umwelt
Environmental & Social Consultants

earthtrade

HABITAT QUALITY ASSESSMENT

Killara Offset Area

FINAL

December 2020

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Killara Offset Area

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Environmental Offset Solutions Pty Ltd (Earthtrade)

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1.0 Introduction

Umwelt was engaged by Environmental Offset Solutions Pty Ltd (Earthtrade) to undertake a terrestrial habitat quality assessment in support of the Arrow Energy Pty Ltd (Arrow) Surat Gas Project (the Project). The Project was conditioned under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Project approval (EPBC 2010/5344) to include the provision of offsets for unavoidable impacts on Matters of National Environmental Significance (MNES).

This assessment considers four land parcels with the potential to satisfy or contribute to the final offset portfolio for the Project by determining the suitability of the proposed offset site relative to the Project impact site.

1.1 Study Area

Four land parcels situated approximately 65 km north-west of Kingaroy in Queensland (QLD) have been provisionally identified by Earthtrade as having potential to satisfy or contribute toward the final offset portfolio for the Project. These four land parcels are collectively known as 'Killara' and will be referred to herein as the 'Study Area' (**Figure 1.1**). The Study Area comprises the following four land parcels:

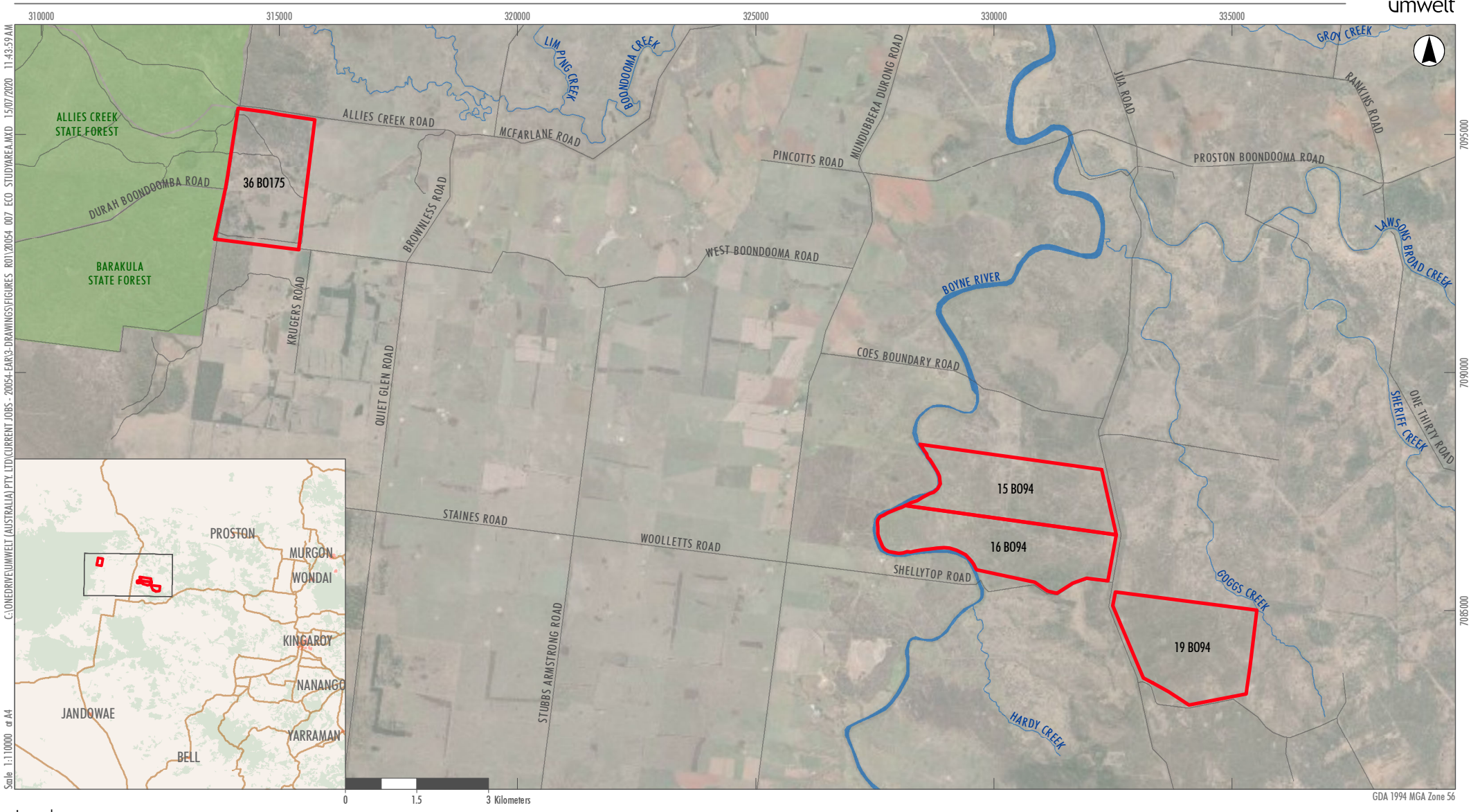
- Lot 36 BO175
- Lot 16 BO94
- Lot 15 BO94
- Lot 19 BO94.

The Study Area has previously been assessed for its suitability as an offset by AECOM (2018), including the preparation of vegetation mapping. A summary of results of the AECOM (2018) report is provided in **Section 1.3.2**.

1.2 Scope of Works

The overarching aim of this habitat quality assessment was to identify suitable offsets within Killara to compensate clearing activities as part of the Project. To meet the Project aims, in accordance with the *Guide to determining terrestrial habitat quality* (Department of Environment and Science (DES), 2020a), the following scope of works was undertaken:

- Review existing habitat quality assessments undertaken within the Study Area and re-score existing habitat quality sites against the updated methodology (DES, 2020a)
- Undertake habitat quality assessments (as outlined in **Section 1.3.2**)
- Provide habitat quality scores for target MNES values (**Section 1.3.1**), informed by targeted fauna surveys and/or habitat assessments.



Legend

- Study Area
- State Forest
- Roads
- Watercourse

FIGURE 1.1

Project Locality

Image Source: ESRI (2020) Data source: Qspatial (2020)

1.3 Background

1.3.1 Surat Gas Project Impacted Values

The Surat Basin Offset Strategy (Arrow Energy, 2019), identifies nine MNES values requiring offsets (**Table 1.1**). These values are the target of this assessment.

Table 1.1 Surat Gas Project Impacted Values

MNES / MSES	Scientific Name	EPBC Act Status	NC Act[1]
Threatened Ecological Community (TEC)			
Brigalow (*Acacia harpophylla* dominant and co-dominant)		Endangered	Endangered
Threatened Species			
Brigalow woodland snail	*Adclarkia cameroni*	Endangered	Vulnerable
Dulacca woodland snail	*Adclarkia dulacca*	Endangered	Endangered
Dunmall's snake	*Furina dunmalli*	Vulnerable	Vulnerable
Greater glider	*Petauroides volans*	Vulnerable	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable
Painted honeyeater	*Grantiella picta*	Vulnerable	Vulnerable
South-eastern long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable
Kogan waxflower	*Philotheca sporadica*	Vulnerable	Near Threatened

1.3.2 Habitat Quality Assessments (AECOM, 2018)

The initial property assessment of the Study Area, undertaken in 2018, involved completion of vegetation mapping, preliminary habitat quality assessments and fauna habitat modelling. A review of this report in conjunction with the vegetation mapping has identified the requirement for additional habitat quality assessment sites to meet the minimum number of sites outlined in the *Guide to determining terrestrial habitat quality* (DES, 2020a).

A breakdown of the existing effort (AECOM, 2018) completed within the Study Area and additional habitat quality sites required is presented in **Table 1.2**.

Table 1.2 Habitat Quality Assessment Sites

Regional Ecosystem	Area (ha)	Number of Sites Required	AECOM (2018) Sites	Umwelt Scope
36 BO175				
11.12.1a	58	3	1	2
11.3.2	14	2	-	2
11.3.25	18	2	-	2
11.4.3	64	3	1	2
11.5.20	57	3	-	3
11.7.6	94	3	2	1
Subtotal				**12**

Regional Ecosystem	Area (ha)	Number of Sites Required	AECOM (2018) Sites	Umwelt Scope
15 BO94 and 16 BO94				
11.12.1a	824	5	3	2
11.12.6b	35	2	-	2
11.3.25	9	2	-	2
11.5.1	54	3	1	2
11.5.1/11.12.3	79	3		3
11.5.1a	18	2	1	1
Subtotal				**12**
19 BO94				
11.12.1a	485	4	3	1
11.12.3	18	2	-	2
Subtotal				**3**
Total Habitat Quality Assessment Sites Required				**27**

2.0 Methods

2.1 Desktop Assessment

Updated desktop searches were completed using the following data sources to inform the field survey and confirm findings made by AECOM (2018):

- Department of Agriculture, Water and the Environment (DAWE) EPBC Protected Matters Search Tool (PMST)
- DES Wildlife Online database
- Department of Natural Resources, Mines and Energy (DNRME) Regulated Vegetation Management Map
- Australian Virtual Herbarium and Atlas of Living Australia database.

The search area for the database searches was designated as the Study Area with a 10 km buffer applied. The PMST search results have been included within **Appendix 1**.

