	0	0	16	0	66	34	2	22
W4	Habitat Management Zone	10.5	100	0	22.5	58	0	0	17	50	28	70	0	4
W5	Habitat Management Zone	6	0	0	8.5	67	0	0	15	22	68	50	0	6
W6	Habitat Restoration Zone	0	0	0	0	17	0	0	18	0	42	0	4	48
Namoi Offsets														
Namoi BOA														
N1	Habitat Management Zone	16.5	100	0	0	37	0	0	13	18	64	18	0	38
N2	Habitat Restoration Zone	0	0	0	5.5	23	0	0	20	0	74	28	0	42
N3	Habitat Management Zone	9	0	2	0	5	0	18.5	22	100	4	0	0	92
N4	Habitat Management Zone	8.5	100	1	5.5	34	0	0	14	19	10	24	0	10
N5	Habitat Restoration Zone	0	0	0	0	12	0	0	18	0	22	46	0	44
N6	Habitat Restoration Zone	0	0	0	0	21	0	0	21	0	38	36	0	54
N7	Habitat Management Zone	12	0	3	0	36	0	17.5	18	27	56	22	0	30
N8	Habitat Management Zone	0	0	0	0	25	0	0	16	0	84	14	0	8

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
N9	Habitat Restoration Zone	0	0	0	2	33	0	0	22	0	72	20	6	14
N10	Habitat Management Zone	3.5	100	0	3	38	0	0	16	4	68	4	0	24
N11	Habitat Restoration Zone	0	0	0	1.5	35	0	0	20	0	60	2	34	42
N12	Habitat Management Zone	15.5	100	1	29	37	0	0	17	66	32	52	4	10
N13	Habitat Management Zone	41	100	5	15	33	0	0	17	40	66	40	2	2
N14	Habitat Management Zone	22.5	100	6	37	47	0	0	15	38	24	40	22	0
Western Offset Area														
Merriendi BOA														
Me1	Habitat Management Zone	10.5	100	1	3.5	53	0	0	16	42	48	56	0	0
Me2	Habitat Restoration Zone	0	0	0	2	26	0	0	18	0	86	22	0	22
Me3	Habitat Management Zone	24.5	100	0	22	36	0	0	11	16	24	52	14	0
Me4	Habitat Management Zone	26.5	100	2	26.5	40	0	0	14	5	40	50	2	4
Me5	Habitat Restoration Zone	0	0	0	0	18	0	0	11	0	66	0	0	84
Me6	Habitat Restoration Zone	0	0	0	0	19	0	0	16	0	24	4	0	88

E3 2017 BENCHMARK

Table E.3 2017 monitoring benchmark scores for vegetation attributes

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUIT-MENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Eastern Offset Area														
Nioka North BOA														
NN1	Habitat Management Zone	20.5	100	2	11	38	0	0	31	70	26	28	12	34
NN2	Habitat Restoration Zone	0	0	0	1	20	0	0	22	1	12	16	0	68
NN3	Habitat Management Zone	16.5	100	0	41.5	52	0	0	8	45	32	17	6	18
NN4	Habitat Management Zone	16	100	0	11.5	42	0	0	21	3	20	32	2	42
NN5	Habitat Restoration Zone	0	0	0	0	24	0	0	20	0	20	44	0	32
NN6	Habitat Restoration Zone	0	0	0	0	22	0	0	18	1.5	26	38	0	42
Sunshine BOA														
S1	Habitat Management Zone	30.5	100	0	16	32	0	0	30	35	32	18	0	42
S2	Habitat Restoration Zone	0	50	0	2	25	0	0	30	3	38	8	0	54
S3	Habitat Management Zone	0	0	0	0.5	13	0	0	19	0	26	4	2	48
S4	Corridor Enhancement Zone	0	0	0	0	8	0	0	19	0	18	2	0	68
S5	Corridor Enhancement Zone	0	0	0	0	10	0	0	18	2	12	4	0	50