2.2 Habitat Assessment and Targeted Surveys

2.2.1 Survey Effort

2.2.1.1 AECOM Survey

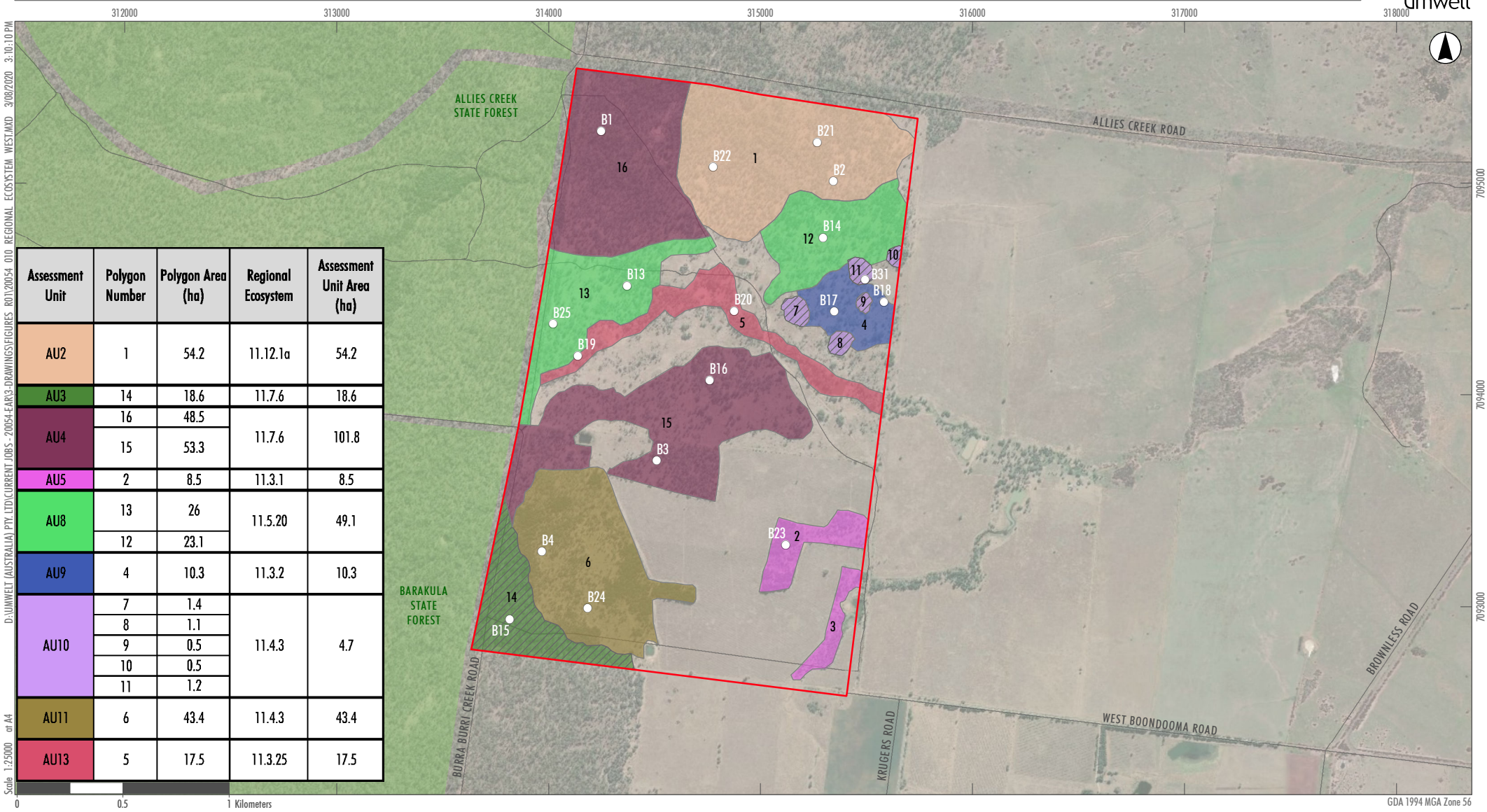
A five-day ecological survey was undertaken from 16 to 19 April 2018 by two AECOM ecologists. Twelve habitat quality assessment sites were sampled during the survey. The AECOM field survey locations are depicted in **Figure 2.1A** and **Figure 2.2B**.

2.2.1.2 Umwelt Survey

An ecological survey of the Study Area was undertaken by two Umwelt ecologists over seven days from 16 to 22 June 2020. Twenty-eight habitat quality assessment sites were sampled during the survey. The Umwelt field survey locations are depicted in **Figure 2.1A** and **Figure 2.2B**.

2.2.2 Regional Ecosystem Delineation

Preliminary vegetation mapping was completed as part of the AECOM (2018) survey. As part of the 2020 assessment, the mapping was further refined, including increased replication, modifications to vegetation community boundaries and resolution of heterogenous vegetation polygons. The vegetation was sampled, classified and mapped in accordance with the *QLD Herbarium Methodology for survey and mapping of vegetation communities and regional ecosystems in Queensland* (Neldner et al., 2019). For the purposes of this assessment, vegetation communities were further delineated by remnant status, categorised as either 'remnant' or 'regrowth'.



Assessment Unit	Polygon Number	Polygon Area (ha)	Regional Ecosystem	Assessment Unit Area (ha)
AU2	1	54.2	11.12.1a	54.2
AU3	14	18.6	11.7.6	18.6
AU4	16	48.5	11.7.6	101.8
	15	53.3		
AU5	2	8.5	11.3.1	8.5
AU8	13	26	11.5.20	49.1
	12	23.1		
AU9	4	10.3	11.3.2	10.3
AU10	7	1.4	11.4.3	4.7
	8	1.1		
	9	0.5		
	10	0.5		
	11	1.2		
AU11	6	43.4	11.4.3	43.4
AU13	5	17.5	11.3.25	17.5

Legend

- Study Area
- State Forest
- Roads
- Sampling Sites

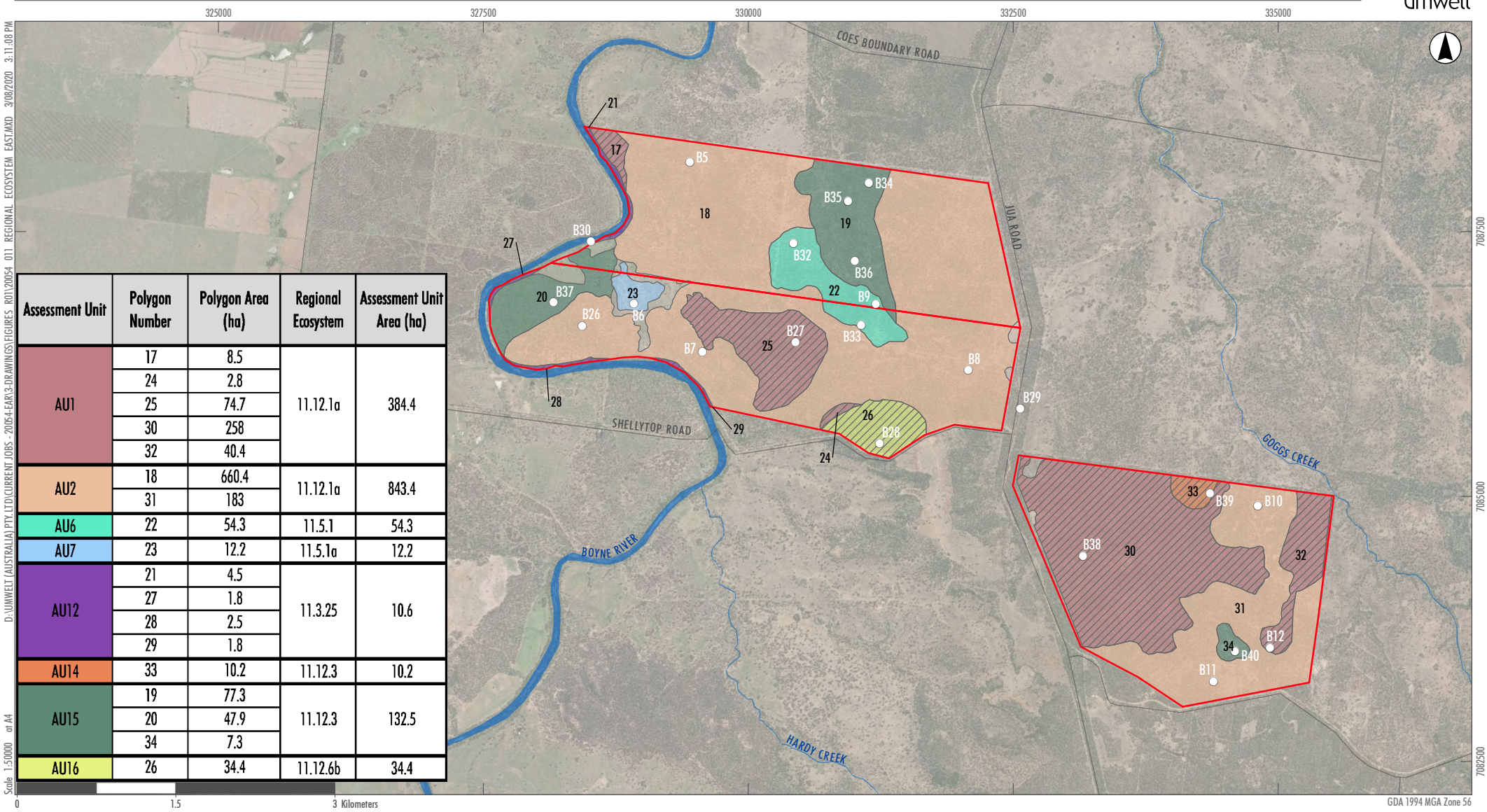
Vegetation Status

- Regrowth
- Remnant

FIGURE 2.1A

Ground-truthed Regional Ecosystems and Sampling Site Locations

Image Source: ESRI (2020) Data source: Qspatial (2020)



Assessment Unit	Polygon Number	Polygon Area (ha)	Regional Ecosystem	Assessment Unit Area (ha)
AU1	17	8.5	11.12.1a	384.4
	24	2.8		
	25	74.7		
	30	258		
	32	40.4		
AU2	18	660.4	11.12.1a	843.4
	31	183		
AU6	22	54.3	11.5.1	54.3
AU7	23	12.2	11.5.1a	12.2
AU12	21	4.5	11.3.25	10.6
	27	1.8		
	28	2.5		
	29	1.8		
AU14	33	10.2	11.12.3	10.2
AU15	19	77.3	11.12.3	132.5
	20	47.9		
	34	7.3		
AU16	26	34.4	11.12.6b	34.4

Legend

- Study Area
- Roads
- Watercourse
- Sampling Sites

Assessment Units

- AU1
- AU2
- AU6
- AU7
- AU12
- AU14
- AU15
- AU16

Vegetation Status

- Regrowth
- Remnant

FIGURE 2.1B

Ground-truthed Regional Ecosystems and Sampling Site Locations

Image Source: ESRI (2020) Data source: Qspatial (2020)

2.2.3 Habitat Quality Assessment and Scoring

Habitat quality was assessed in accordance with the *Guide to determining terrestrial habitat quality* (DES, 2020a). Habitat quality was determined based on an assessment of the following three attributes:

- **Site condition** indicates the general vegetation condition of the site compared to a reference site in an undisturbed state with most of its natural values intact (a BioCondition benchmark).
- **Site context** indicates the position of the site within the landscape and the influence this has on the site's vegetation quality.
- **Species habitat index** indicates the ability of the site to support a particular fauna species based on that species' specific habitat requirements.

The assessment of each set of attributes results in a habitat quality score out of 10, with a maximum score of 10 indicating a fully intact habitat. This method required the collection of site condition and ecological data (vegetation and microhabitat) at sampling sites within a 100 m x 50 m plot and various smaller sub-plots in accordance with the BioCondition assessment manual (Eyre et al., 2015).

2.2.3.1 Site Condition

Site-based attributes (**Table 2.1**) were scored against a 'BioCondition benchmark' document prepared by the QLD Herbarium, containing site-based attribute measurements for vegetation within a particular regional ecosystem (RE) in a relatively undisturbed state. Where a benchmark has not yet been developed by the QLD Herbarium (as with 11.12.3), reference sites were identified and surveyed in accordance with the *Method for the Establishment and Survey of Reference Sites for BioCondition* (Eyre et al., 2017). Two reference sites were established in 11.12.3, the locations of which are depicted in **Figure 2.1B**.

The site condition score for each sampling site was calculated by adding the scores obtained for each site-based attribute, and then dividing by the maximum possible score for the RE in question.

Table 2.1 Site-Based Attributes

Attribute	Maximum Score
Number of large native trees	15
Tree canopy height (emergent, canopy and sub-canopy)	5
Recruitment of woody perennial species (in the ecologically dominant layer)	5
Tree canopy cover (%) (emergent, canopy and sub-canopy)	5
Native shrub layer cover (%)	5
Coarse woody debris	5
Native plant species richness for trees, shrubs, grasses, and forbs/others	20
Non-native plant cover	10
Native perennial grass cover (%)	5
Organic litter cover	5
Maximum Total Score	**80**

2.2.3.2 Site Context

A site context assessment was undertaken at each sampling site to describe the landscape surrounding the Study Area and its influence on vegetation quality within the Study Area. The assessment used predefined thresholds for a fragmented landscape, as outlined in **Table 2.2**.