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Braefield BOA														
B1	Habitat Management Zone	11.5	100	0	9	46	0	0	18	60	36	18	2	38
B2	Habitat Management Zone	32	100	3	49	44	0	0	7	124	28	36	4	8
B3	Habitat Management Zone	28.5	100	3	36	47	0	0	8	80	28	36	6	6
B4	Habitat Restoration Zone	0	0.5	0	0	28	0	0	18	11	26	46	0	32
B5	Habitat Management Zone	34.5	100	1	19.5	32	0	0	22	80	18	44	2	28
B6	Habitat Restoration Zone	3	0	0	18.5	21	0	0	18	2.5	24	28	2	12
Central Offset Area														
Mallee BOA														
Ma1	Habitat Restoration Zone	0	20	0	0	19	0	0	15	0	34	24	0	58
Ma2	Habitat Management Zone	6.6	100	1	12.25	42	0	0	13	14	44	24	12	28
Ma3	Habitat Management Zone	7.5	100	0	10	40	0	0	5	7	24	24	14	8
Ma4	Habitat Management Zone	24.5	100	0	15.5	40	0	0	9	30	34	28	0	4
Ma5	Habitat Management Zone	37.5	100	0	20	41	0	0	12	30	32	38	0	22
Myall Plains BOA														
My1	Habitat Restoration Zone	2.5	100	0	17.5	38	0	0	12	4	26	28	0	34
My2	Habitat Restoration Zone	0	0	1	0.5	26	0	0	16	12	38	32	0	46
My3	Habitat Management Zone	20	100	4	7.8	40	0	0	4	32	38	32	4	6
My4	Habitat Management Zone	21	100	3	21.5	41	0	0	5	52	26	28	4	4

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
My5	Habitat Management Zone	19.5	100	4	39.5	42	0	0	4	65	46	28	12	2
My6	Habitat Management Zone	30	100	0	28	44	0	0	6	90	62	28	0	4
Wirrilah BOA														
W1	Habitat Management Zone	24	100	1	4.5	55	0	0	7	32	38	34	2	0
W2	Corridor Enhancement Zone	0	0	0	0	24	0	0	14	0	28	6	4	28
W3	Habitat Restoration Zone	0	0	0	28.5	48	0	0	11	0	50	24	6	12
W4	Habitat Management Zone	18.5	100	0	21.5	55	0	0	3	49	36	24	14	0
W5	Habitat Management Zone	4.5	100	0	26.5	47	0	0	5	40	54	6	34	0
W6	Habitat Restoration Zone	0	0	0	0	19	0	0	16	0	32	8	0	30
Namoi Offsets														
Namoi BOA														
N1	Habitat Management Zone	16	100	0	0	38	0	0	13	44	48	20	0	14
N2	Habitat Restoration Zone	0	0	0	4	20	0	0	9	0	64	8	0	46
N3	Habitat Management Zone	25.5	0	2	0	24	0	52	6	127	0	0	0	98
N4	Habitat Management Zone	15	100	1	5.5	33	0	0	23	20	4	28	0	8
N5	Habitat Restoration Zone	0	0	0	0	21	0	0	12	0	42	2	20	46
N6	Habitat Restoration Zone	0	0	0	0	27	0	0	13	0	14	14	4	62
N7	Habitat Management Zone	16.5	0	3	0	22	0	15	15	30	32	8	0	20
N8	Habitat Management Zone	0	0	0	0	25	0	0	23	61	80	10	0	10