The scores for each attribute were calculated using GIS software QGIS (Version 3.10.7) and compared against the site context scoring guide to obtain a final site context score for each sampling site.

Table 2.2 Site Context Attributes (DES, 2020a)

Attribute	Maximum Score
Size of patch	10
Context	5
Connectivity	5
Ecological corridors[1]	N/A
Maximum Total Score	**20**

[1] An ecological corridor is represented as any riparian or terrestrial feature on the 'Statewide Biodiversity Corridors' layer, viewable on Queensland Globe (https://qldglobe.information.qld.gov.au/).

2.2.3.3 Species Habitat Index

A species habitat index assessment was undertaken for each sampling site to determine the Study Area's capacity to support threatened fauna species for all or part of their life cycles. In addition to a survey of potential fauna habitat in the field, the assessment involved undertaking a desktop review of identified target values to identify the species-specific factors relating to each of four predetermined attributes (**Table 2.3**).

The designated scores for each attribute were compared against the habitat index scoring guide to obtain a final habitat index score for each sampling site.

Table 2.3 Species Habitat Attributes (DES, 2020a)

Species Habitat Attribute	Maximum Score
Quality and availability of food and habitat required for foraging	25
Quality and availability of habitat required for shelter and breeding	25
Quality and availability of habitat required for mobility	25
Absence of threats	25
Maximum Total Score	**100**

2.2.3.4 Assessment Unit Scores

Habitat quality was assessed for each assessment unit by undertaking the following steps:

1. Habitat quality scores for each sampling site were calculated by adding the scores obtained for each site-based attribute, and then dividing by the maximum possible score for the RE in question (i.e. 80 for wooded ecosystems).

2. Assessment unit scores were determined by taking the average of the scores of the sampling sites within it.

2.2.3.5 Target Value Scores

Habitat quality was assessed for each target value by undertaking the following steps:

1. Habitat quality scores for each target value were calculated for relevant sampling sites by adding the scores obtained for site condition, site context and species habitat index assessments, and then dividing by the maximum possible score (i.e. 200 for wooded ecosystems).

2. Assessment unit scores were determined by taking the average of the scores of the sampling sites within it.

3. Area-weighted scores (e.g. a 'per-hectare' score) for each target value were calculated using the following equation:

$$Weighted\ Habitat\ Quality\ Score\ (Target\ Value) = \frac{Assessment\ Unit\ Habitat\ Quality\ Score\ \times Area\ (ha)\ of\ Assessment\ Unit}{Total\ Area\ (ha)\ of\ Matter\ Area}$$

Where:

Matter Area = All assessable potential habitat for target value within Study Area

2.2.4 Targeted Fauna Assessment

A targeted fauna assessment was undertaken across the Study Area in accordance with *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC), 2011) and the *EPBC Act referral guidelines for the vulnerable koala* (Department of the Environment, 2014) to determine the potential use of the Study Area for offsets for the greater glider and koala.

A brief summary of methods used in the fauna assessment is provided below, with the full report available as **Appendix 5**.

- Habitat assessments which characterise fauna habitat values were undertaken in accordance with *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et al., 2018). Information on the location, landform, vegetation structure, RE, and disturbance characteristics of sites were recorded. Microhabitat features such as coarse woody debris, tree hollows, soil cracking and leaf litter were also documented.

- Koala presence was assessed throughout the Study Area using the Spot Assessment Technique (SAT) (Phillips & Callaghan, 2011). A total of 20 koala SAT assessments were conducted.

- Hollow density counts were conducted at 18 of the 20 koala SAT survey location to assess the suitability of the habitat for greater glider.

- Spotlight searches were used to identify koalas and greater gliders within suitable habitat. This method involved the active scanning of vegetation using high powered torches, both on foot and using a vehicle.

2.3 Limitations

Ecological field surveys have inherent limitations associated with natural variation, seasonal constraints and accessibility. The field survey design considered these constraints, with sampling locations located within representative samples of vegetation communities. This assessment utilises field survey data collected over two seasons: autumn and winter. It is noted, however, that these surveys cannot account for the entire floral diversity present in one location.

Unavailability of benchmark data and suitable locations for the establishment of reference sites resulted in the inability to assess the quality of one RE (11.12.6b) within the Study Area. Notwithstanding, the number of sites sampled for each assessable RE met or exceed the minimum number of sites recommended in the *Guide to determining terrestrial habitat quality* (DES, 2020a).

3.0 Results

3.1 Desktop Assessment

3.1.1 Threatened Ecological Values

Database searches identified 7 TECs and 31 threatened species that may occur within the Study Area. Habitat within the Study Area aligns with Project offset requirements for one TEC and six threatened fauna species, as described in **Table 3.1**.

The full PMST database results are available in **Appendix 1**.

Table 3.1 Identified Target Values for the Project

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Threatened Ecological Communities			
Brigalow (*Acacia harpophylla* dominant and co-dominant)		Endangered	Endangered
Threatened Fauna			
Brigalow woodland snail	*Adclarkia cameroni*	Endangered	Vulnerable
Dunmall's snake	*Furina dunmalli*	Vulnerable	Vulnerable
Painted honeyeater	*Grantiella picta*	Vulnerable	Vulnerable
Greater glider	*Petauroides volans*	Vulnerable	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable
South-eastern long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable

3.2 Field Survey

3.2.1 Vegetation Communities

Eleven REs were verified within the Study Area and sampled for habitat quality, as detailed in **Table 3.2** and represented on **Figure 2.1A** and **Figure 2.1B**.

3.2.1.1 Threatened Ecological Communities

The field survey confirmed the occurrence of one TEC: Brigalow (*Acacia harpophylla* dominant and co-dominant). Analogous REs 11.4.3 and 11.3.1 were identified as meeting criteria for the TEC (Department of the Environment, 2013).

RE 11.3.2, analogous with the Poplar Box Grassy Woodland on Alluvial Plains TEC, was ground-truthed within the Study Area but did not meet key diagnostic characteristics and condition thresholds for the TEC (Department of the Environment and Energy (DoEE), 2019).

No other TECs were confirmed within the Study Area.

Table 3.2 Ground-truthed Regional Ecosystems within the Study Area

AU	RE ID	Status	Description	VM Act Status	Sampling Sites	Extent (ha)
AU1	11.12.1a	Remnant	*Eucalyptus crebra* woodland on igneous rocks	Least Concern	B12, B27, B38	384.5
AU2	11.12.1a	Regrowth			B2, B5, B7, B8, B10, B11, B21, B22, B26	897.7
AU3	11.7.6	Remnant	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	Least Concern	B15	18.7
AU4	11.7.6	Regrowth			B1, B3, B16	101.8
AU5	11.3.1	Regrowth	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Endangered	B23	12.8
AU6	11.5.1	Regrowth	*Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces	Least Concern	B9, B32, B33	54.3
AU7	11.5.1a	Regrowth	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer	Least Concern	B6	12.2
AU8	11.5.20	Regrowth	*Eucalyptus moluccana* and/or *E. microcarpa* and/or *E. woollsiana* +/- *E. crebra* woodland on Cainozoic sand plains	Least Concern	B13, B14, B25	49.1
AU9	11.3.2	Regrowth	*Eucalyptus populnea* woodland on alluvial plains	Of Concern	B17, B18	10.3
AU10	11.4.3	Remnant	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	Endangered	B31	4.7
AU11	11.4.3	Regrowth			B4, B24	43.4
AU12	11.3.25	Remnant	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least Concern	B30	10.6
AU13	11.3.25	Regrowth			B19, B20	17.5
AU14*	11.12.3	Remnant	*Eucalyptus crebra*, *E. tereticornis*, *Angophora leiocarpa* woodland on igneous rocks especially granite	Least Concern	B29, B39	10.2
AU15	11.12.3	Regrowth			B34, B35, B36, B37, B40	132.5
AU16^	11.12.6b	Remnant	*Corymbia citriodora* open forest on igneous rocks (granite)	Least Concern	B28	34.4
Total						1794.7

* Evaluation not undertaken due to being established as reference sites ^ Evaluation not undertaken due to the unavailability of benchmark data

3.2.2 Threatened Species

Koala and greater glider were visually identified within the Study Area during spotlight searches undertaken for the fauna assessment. Records were made from three REs, including regrowth *Eucalyptus tereticornis* fringing woodland (RE 11.3.25) and regrowth *Eucalyptus crebra* woodland (11.12.1a). The greater glider records were made within remnant *Corymbia citriodora* woodland (RE 11.7.6) and regrowth *Eucalyptus crebra* woodland (11.12.1a).

Koala scats were also observed in regrowth *Eucalyptus populnea* woodland (RE 11.5.1a), remnant and regrowth *Eucalyptus crebra* woodland (RE 11.12.1a) and regrowth *Eucalyptus crebra*/ *Eucalyptus tereticornis* woodland (11.12.3).

The full results of the targeted fauna assessment, including record locations, is available as **Appendix 5**.

3.2.3 Introduced Species

The field survey recorded 18 introduced flora species, of which three are Category 3 restricted species under the *Biosecurity Act 2014* (**Table 3.3**).

Table 3.3 Introduced Species Recorded within the Study Area

Scientific Name	Common Name	Biosecurity Act Status[1]
Dolichandra unguis-cati	cat's claw creeper	Category 3
Opuntia stricta	common prickly pear	Category 3
Opuntia tomentosa	velvety tree pear	Category 3

[1] *Biosecurity Act 2014* (Qld)

In addition to being listed as Category 3 restricted invasive plants under the *Biosecurity Act 2014*, cat's claw creeper, *Opuntia stricta* and *Opuntia tomentosa* are designated Weeds of National Significance (Invasive Plants and Animals Committee, 2016).

It is also noted that large areas (near B37), adjacent to the Boyne River, are impacted by the exotic species *Eragrostis curvula* (African lovegrass).

No introduced fauna species were observed during the field survey.

3.3 Habitat Quality Scores

3.3.1 Assessment Unit Scores

Habitat quality scores for each sampling site were determined using the methodology described in **Section 2.2.3** and are presented in **Appendix 2**. Habitat quality sites were generally of moderate to good condition, with scores ranging between 5.2 and 8.0 out of 10. Sampling sites within regrowth vegetation were generally in poorer condition than remnant vegetation, with scores averaging 6.0 and 7.6 respectively.

Habitat quality scores for each assessment unit are outlined in **Table 3.4**.

Table 3.4 Habitat Quality Scores by Assessment Unit

AU	RE ID	Status	Sampling Sites	Extent (ha)	Habitat Quality Score
AU1	11.12.1a	Remnant	B12, B27, B38	384.5	**7.6**
AU2	11.12.1a	Regrowth	B2, B5, B7, B8, B10, B11, B21, B22, B26	897.7	**6.4**
AU3	11.7.6	Remnant	B15	18.7	**8.0**
AU4	11.7.6	Regrowth	B1, B3, B16	101.8	**5.2**
AU5	11.3.1	Regrowth	B23	12.8	**5.9**
AU6	11.5.1	Regrowth	B9, B32, B33	54.3	**6.6**
AU7	11.5.1a	Regrowth	B6	12.2	**5.3**
AU8	11.5.20	Regrowth	B13, B14, B25	49.1	**6.4**
AU9	11.3.2	Regrowth	B17, B18	10.3	**6.3**
AU10	11.4.3	Remnant	B31	4.7	**7.4**
AU11	11.4.3	Regrowth	B4, B24	43.4	**5.9**
AU12	11.3.25	Remnant	B30	10.6	**7.5**
AU13	11.3.25	Regrowth	B19, B20	17.5	**6.8**
AU15	11.12.3	Regrowth	B34, B35, B36, B37, B40	132.5	**5.7**

3.3.2 Target Value Scores

Habitat quality scores for each target value were determined using the methodology described in **Section 2.2.3** and are presented in **Appendix 3.** Fauna habitat rules were adapted from AECOM (2018) and applied when calculating species habitat index scores to determine the amount of potential habitat available within the Study Area for each target value. Fauna habitat rules are detailed in **Table 3.5**.