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
N9	Habitat Restoration Zone	0	0	0	0	32	0	0	21	0	38	12	4	38
N10	Habitat Management Zone	20	100	0	20	23	0	0	28	4	70	4	0	34
N11	Habitat Restoration Zone	0	100	0	26	22	0	0	26	0	56	28	0	36
N12	Habitat Management Zone	17.5	100	1	27	32	0	0	20	84	30	12	42	4
N13	Habitat Management Zone	42.5	100	5	15.5	34	0	1.5	7	66	44	32	2	2
N14	Habitat Management Zone	18.5	100	3	43	35	0	0	15	101	18	10	34	0
N15	Habitat Management Zone	15	0	1	0	14	0	0	3	12	0	14	0	80
Western Offset Area														
Merriendi BOA														
Me1	Habitat Management Zone	10.5	100	1	4.5	46	0	0	18	55	28	38	0	0
Me2	Habitat Restoration Zone	0	0	0	0	28	0	0	19	0	54	14	0	32
Me3	Habitat Management Zone	14.5	100	0	24.5	40	0	0	12	41	8	38	25	0
Me4	Habitat Management Zone	17.5	100	2	25.5	39	0	0	10	27	20	24	18	0
Me5	Habitat Restoration Zone	0	0	0	1.5	14	0	0	10	23	34	4	0	4
Me6	Habitat Restoration Zone	0	0	0	0	19	0	0	12	0	34	0	12	52

E4 2018 BENCHMARK

Table E.4 2018 monitoring benchmark scores for vegetation attributes

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Eastern Offset Area														
Nioka North BOA														
NN1	Habitat Management Zone	18.5	0	2	0.9	32	0	0.1	25	76	48	30	14	6
NN2	Habitat Restoration Zone	0	0	0	0.1	30	0	0	18	2	40	4	0	54
NN3	Habitat Management Zone	15	50	0	31.5	53	0	0	21	64	40	42	12	6
NN4	Habitat Management Zone	12	100	0	14.2	37	0	0	9	19	60	22	6	10
NN5	Habitat Restoration Zone	0	0	0	0.1	28	0	0.05	22	0	20	12	0	78
NN6	Habitat Restoration Zone	0	0	0	0.1	28	0	0	15	0	20	8	0	72
Sunshine BOA														
S1	Habitat Management Zone	38.5	100	0	18	31	0	0	25	46	48	30	4	18
S2	Habitat Restoration Zone	0	100	0	5	43	0	4.1	20	0	36	30	1	17
S3	Habitat Management Zone	0	0	0	0.1	12	0	0	24	4	12	4	0	84
S4	Corridor Enhancement Zone	0	0	0	0.8	18	0	0	23	0	14	4	0	82
S5	Corridor Enhancement Zone	0	0	0	0	17	0	0	14	0	12	6	0	82

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Braefield BOA														
B1	Habitat Management Zone	9.7	100	1	4.5	45	0	0	11	53	76	22	2	0
B2	Habitat Management Zone	20.5	100	2	46	38	0	0	3	57	20	22	42	0
B3	Habitat Management Zone	27	100	4	67	37	0	0	2	41	16	20	44	4
B4	Habitat Restoration Zone	0	0	0	0.4	37	0	0	13	6	14	32	0	54
B5	Habitat Management Zone	18.5	100	1	16.5	35	0	1.5	10	47	64	38	0	4
B6	Habitat Restoration Zone	0	0	0	24	31	0	0	14	0	40	8	0	16
Central Offset Area														
Mallee BOA														
Ma1	Habitat Restoration Zone	0	0	0	5.6	31	0	0	12	0	54	34	2	12
Ma2	Habitat Management Zone	3.5	0	3	4.7	37	0	0	2	0	78	10	0	2
Ma3	Habitat Management Zone	2	0	0	9	35	0	0	1	23	10	2	30	0
Ma4	Habitat Management Zone	22.5	67	2	22.5	35	0	0	1	39	52	2	16	0
Ma5	Habitat Management Zone	6	0	0	39	46	0	0	4	37	44	24	18	6
Myall Plains BOA														
My1	Habitat Restoration Zone	0	50	1	20	36	0	0	4	0	86	10	4	0
My2	Habitat Restoration Zone	0	0	1	0	28	0	0	10	6	78	10	0	12
My3	Habitat Management Zone	23.5	0	5	10	30	0	0	1	27	42	0	10	0
My4	Habitat Management Zone	13.5	0	5	29.5	50	0	0	2	22	56	12	24	0

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
My5	Habitat Management Zone	13.5	100	5	31.5	46	0	0	1	39	50	4	38	0
My6	Habitat Management Zone	30	50	3	20	43	0	0	4	80	72	14	10	0
Wirrilah BOA														
W1	Habitat Management Zone	15	0	0	4.4	43	0	0	7	12	70	24	6	0
W2	Corridor Enhancement Zone	0	0	0	0	24	0	0	11	0	74	6	0	18
W3	Habitat Restoration Zone	0.4	100	0	37.5	36	0	0	1	0	64	20	10	0
W4	Habitat Management Zone	2.5	50	0	21	47	0	0	2	28	60	24	14	0
W5	Habitat Management Zone	1.5	100	0	27	42	0	0	2	17	72	8	0	0
W6	Habitat Restoration Zone	0	0	0	0	24	0	0	10	0	52	4	6	38
W7	Corridor Enhancement Zone	0	0	0	0	22	0	0	10	0	78	8	2	12
Goonbri BOA														
G1	Habitat Management Zone	11	50	0	3.7	38	0	0	3	11	84	12	0	0
G2	Habitat Restoration Zone	0	100	0	0	25	0	0	10	0	48	20	6	26
Namoi Offsets														
Namoi BOA														
N1	Habitat Management Zone	25.5	0	0	0	46	0	0.4	8	36	80	16	0	0
N2	Habitat Restoration Zone	0	0	0	1	32	0	0	18	0	76	14	6	4
N3	Habitat Management Zone	30	0	1	1	113	0	1.6	21	147	0	6	2	92
N4	Habitat Management Zone	16.5	0	1	3.5	50	0	0	9	38	20	38	6	4

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
N5	Habitat Restoration Zone	0	0	0	0	29	0	0	21	0	6	4	0	90
N6	Habitat Restoration Zone	0	0	0	0.9	27	0	0	20	0	0	2	2	52
N7	Habitat Management Zone	13.5	0	2	10.5	33	0	0	24	48	58	24	16	0
N8	Habitat Management Zone	0	0	1	0	42	0	0.6	9	65	72	18	0	6
N9	Habitat Restoration Zone	0	0	0	1.7	32	0	0.1	11	0	72	26	0	2
N10	Habitat Management Zone	1	0	0	1.2	53	0	0.6	15	21	72	16	2	0
N11	Habitat Restoration Zone	0	0	0	0	37	0	0	12	0	68	30	0	2
N12	Habitat Management Zone	19.5	0	1	29.5	39	0	0	10	70	56	34	10	0
N13	Habitat Management Zone	48.5	0	0	10.5	40	0	0	6	47	18	52	14	6
N14	Habitat Management Zone	13	50	1	37	46	0	0	1	84	30	32	10	0
N15	Habitat Management Zone	2	0	1	0.2	9	0	0	11	9	0	2	4	94
N16	Habitat Restoration Zone	0	0	0	0	30	0	0	20	0	22	4	0	74
N17	Habitat Restoration Zone	0	0	0	4.5	21	0	0	12	0	6	16	48	30

SITE ID	MANAGEMENT ZONE	NATIVE OVER-STOREY COVER %	CANOPY RECRUITMENT %	NO. TREES WITH HOLLOWES	NATIVE MID-STOREY COVER %	NATIVE SPECIES RICHNESS	EXOTIC OVER-STOREY COVER %	EXOTIC MID-STOREY COVER %	EXOTIC SPECIES RICHNESS	LARGE WOODY DEBRIS (M)	NATIVE GRASS %	NATIVE OTHER %	NATIVE SHRUB (<1M) %	EXOTIC %
Western Offset Area														
Merriendi BOA														
Me1	Habitat Management Zone	2.7	50	2	3	54	0	0	7	15	62	28	0	10
Me2	Habitat Restoration Zone	0	0	0	0.8	38	0	0	7	0	56	6	0	38
Me3	Habitat Management Zone	3.3	0	0	23.5	35	0	0	19	17	18	64	18	0
Me4	Habitat Management Zone	3.5	100	2	36	42	0	0	8	17	38	12	36	2
Me5a	Habitat Restoration Zone	0	0	0	0.3	19	0	0	5	6	54	0	0	46
Me6	Habitat Restoration Zone	0	0	0	0	27	0	0	10	0	38	20	14	28