Table 3.5 Potential Habitat Criteria

Scientific Name	Common Name	Habitat Criteria (Suitable Regional Ecosystems)
Threatened Ecological Communities		
Brigalow (*Acacia harpophylla*) dominant and co-dominant		11.3.1, 11.4.3
Threatened Fauna		
Adclarkia cameroni	Brigalow woodland snail	11.3.1, 11.4.3
Furina dunmalli	Dunmall's snake	11.3.1, 11.4.3, 11.5.1, 11.5.1a, 11.5.20, 11.7.6,
Grantiella picta	painted honeyeater	11.4.3, 11.5.1, 11.5.1a, 11.7.6, 11.12.1a, 11.12.3, 11.12.6b
Petauroides volans	greater glider	11.3.2, 11.3.25, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3
Phascolarctos cinereus	koala	11.3.2, 11.3.25, 11.5.1, 11.5.1.a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3
Nyctophilus corbeni	south-eastern long-eared bat	11.3.2, 11.3.25, 11.4.3, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3, 11.12.6b

Habitat quality sites were generally of moderate condition, with scores ranging between 4.9 and 6.1 out of 10. Overall habitat quality scores for each target value are detailed in **Table 3.6**. Scores by individual assessment unit are available as **Appendix 4.**

Table 3.6 Target Value Habitat Quality Scores

Scientific Name	Common Name	Potential Habitat (ha)	Habitat Quality Score
Threatened Ecological Communities			
Brigalow (*Acacia harpophylla*) dominant and co-dominant		60.9	**5.2**
Threatened Fauna			
Adclarkia cameroni	Brigalow woodland snail	60.9	**5.2**
Furina dunmalli	Dunmall's snake	297	**5.5**
Grantiella picta	painted honeyeater	1660	**5.7**
Petauroides volans	greater glider	1699.4	**4.9**
Phascolarctos cinereus	koala	1699.4	**5.7**
Nyctophilus corbeni	south-eastern long-eared bat	1781.9	**6.1**

4.0 Conclusion

The aim of this assessment was to identify suitable offsets within Killara to compensate for clearing activities as part of the Arrow Surat Gas Project. The assessment involved required field survey to verify and quantify the extent and condition of habitat for seven target values (one TEC and six threatened fauna) located within the Study Area. The results of this assessment confirmed:

- 60.9 ha of Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC habitat
- 60.9 ha brigalow woodland snail potential habitat
- 297 ha of Dunmall's snake potential habitat
- 1660 ha of painted honeyeater potential habitat
- 1699.4 ha of greater glider potential habitat
- 1699.4 ha of koala potential habitat
- 1781.9 ha of south-eastern long-eared bat potential habitat.

Habitat quality sites were generally of moderate to good condition, with scores ranging between 5.2 and 8.0 out of 10. Sampling sites within regrowth vegetation were generally in poorer condition than remnant vegetation, with scores averaging 6.0 and 7.6 respectively.

Targeted fauna surveys conducted as part of this assessment also confirmed the occurrence of two MNES fauna, including koala and greater glider. Current habitat for the greater glider is mostly associated with remnant vegetation (where hollows are present), however habitat use within regrowth woodlands were also detected. Koala activity was recorded across remnant and regrowth woodlands.

The assessment has identified opportunities and risks associated with offsets at Killara:

- Brigalow vegetation occurs as small, isolated patches or degraded, open communities.
- The Study Area is highly connected to areas of local and regional importance including, Barakula State Forest, Allies Creek State Forest and remnant vegetation along the Boyne River. Offset areas which consider connectivity into these areas and aim to enhance these corridors are likely to result in greater conservation outcomes for terrestrial fauna, including the target MNES values.

5.0 References

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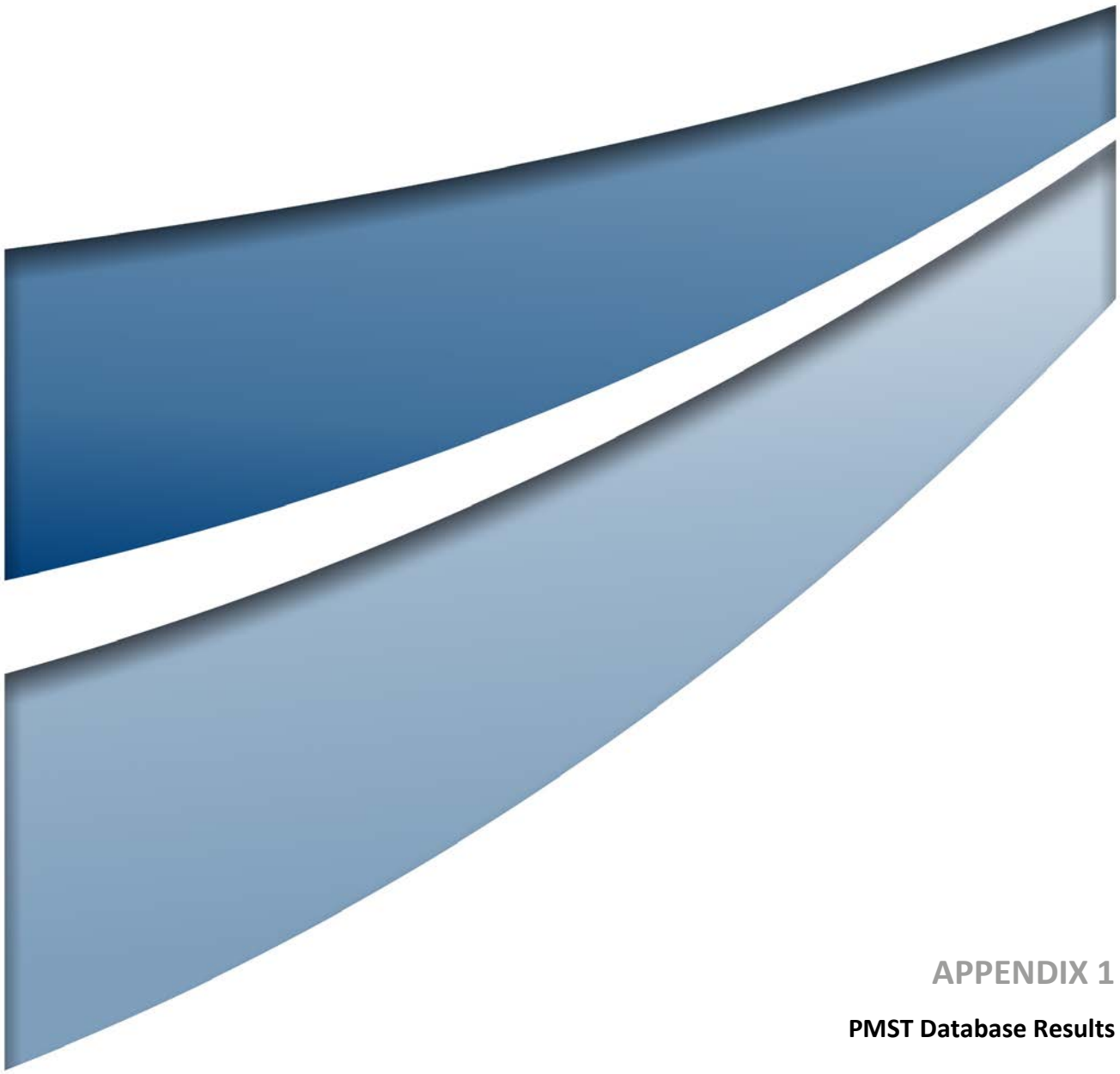
Phillips, S., & Callaghan, J. (2011). The Spot Assessment Technique: A tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus. *Australian Zoologist*, *35*(3), 774–779. https://doi.org/10.7882/az.2011.029



APPENDIX 1

PMST Database Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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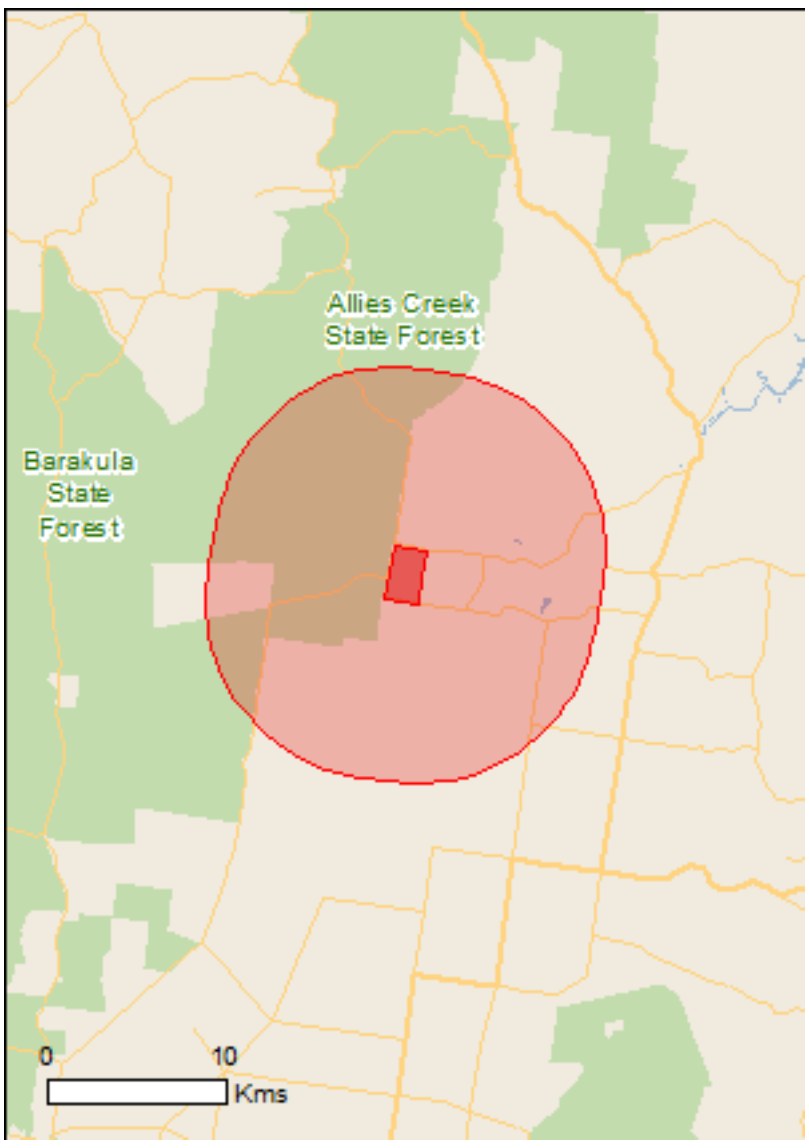