APPENDIX F

PHOTOGRAPHIC MONITORING



F.1 EASTERN OFFSET AREA

F.1.1 Nioka North BOA

Nioka North (Nil)	
	
2015 baseline monitoring event	2016 monitoring event
	
2017 monitoring event	2018 monitoring event

Nioka North (Ni2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Nioka North (Ni3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Nioka North (Ni4)



2015 baseline monitoring event



2016 monitoring event

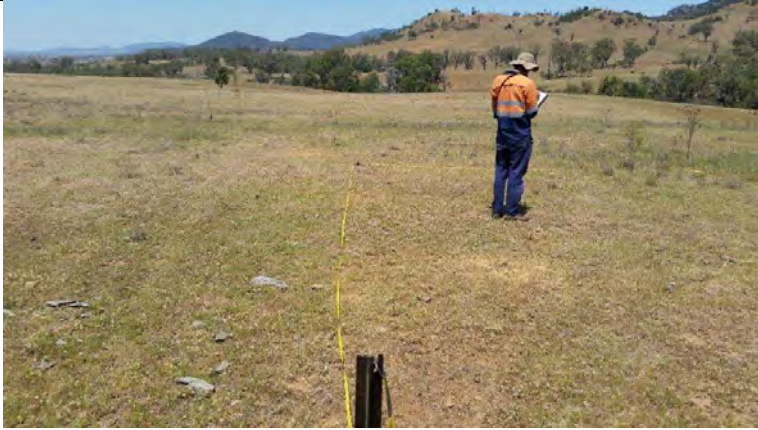


2017 monitoring event



2018 monitoring event

Nioka North (Ni5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Nioka North (Ni6)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

F.1.2 Sunshine BOA

Sunshine (S1)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Sunshine (S2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Sunshine (S3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Sunshine (S4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Sunshine (S5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

F.1.3 Braefield BOA

Braefield (B1)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Braefield (B2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Braefield (B3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

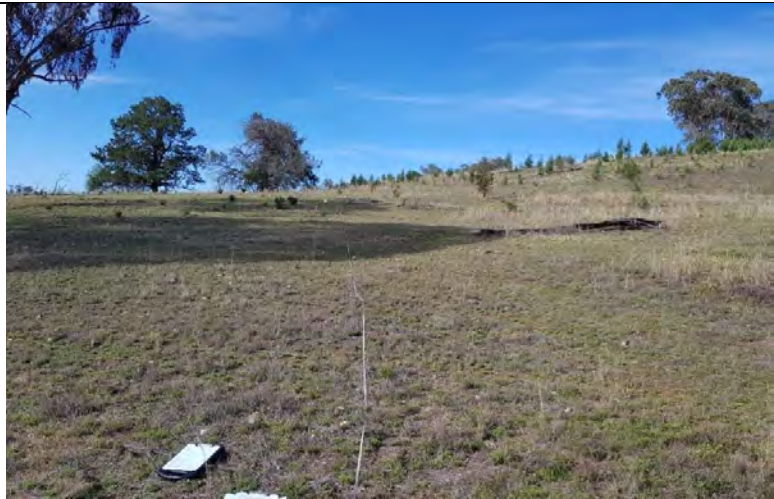
Braefield (B4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Braefield (B5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Braefield (B6)



2015 baseline monitoring event



2016 monitoring event






2017 monitoring event



2018 monitoring event

F.2 CENTRAL OFFSET AREA

F.2.1 Mallee BOA

Mallee (Ma1)	
	
2015 baseline monitoring event	2016 monitoring event
	
2017 monitoring event	2018 monitoring event

Mallee (Ma2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Mallee (Ma3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Mallee (Ma4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Mallee (Ma5)