Coordinates

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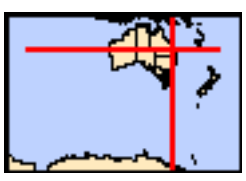

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	28
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	1300 - 1400km
Narran lake nature reserve	500 - 600km upstream
Riverland	1200 - 1300km
The coorong, and lakes alexandrina and albert wetland	1400 - 1500km

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		
[Maccullochella peelii](#) Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Mammals		
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
[Petauroides volans](#) Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
[Acacia grandifolia](#) [3566]	Vulnerable	Species or species habitat likely to occur within area
[Arthraxon hispidus](#) Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
[Cadellia pentastylis](#) Ooline [9828]	Vulnerable	Species or species habitat may occur within area
[Denhamia parvifolia](#) Small-leaved Denhamia [18106]	Vulnerable	Species or species habitat known to occur within area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
[Eucalyptus argophloia](#) Queensland White Gum, Queensland Western White Gum, Lapunyah, Scrub Gum, White Gum [19748]	Vulnerable	Species or species habitat may occur within area
[Homoranthus decumbens](#) a shrub [55186]	Endangered	Species or species habitat likely to occur within area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
[Xerothamnella herbacea](#) [4146]	Endangered	Species or species habitat known to occur within area
[Zieria verrucosa](#) [56761]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Reptiles		
[Anomalopus mackayi](#) Five-clawed Worm-skink, Long-legged Worm-skink [25934]	Vulnerable	Species or species habitat may occur within area
[Delma torquata](#) Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
[Egernia rugosa](#) Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
[Furina dunmalli](#) Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat likely to occur within area
[Monarcha trivirgatus](#) Spectacled Monarch [610]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat likely to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		

Name	Status	Type of Presence
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

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Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Australian Government
Department of the Environment and Energy

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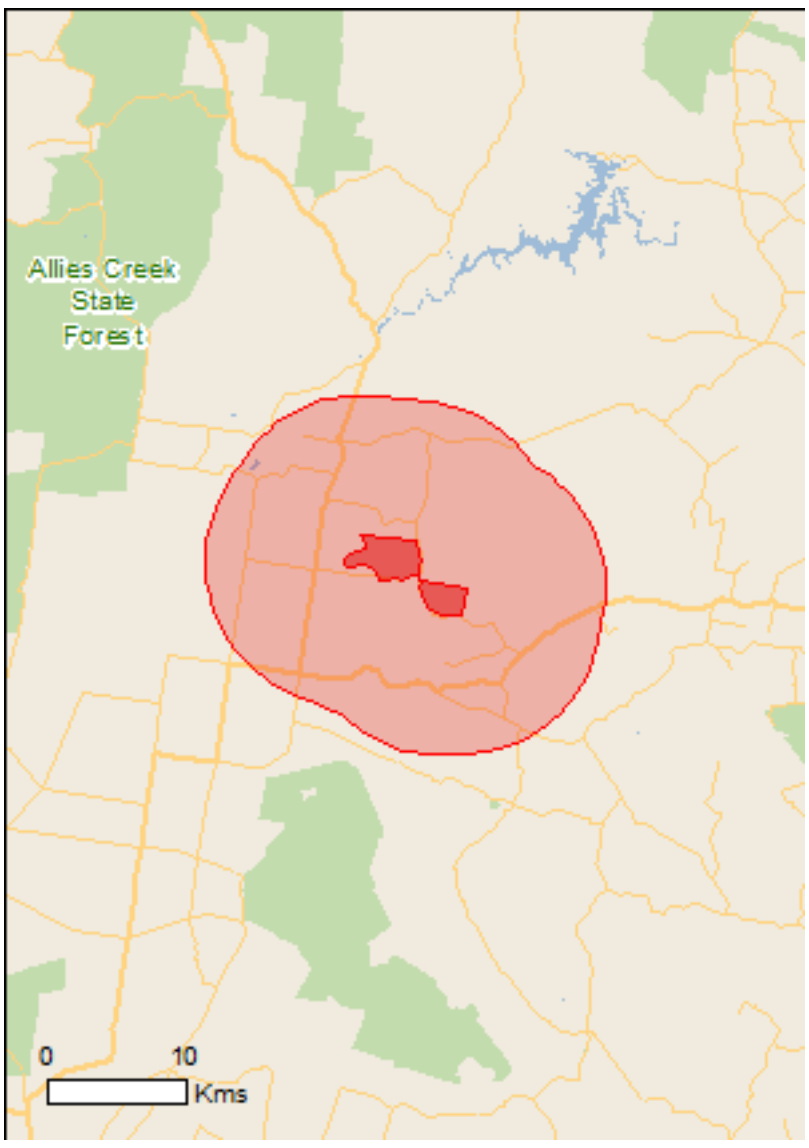

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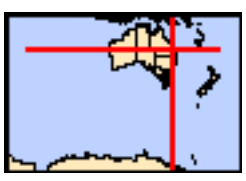

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Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	1300 - 1400km
Narran lake nature reserve	500 - 600km upstream
Riverland	1200 - 1300km
The coorong, and lakes alexandrina and albert wetland	1500 - 1600km

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
[Petauroides volans](#) Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
[Acacia grandifolia](#) [3566]	Vulnerable	Species or species habitat may occur within area
[Arthraxon hispidus](#) Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
[Cadellia pentastylis](#) Ooline [9828]	Vulnerable	Species or species habitat may occur within area
[Denhamia parvifolia](#) Small-leaved Denhamia [18106]	Vulnerable	Species or species habitat known to occur within area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
[Eucalyptus argophloia](#) Queensland White Gum, Queensland Western White Gum, Lapunyah, Scrub Gum, White Gum [19748]	Vulnerable	Species or species habitat may occur within area
[Haloragis exalata subsp. velutina](#) Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
[Phebalium distans](#) Mt Berryman Phebalium [81869]	Critically Endangered	Species or species habitat likely to occur within area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
[Xerothamnella herbacea](#) [4146]	Endangered	Species or species habitat known to occur within area
Reptiles		
[Anomalopus mackayi](#) Five-clawed Worm-skink, Long-legged Worm-	Vulnerable	Species or species

Name	Status	Type of Presence
skink [25934]		habitat may occur within area
Delma torquata		
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Egernia rugosa		
Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Elseya albagula		
Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Furina dunmalli		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area

Name	Status	Type of Presence
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-26.361376 151.348837,-26.361684 151.344888,-26.362145 151.33476,-26.356916 151.326864,-26.345071 151.321543,-26.342148 151.321886,-26.338764 151.319311,-26.338918 151.314848,-26.340764 151.311243,-26.340918 151.309183,-26.340148 151.307295,-26.339379 151.30575,-26.339841 151.303346,-26.340764 151.301458,-26.34061 151.294935,-26.336302 151.293047,-26.33461 151.291845,-26.333225 151.289614,-26.33261 151.285322,-26.333533 151.276911,-26.333072 151.274507,-26.331995 151.273134,-26.329533 151.272447,-26.327225 151.273477,-26.325225 151.277941,-26.323686 151.281545,-26.322148 151.285494,-26.320148 151.286695,-26.314454 151.282919,-26.318147 151.319311,-26.329841 151.322229,-26.338456 151.320169,-26.341379 151.322401,-26.345379 151.351927,-26.361376 151.348837

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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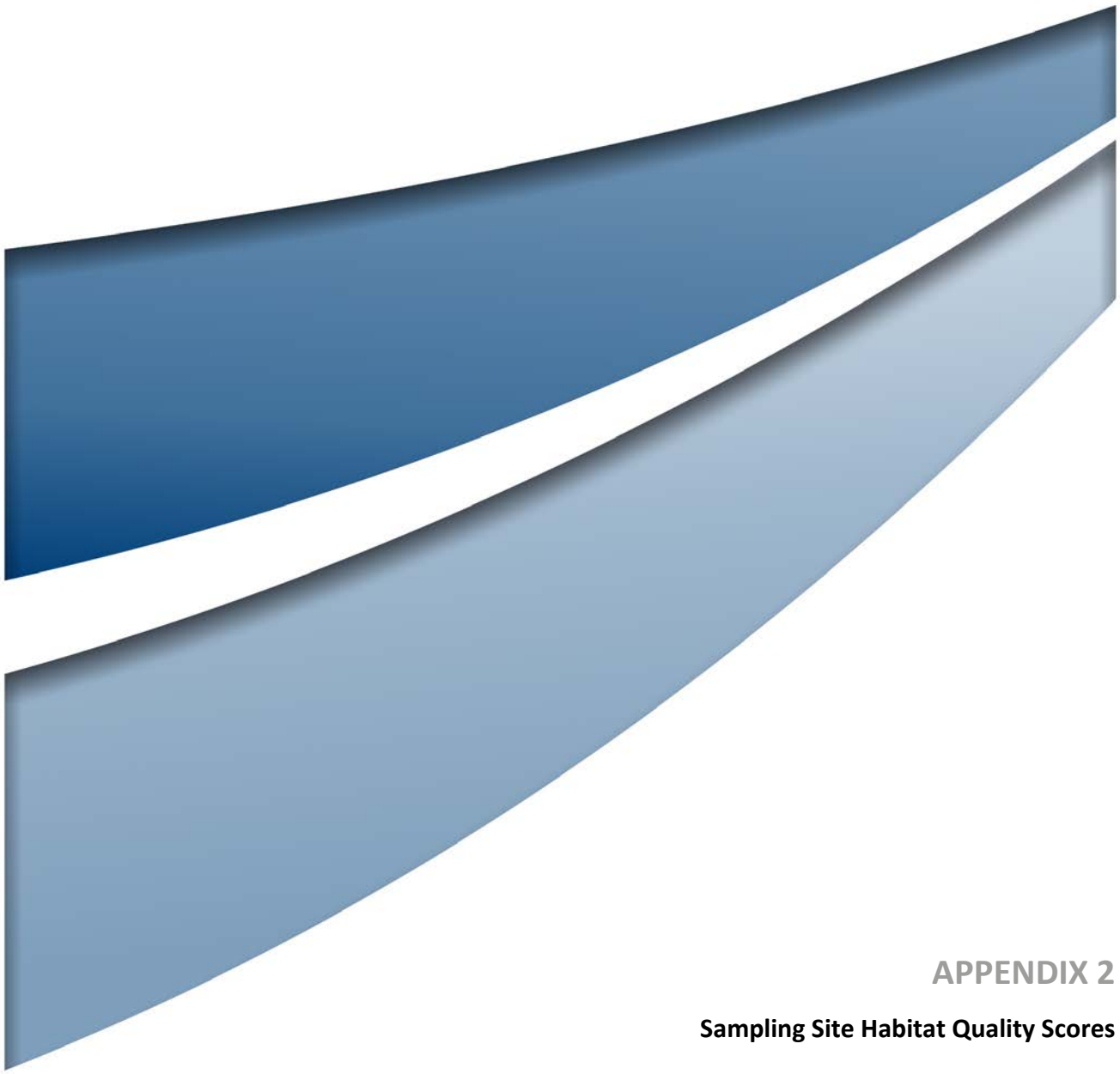


APPENDIX 2

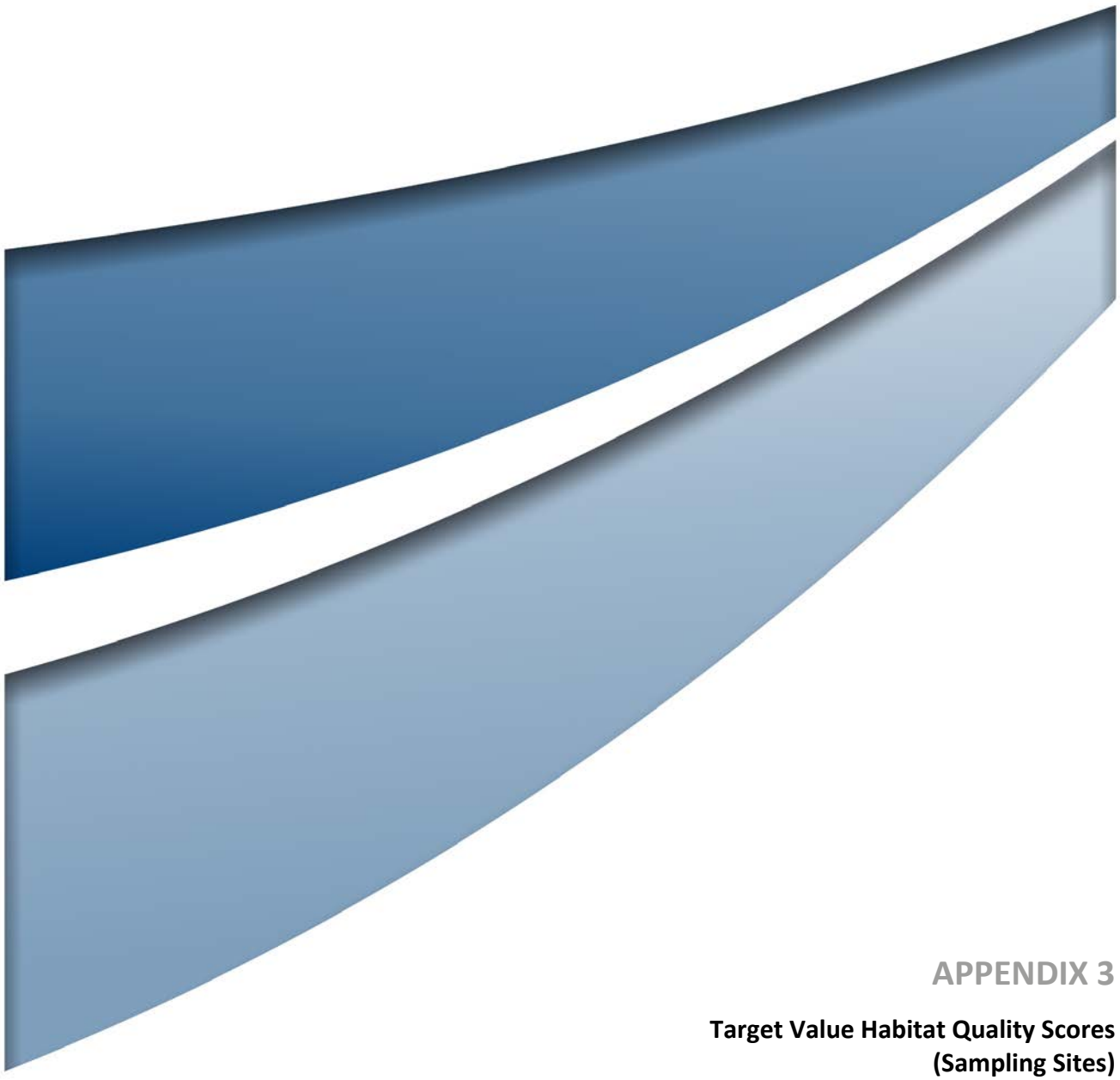
Sampling Site Habitat Quality Scores

Attribute	Sampling Site								
	AU4	AU2	AU4	AU11	AU2	AU7	AU2	AU2	AU6
	11.7.6	11.12.1a	11.7.6	11.4.3	11.12.1a	11.5.1a	11.12.1a	11.12.1a	11.5.1
	B1	B2	B3	B4	B5	B6	B7	B8	B9
Site Condition									
Number of large native trees	0	5	0	5	5	5	5	5	5
Tree canopy height	1.5	2.5	1.5	3.0	4.0	1.5	1.5	1.5	3.0
Recruitment of woody perennial species	5.0	5.0	5.0	5.0	3.0	5.0	3.0	3.0	5.0
Tree canopy cover	2.5	2.5	2.5	2.0	4.0	2.5	2.5	2.5	5.0
Native shrub layer cover (%)	5	3	0	0	5	0	2	2	5
Coarse woody debris	2	5	2	0	2	5	5	5	2
Native tree species richness	2.5	5.0	2.5	5.0	5.0	2.5	5.0	5.0	5.0
Native shrub species richness	0.0	2.5	2.5	2.5	2.5	0.0	2.5	2.5	2.5
Native grass species richness	2.5	2.5	5.0	5.0	5.0	2.5	2.5	2.5	5.0
Native forbs/other species richness	2.5	2.5	5.0	2.5	0.0	2.5	0.0	0.0	2.5
Non-native plant cover (%)	10	10	10	10	10	10	5	5	10
Native perennial grass cover (%)	5	5	5	5	1	5	3	3	3
Organic litter cover (%)	5	5	5	5	3	5	5	5	5
Total Site Condition Score	**43.5**	**55.5**	**46**	**50**	**49.5**	**46.5**	**42**	**42**	**58**
Site Context									
Size of patch (ha)	5	5	5	5	7	2	7	7	5
Connectivity (%)	2	2	0	2	2	0	2	2	2
Context	4	2	2	4	2	4	4	2	2
Ecological corridors	0	0	0	0	4	0	4	4	0
Total Site Context Score	**11**	**9**	**7**	**11**	**15**	**6**	**17**	**15**	**9**
Habitat Quality Score (Measured)	**54.5**	**64.5**	**53**	**61**	**64.5**	**52.5**	**59**	**57**	**67**
Habitat Quality Score (Maximum)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Habitat Quality Score /10	**5.5**	**6.5**	**5.3**	**6.1**	**6.5**	**5.3**	**5.9**	**5.7**	**6.7**

Attribute	Sampling Site								
	AU2	AU2	AU1	AU8	AU8	AU3	AU4	AU9	AU9
	11.12.1a	11.12.1a	11.12.1a	11.5.20	11.5.20	11.7.6	11.7.6	11.3.2	11.3.2
	B10	B11	B12	B13	B14	B15	B16	B17	B18
Site Condition									
Number of large native trees	5	5	10	5	0	15	0	0	5
Tree canopy height	4.0	2.5	2.5	3.0	3.0	5.0	4.0	3.0	5.0
Recruitment of woody perennial species	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0
Tree canopy cover	5.0	2.5	4.0	0.0	1.0	4.0	1.5	2.0	5.0
Native shrub layer cover (%)	2	2	5	0	0	0	0	0	5
Coarse woody debris	2	5	5	0	5	2	2	5	2
Native tree species richness	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Native shrub species richness	2.5	2.5	2.5	2.5	2.5	2.5	0.0	5.0	5.0
Native grass species richness	2.5	5.0	5.0	5.0	5.0	2.5	5.0	5.0	5.0
Native forbs/other species richness	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Non-native plant cover (%)	10	10	10	10	10	10	10	10	10
Native perennial grass cover (%)	5	5	1	5	5	5	5	5	5
Organic litter cover (%)	5	5	3	3	5	5	3	3	5
Total Site Condition Score	**55.5**	**57**	**60.5**	**46**	**49**	**63.5**	**41**	**50.5**	**64.5**
Site Context									
Size of patch (ha)	5	5	5	7	7	7	5	7	2
Connectivity (%)	4	2	0	2	0	5	0	0	0
Context	4	4	4	4	2	4	2	2	0
Ecological corridors	0	0	0	0	0	0	0	0	0
Total Site Context Score	**13**	**11**	**9**	**13**	**9**	**16**	**7**	**9**	**2**
Habitat Quality Score (Measured)	**68.5**	**68**	**69.5**	**59**	**58**	**79.5**	**48**	**59.5**	**66.5**
Habitat Quality Score (Maximum)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Habitat Quality Score /10	**6.9**	**6.8**	**7.0**	**5.9**	**5.8**	**8.0**	**4.8**	**6.0**	**6.7**

Attribute	Sampling Site								
	AU13	AU13	AU2	AU2	AU5	AU11	AU8	AU2	AU1
	11.3.25	11.3.25	11.12.1a	11.12.1a	11.3.1	11.4.3	11.5.20	11.12.1a	11.12.1a
	B19	B20	B21	B22	B23	B24	B25	B26	B27
Site Condition									
Number of large native trees	5	5	5	0	5	5	5	5	10
Tree canopy height	5.0	3.0	5.0	5.0	4.0	3.0	5.0	5.0	5.0
Recruitment of woody perennial species	5.0	5.0	3.0	3.0	3.0	5.0	5.0	5.0	3.0
Tree canopy cover	5.0	5.0	2.5	5.0	5.0	0.0	3.5	3.5	5.0
Native shrub layer cover (%)	2	0	0	2	2	2	0	0	2
Coarse woody debris	5	2	5	2	0	0	5	5	5
Native tree species richness	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Native shrub species richness	5.0	5.0	5.0	0.0	5.0	2.5	5.0	5.0	5.0
Native grass species richness	2.5	5.0	5.0	5.0	5.0	5.0	5.0	2.5	5.0
Native forbs/other species richness	2.5	2.5	2.5	2.5	2.5	2.5	5.0	2.5	2.5
Non-native plant cover (%)	10	10	5	10	10	5	10	5	10
Native perennial grass cover (%)	5	5	5	5	5	5	5	3	5
Organic litter cover (%)	3	3	3	5	5	5	3	5	5
Total Site Condition Score	**60**	**55.5**	**51**	**49.5**	**56.5**	**45**	**61.5**	**51.5**	**67.5**
Site Context									
Size of patch (ha)	7	7	7	7	2	5	7	7	7
Connectivity (%)	0	0	2	2	0	2	2	2	2
Context	4	2	4	2	0	4	4	2	4
Ecological corridors	0	0	0	0	0	0	0	4	0
Total Site Context Score	**11**	**9**	**13**	**11**	**2**	**11**	**13**	**15**	**13**
Habitat Quality Score (Measured)	**71**	**64.5**	**64**	**60.5**	**58.5**	**56**	**74.5**	**66.5**	**80.5**
Habitat Quality Score (Maximum)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Habitat Quality Score /10	**7.1**	**6.5**	**6.4**	**6.1**	**5.9**	**5.6**	**7.5**	**6.7**	**8.1**