2015 baseline monitoring event



2016 monitoring event







2017 monitoring event



2018 monitoring event

F.2.2 Myall Plains BOA

Myall Plains (My1)	
 A wide-angle photograph of a grassy field with scattered trees under a cloudy sky. The grass is dry and yellowish-brown.	 A photograph of a grassy field with scattered trees under a clear blue sky. The grass is green and lush.
<p>2015 baseline monitoring event</p>	<p>2016 monitoring event</p>
 A photograph of a grassy field with scattered trees under a cloudy sky. The grass is dry and yellowish-brown.	 A photograph of a grassy field with scattered trees under a cloudy sky. The grass is dry and yellowish-brown.
<p>2017 monitoring event</p>	<p>2018 monitoring event</p>

Myall Plains (My2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Myall Plains (My3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Myall Plains (My4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Myall Plains (My5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Myall Plains (My6)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

F.2.3 Wirrilah BOA

Wirrilah (W1)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Wirrilah (W2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Wirrilah (W3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Wirrilah (W4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Wirrilah (W5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

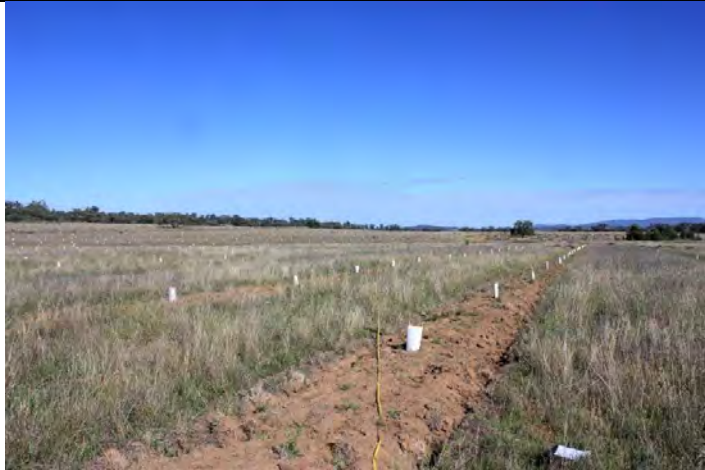
Wirrilah (W6)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Wirrilah (W7)



2018 baseline monitoring event

F.2.4 Goonbri BOA

Goonbri (G1)



2018 baseline monitoring event


Goonbri (G2)



2018 baseline monitoring event

F.3 NAMOI OFFSET AREA

F.3.1 Namoi BOA

Namoi (Na1a)	
	
2015 baseline monitoring event	2016 monitoring event
	
2017 monitoring event	2018 monitoring event

Namoi (Na2a)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na5)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na6)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na7a)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na8)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na9)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na10)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na11)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na12)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na13)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na14)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Namoi (Na15a)



2017 baseline monitoring event



2018 monitoring event

Namoi (Na16)



2018 baseline monitoring event





Namoi (Na17)



2018 baseline monitoring event

F.4 WESTERN OFFSET AREA

F.4.1 Merriendi BOA

Merriendi (Me1)	
	
2015 baseline monitoring event	2016 monitoring event
	
2017 monitoring event	2018 monitoring event

Merriendi (Me2)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Merriendi (Me3)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Merriendi (Me4)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

Merriendi (Me5a)



2017 baseline monitoring event



2018 monitoring event

Merriendi (Me6)



2015 baseline monitoring event



2016 monitoring event



2017 monitoring event



2018 monitoring event

ABOUT US

WSP is one of the world's leading engineering professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, planners, surveyors, environmental specialists, as well as other design, program and construction management professionals. We design lasting Property & Buildings, Transportation & Infrastructure, Resources (including Mining and Industry), Water, Power and Environmental solutions, as well as provide project delivery and strategic consulting services. With 36,000 talented people in more than 500 offices across 40 countries, we engineer projects that will help societies grow for lifetimes to come.