Attribute	Sampling Site									
	AU12	AU10	AU6	AU6	AU15	AU15	AU15	AU15	AU1	AU15
	11.3.25	11.4.3	11.5.1	11.5.1	11.12.3	11.12.3	11.12.3	11.12.3	11.12.1	11.12.3
	B30	B31	B32	B33	B34	B35	B36	B37	B38	B40
Site Condition										
Number of large native trees	15	15	0	10	0	0	0	5	5	0
Tree canopy height	5	5	4.0	4.0	3.0	3.0	4.0	5.0	5.0	5.0
Recruitment of woody perennial	5	3.0	5.0	3	5	5	3	5	3	5
Tree canopy cover	3	5	3.5	3.5	2.5	5	3.5	3.5	4	2.5
Native shrub layer cover (%)	0	0	5	2	3	0	3	0	2	0
Coarse woody debris	5	5	2	5	5	2	2	2	5	2
Native tree species richness	5	5	5	5	2.5	5	5	2.5	5	5
Native shrub species richness	2.5	2.5	5	5	2.5	2.5	2.5	2.5	5	2.5
Native grass species richness	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	2.5
Native forbs/other species richness	0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	2.5
Non-native plant cover (%)	10	10	10	10	10	10	10	0	10	10
Native perennial grass cover (%)	0	5	3	1	1	3	3	3	1	5
Organic litter cover (%)	3	3	3	5	5	5	3	3	5	5
Total Site Condition Score	**56**	**63.5**	**50.5**	**58.5**	**44.5**	**45.5**	**44**	**36.5**	**60**	**47**
Site Context										
Size of patch (ha)	7	7	7	7	7	7	7	7	10	7
Connectivity (%)	2	0	2	2	2	2	2	2	2	2
Context	4	2	2	2	4	2	2	4	5	4
Ecological corridors	6	0	0	0	0	0	0	4	0	0
Total Site Context Score	**19**	**9**	**11**	**11**	**13**	**11**	**11**	**17**	**17**	**13**
Habitat Quality Score (Measured)	**75**	**72.5**	**61.5**	**69.5**	**57.5**	**56.5**	**55**	**53.5**	**77**	**60**
Habitat Quality Score (Maximum)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Habitat Quality Score /10	**7.5**	**7.3**	**6.2**	**7**	**5.8**	**5.7**	**5.5**	**5.4**	**7.7**	**6**



APPENDIX 3

Target Value Habitat Quality Scores
(Sampling Sites)

Adclarkia cameroni (Brigalow woodland snail)

Attribute	Maximum Score	Sampling Site			
		AU11	AU5	AU11	AU10
		11.4.3	11.3.1	11.4.3	11.4.3
		B4	B23	B24	B31
Quality and availability of food and habitat required for foraging	25	10	20	5	20
Quality and availability of habitat required for shelter and breeding	25	10	18.3	6.7	16.7
Quality and availability of habitat required for mobility	25	5	15	5	25
Absence of threats	25	6	4	6	4
Total		**31**	**57.3**	**22.7**	**65.7**
Site Condition Score	80	50	56.5	45	63.5
Site Context Score	20	11	2	11	9
Species Index Score	100	31	57.3	22.7	65.7
Habitat Quality Score (Measured)		**92**	**115.8**	**78.7**	**138.2**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**
Habitat Quality Score/10		**4.6**	**5.8**	**3.9**	**6.9**

Furina dunmalli (Dunmall's snake)

Attribute	Maximum Score	Sampling Site							
		AU4	AU4	AU11	AU7	AU6	AU8	AU8	AU3
		11.7.6	11.7.6	11.4.3	11.5.1a	11.5.1	11.5.20	11.5.20	11.7.6
		B1	B3	B4	B6	B9	B13	B14	B15
Quality and availability of food and habitat required for foraging	25	16.3	13.8	8.8	13.8	16.3	8.8	13.8	13.8
Quality and availability of habitat required for shelter and breeding	25	18.3	15	8.3	15	18.3	6.7	15	15
Quality and availability of habitat required for mobility	25	18.3	15	8.3	15	18.3	6.7	15	15
Absence of threats	25	8	6	6	4	6	6	6	8
Total		**60.9**	**49.8**	**31.4**	**47.8**	**58.9**	**28.1**	**49.8**	**51.8**
Site Condition Score	80	43.5	46	50	46.5	58	46	49	63.5
Site Context Score	20	11	7	11	6	9	13	9	16
Species Index Score	100	60.9	49.8	31.4	47.8	58.9	28.1	49.8	51.8
Habitat Quality Score (Measured)		**115.4**	**102.8**	**92.4**	**100.3**	**125.9**	**87.1**	**107.8**	**131.3**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score /10		**5.8**	**5.1**	**4.6**	**5.0**	**6.3**	**4.4**	**5.4**	**6.6**

Furina dunmalli (Dunmall's snake) (continued)

Attribute	Maximum Score	Sampling Site						
		AU4	AU5	AU11	AU8	AU10	AU6	AU6
		11.7.6	11.3.1	11.4.3	11.5.20	11.4.3	11.5.1	11.5.1
		B16	B23	B24	B25	B31	B32	B33
Quality and availability of food and habitat required for foraging	25	13.8	13.8	6.25	16.25	15	13.8	16.3
Quality and availability of habitat required for shelter and breeding	25	15	15	5	15	15	15	18.3
Quality and availability of habitat required for mobility	25	15	15	5	15	15	15	18.3
Absence of threats	25	6	4	6	6	4	6	6
Total		**49.8**	**47.8**	**22.3**	**52.3**	**49**	**49.8**	**58.9**
Site Condition Score	80	41	56.5	45	61.5	63.5	50.5	58.5
Site Context Score	20	7	2	11	13	9	11	11
Species Index Score	100	49.8	47.8	22.3	52.3	49	49.8	58.9
Habitat Quality Score (Measured)		**97.8**	**106.3**	**78.3**	**126.8**	**121.5**	**111.3**	**128.4**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score /10		**4.9**	**5.3**	**3.9**	**6.3**	**6.1**	**5.6**	**6.4**

Grantiella picta (painted honeyeater)

Attribute	Maximum Score	Sampling Site									
		AU4	AU2	AU4	AU11	AU2	AU7	AU2	AU2	AU6	AU2
		11.7.6	11.12.1a	11.7.6	11.4.3	11.12.1a	11.5.1a	11.12.1a	11.12.1a	11.5.1	11.12.1a
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Quality and availability of food and habitat required for foraging	25	17.5	17.5	17.5	10	15	15	12.5	20	10	15
Quality and availability of habitat required for shelter and breeding	25	17.5	17.5	17.5	10	15	15	12.5	20	10	15
Quality and availability of habitat required for mobility	25	25	22.5	17.5	15	20	17.5	17.5	17.5	15	17.5
Absence of threats	25	8	8	6	6	6	4	6	6	6	6
Total		**68**	**65.5**	**58.5**	**41**	**56**	**51.5**	**48.5**	**63.5**	**41**	**53.5**
Site Condition Score	80	43.5	55.5	46.0	50	49.5	46.5	42	42	58	55.5
Site Context Score	20	11	9	7	11	15	6	17	15	9	13
Species Index Score	100	68	65.5	58.5	41	56	51.5	48.5	63.5	41	53.5
Habitat Quality Score (Measured)		**122.5**	**130**	**111.5**	**102**	**120.5**	**104**	**107.5**	**120.5**	**108**	**122**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**6.1**	**6.5**	**5.6**	**5.1**	**6.0**	**5.2**	**5.4**	**6.0**	**5.4**	**6.1**

Grantiella picta (painted honeyeater) (continued)

Attribute	Maximum Score	Sampling Site									
		AU2	AU1	AU3	AU4	AU2	AU2	AU11	AU2	AU1	AU10
		11.12.1a	11.12.1a	11.7.6	11.7.6	11.12.1a	11.12.1a	11.4.3	11.12.1a	11.12.1a	11.4.3
		B11	B12	B15	B16	B21	B22	B24	B26	B27	B31
Quality and availability of food and habitat required for foraging	25	15	15	20	10	12.5	10	17.5	7.5	10	20
Quality and availability of habitat required for shelter and breeding	25	15	15	20	10	12.5	10	17.5	7.5	10	20
Quality and availability of habitat required for mobility	25	17.5	17.5	25	12.5	17.5	12.5	22.5	17.5	17.5	17.5
Absence of threats	25	8	6	8	6	8	8	6	6	10	4
Total		**55.5**	**53.5**	**73**	**38.5**	**50.5**	**40.5**	**63.5**	**38.5**	**47.5**	**61.5**
Site Condition Score	80	57	60.5	63.5	41	51	49.5	45	51.5	67.5	63.5
Site Context Score	20	11	9	16	7	13	11	11	15	13	9
Species Index Score	100	55.5	53.5	73	38.5	50.5	40.5	63.5	38.5	47.5	61.5
Habitat Quality Score (Measured)		**123.5**	**123**	**152.5**	**86.5**	**114.5**	**101**	**119.5**	**105**	**128**	**134**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**6.2**	**6.2**	**7.6**	**4.3**	**5.7**	**5.1**	**6.0**	**5.3**	**6.4**	**6.7**

Grantiella picta (painted honeyeater) (continued)

Attribute	Maximum Score	Sampling Site							
		AU6	AU6	AU15	AU15	AU15	AU15	AU1	AU15
		11.5.1	11.5.1	11.12.3	11.12.3	11.12.3	11.12.3	11.12.1a	11.12.3
		B32	B33	B34	B35	B36	B37	B38	B40
Quality and availability of food and habitat required for foraging	25	5	15	5	5	5	7.5	5	5
Quality and availability of habitat required for shelter and breeding	25	5	15	5	5	5	7.5	5	5
Quality and availability of habitat required for mobility	25	10	20	12.5	12.5	12.5	15	12.5	10
Absence of threats	25	6	6	6	6	6	8	10	6
Total		**26**	**56**	**28.5**	**28.5**	**28.5**	**38**	**32.5**	**26**
Site Condition Score	80	50.5	58.5	44.5	45.5	44	36.5	60	47
Site Context Score	20	11	11	13	11	11	17	17	13
Species Index Score	100	26	56	28.5	28.5	28.5	38	32.5	26
Habitat Quality Score (Measured)		**87.5**	**125.5**	**86**	**85**	**83.5**	**91.5**	**109.5**	**86**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**4.4**	**6.3**	**4.3**	**4.3**	**4.2**	**4.6**	**5.5**	**4.3**

Petauroides volans (greater glider)

Attribute	Maximum Score	Sampling Site								
		AU4	AU2	AU4	AU2	AU7	AU2	AU2	AU6	AU2
		11.7.6	11.12.1a	11.7.6	11.12.1a	11.5.1a	11.12.1a	11.12.1a	11.5.1	11.12.1a
		B1	B2	B3	B5	B6	B7	B8	B9	B10
Quality and availability of food and habitat required for foraging	25	12.5	12.5	12.5	12.5	15	12.5	12.5	12.5	12.5
Quality and availability of habitat required for shelter and breeding	25	10	7.5	7.5	7.5	12.5	7.5	7.5	7.5	7.5
Quality and availability of habitat required for mobility	25	17.5	15	10	12.5	12.5	12.5	12.5	12.5	10
Absence of threats	25	8	8	6	6	4	6	6	6	6
Total		**48**	**43**	**36**	**38.5**	**44**	**38.5**	**38.5**	**38.5**	**36**
Site Condition Score	80	43.5	55.5	46	49.5	46.5	42	42	58	55.5
Site Context Score	20	11	9	7	15	6	17	15	9	13
Species Index Score	100	48	43	36	38.5	44	38.5	38.5	38.5	36
Habitat Quality Score (Measured)		**102.5**	**107.5**	**89**	**103**	**96.5**	**97.5**	**95.5**	**105.5**	**104.5**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.1**	**5.4**	**4.5**	**5.2**	**4.8**	**4.9**	**4.8**	**5.3**	**5.2**

Petauroides volans (greater glider) (continued)

Attribute	Maximum Score	Sampling Site								
		AU2	AU1	AU8	AU8	AU3	AU4	AU9	AU9	AU13
		11.12.1a	11.12.1a	11.5.20	11.5.20	11.7.6	11.7.6	11.3.2	11.3.2	11.3.25
		B11	B12	B13	B14	B15	B16	B17	B18	B19
Quality and availability of food and habitat required for foraging	25	15	17.5	15	10	20	7.5	10	15	15
Quality and availability of habitat required for shelter and breeding	25	7.5	12.5	10	5	17.5	5	5	10	10
Quality and availability of habitat required for mobility	25	10	12.5	15	12.5	25	12.5	12.5	15	20
Absence of threats	25	8	6	6	6	8	6	6	6	8
Total		40.5	48.5	46	33.5	70.5	31	33.5	46	53
Site Condition Score	80	57	60.5	46	49	63.5	41	50.5	64.5	60
Site Context Score	20	11	9	13	9	16	7	9	2	11
Species Index Score	100	40.5	48.5	46	33.5	70.5	31	33.5	46	53
Habitat Quality Score (Measured)		**108.5**	**118**	**105**	**91.5**	**150**	**79**	**93**	**112.5**	**124**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.4**	**5.9**	**5.3**	**4.6**	**7.5**	**4.0**	**4.7**	**5.6**	**6.2**

Petauroides volans (greater glider) (continued)

Attribute	Maximum Score	Sampling Site							
		AU13	AU2	AU2	AU8	AU2	AU1	AU12	AU6
		11.3.25	11.12.1a	11.12.1a	11.5.20	11.12.1a	11.12.1a	11.3.25	11.5.1
		B20	B21	B22	B25	B26	B27	B30	B32
Quality and availability of food and habitat required for foraging	25	15	15	10	10	10	10	20	15
Quality and availability of habitat required for shelter and breeding	25	7.5	7.5	5	5	5	10	22.5	10
Quality and availability of habitat required for mobility	25	17.5	15	12.5	15	12.5	10	25	15
Absence of threats	25	8	8	8	8	8	6	8	4
Total		**48**	**45.5**	**35.5**	**38**	**35.5**	**36**	**75.5**	**44**
Site Condition Score	80	55.5	51	49.5	61.5	51.5	67.5	56	50.5
Site Context Score	20	9	13	11	13	15	13	19	11
Species Index Score	100	48	45.5	35.5	38	35.5	36	75.5	44
Habitat Quality Score (Measured)		**112.5**	**109.5**	**96**	**112.5**	**102**	**116.5**	**150.5**	**105.5**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.6**	**5.5**	**4.8**	**5.6**	**5.1**	**5.8**	**7.5**	**5.3**

Petauroides volans (greater glider) (continued)

Attribute	Maximum Score	Sampling Site						
		AU6	AU15	AU15	AU15	AU15	AU1	AU15
		11.5.1	11.12.3	11.12.3	11.12.3	11.12.3	11.12.1a	11.12.3
		B33	B34	B35	B36	B37	B38	B40
Quality and availability of food and habitat required for foraging	25	22.5	10	12.5	12.5	12.5	10	10
Quality and availability of habitat required for shelter and breeding	25	15	5	5	5	5	7.5	5
Quality and availability of habitat required for mobility	25	20	12.5	12.5	12.5	12.5	12.5	10
Absence of threats	25	4	4	4	4	8	8	4
Total		**61.5**	**31.5**	**34**	**34**	**38**	**38**	**29**
Site Condition Score	80	58.5	44.5	45.5	44	36.5	60	47
Site Context Score	20	11	13	11	11	17	17	13
Species Index Score	100	61.5	31.5	34	34	38	38	29
Habitat Quality Score (Measured)		**131**	**89**	**90.5**	**89**	**91.5**	**115**	**89**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**6.6**	**4.5**	**4.5**	**4.5**	**4.6**	**5.8**	**4.5**

Phascolarctos cinereus (koala)

Attribute	Maximum Score	Sampling Site							
		AU4	AU2	AU4	AU2	AU7	AU2	AU2	AU6
		11.7.6	11.12.1a	11.7.6	11.12.1a	11.5.1a	11.12.1a	11.12.1a	11.5.1
		B1	B2	B3	B5	B6	B7	B8	B9
Quality and availability of food and habitat required for foraging	25	12.5	12.5	12.5	12.5	15	12.5	12.5	12.5
Quality and availability of habitat required for shelter and breeding	25	18.3	20	13.3	20	16.7	16.7	16.7	16.7
Quality and availability of habitat required for mobility	25	17.5	15	10	12.5	12.5	12.5	12.5	12.5
Absence of threats	25	6	6	6	6	4	6	6	6
Total		**54.3**	**53.5**	**41.8**	**51**	**48.2**	**47.7**	**47.7**	**47.7**
Site Condition Score	80	43.5	55.5	46	49.5	46.5	42	42	58
Site Context Score	20	11	9	7	15	6	17	15	9
Species Index Score	100	54.3	53.5	41.8	51	48.2	47.7	47.7	47.7
Habitat Quality Score (Measured)		**108.8**	**118**	**94.8**	**115.5**	**100.7**	**106.7**	**104.7**	**114.7**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.4**	**5.9**	**4.7**	**5.8**	**5.0**	**5.3**	**5.2**	**5.7**

Phascolarctos cinereus (koala) (continued)

Attribute	Maximum Score	Sampling Site							
		AU2	AU2	AU1	AU8	AU8	AU3	AU4	AU9
		11.12.1a	11.12.1a	11.12.1a	11.5.20	11.5.20	11.7.6	11.7.6	11.3.2
		B10	B11	B12	B13	B14	B15	B16	B17
Quality and availability of food and habitat required for foraging	25	12.5	15	17.5	15	10	20	7.5	10
Quality and availability of habitat required for shelter and breeding	25	18.3	18.3	21.7	10	13.3	20	10	15
Quality and availability of habitat required for mobility	25	10	10	12.5	15	12.5	25	12.5	12.5
Absence of threats	25	6	6	6	6	6	6	6	6
Total		**46.8**	**49.3**	**57.7**	**46**	**41.8**	**71**	**36**	**43.5**
Site Condition Score	80	55.5	57	60.5	46	49	63.5	41	50.5
Site Context Score	20	13	11	9	13	9	16	7	9
Species Index Score	100	46.8	49.3	57.7	46	41.8	71	36	43.5
Habitat Quality Score (Measured)		**115.3**	**117.3**	**127.2**	**105**	**99.8**	**150.5**	**84**	**103**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.8**	**5.9**	**6.4**	**5.3**	**5.0**	**7.5**	**4.2**	**5.2**

Phascolarctos cinereus (koala) (continued)

Attribute	Maximum Score	Sampling Site								
		AU9	AU13	AU13	AU2	AU2	AU8	AU2	AU1	AU12
		11.3.2	11.3.25	11.3.25	11.12.1a	11.12.1a	11.5.20	11.12.1a	11.12.1a	11.3.25
		B18	B19	B20	B21	B22	B25	B26	B27	B30
Quality and availability of food and habitat required for foraging	25	15	15	15	15	10	10	10	10	20
Quality and availability of habitat required for shelter and breeding	25	16.7	15	18.3	16.7	11.7	11.7	18.3	15	21.7
Quality and availability of habitat required for mobility	25	15	20	17.5	15	12.5	15	12.5	10	25
Absence of threats	25	6	8	8	6	6	6	8	6	8
Total		**52.7**	**58**	58.8	52.7	40.2	42.7	48.8	41	74.7
Site Condition Score	80	64.5	60	55.5	51	49.5	61.5	51.5	67.5	56
Site Context Score	20	2	11	9	13	11	13	15	13	19
Species Index Score	100	52.7	58	58.8	52.7	40.2	42.7	48.8	41	74.7
Habitat Quality Score (Measured)		**119.2**	**129**	**123.3**	**116.7**	**100.7**	**117.2**	**115.3**	**121.5**	**149.7**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**6.0**	**6.5**	**6.2**	**5.8**	**5.0**	**5.9**	**5.8**	**6.1**	**7.5**

Phascolarctos cinereus (koala) (continued)

Attribute	Maximum Score	Sampling Site							
		AU6	AU6	AU15	AU15	AU15	AU15	AU1	AU15
		11.5.1	11.5.1	11.12.3	11.12.3	11.12.3	11.12.3	11.12.1a	11.12.3
		B32	B33	B34	B35	B36	B37	B38	B40
Quality and availability of food and habitat required for foraging	25	15	22.5	10	12.5	12.5	15	10	10
Quality and availability of habitat required for shelter and breeding	25	13.3	22.5	11.7	16.7	13.3	11.7	15	16.7
Quality and availability of habitat required for mobility	25	12.5	17.5	12.5	12.5	12.5	15	12.5	10
Absence of threats	25	6	6	6	6	8	8	6	6
Total		**46.8**	**68.5**	**40.2**	**47.7**	**46.3**	**49.7**	**43.5**	**42.7**
Site Condition Score	80	50.5	58.5	44.5	45.5	44	36.5	60	47
Site Context Score	20	11	11	13	11	11	17	17	13
Species Index Score	100	46.8	68.5	40.2	47.7	46.3	49.7	43.5	42.7
Habitat Quality Score (Measured)		**108.3**	**138**	**97.7**	**104.2**	**101.3**	**103.2**	**120.5**	**102.7**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.4**	**6.9**	**4.9**	**5.2**	**5.1**	**5.2**	**6.0**	**5.1**

Nyctophilus corbeni (south-eastern long-eared bat)

Attribute	Maximum Score	Sampling Site								
		AU4	AU2	AU4	AU11	AU2	AU7	AU2	AU2	AU6
		11.7.6	11.12.1a	11.7.6	11.4.3	11.12.1a	11.5.1a	11.12.1a	11.12.1a	11.5.1
		B1	B2	B3	B4	B5	B6	B7	B8	B9
Quality and availability of food and habitat required for foraging	25	20	18.3	11.7	10	25	11.7	18.3	18.3	21.7
Quality and availability of habitat required for shelter and breeding	25	15	15	11.7	11.7	18.3	13.3	16.7	16.7	15
Quality and availability of habitat required for mobility	25	17.5	17.5	17.5	17.5	20	10	20	20	12.5
Absence of threats	25	8	8	6	6	6	4	6	6	6
Total		**60.5**	**58.8**	**46.8**	**45.2**	**69.3**	**39**	**61**	**61**	**55.2**
Site Condition Score	80	43.5	55.5	46	50	49.5	46.5	42	42	58
Site Context Score	20	11	9	7	11	15	6	17	15	9
Species Index Score	100	60.5	58.8	46.8	45.2	69.3	39	61	61	55.2
Habitat Quality Score (Measured)		**115**	**123.3**	**99.8**	**106.2**	**133.8**	**91.5**	**120**	**118**	**122.2**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.8**	**6.2**	**5.0**	**5.3**	**6.7**	**4.6**	**6.0**	**5.9**	**6.1**

Nyctophilus corbeni (south-eastern long-eared bat)

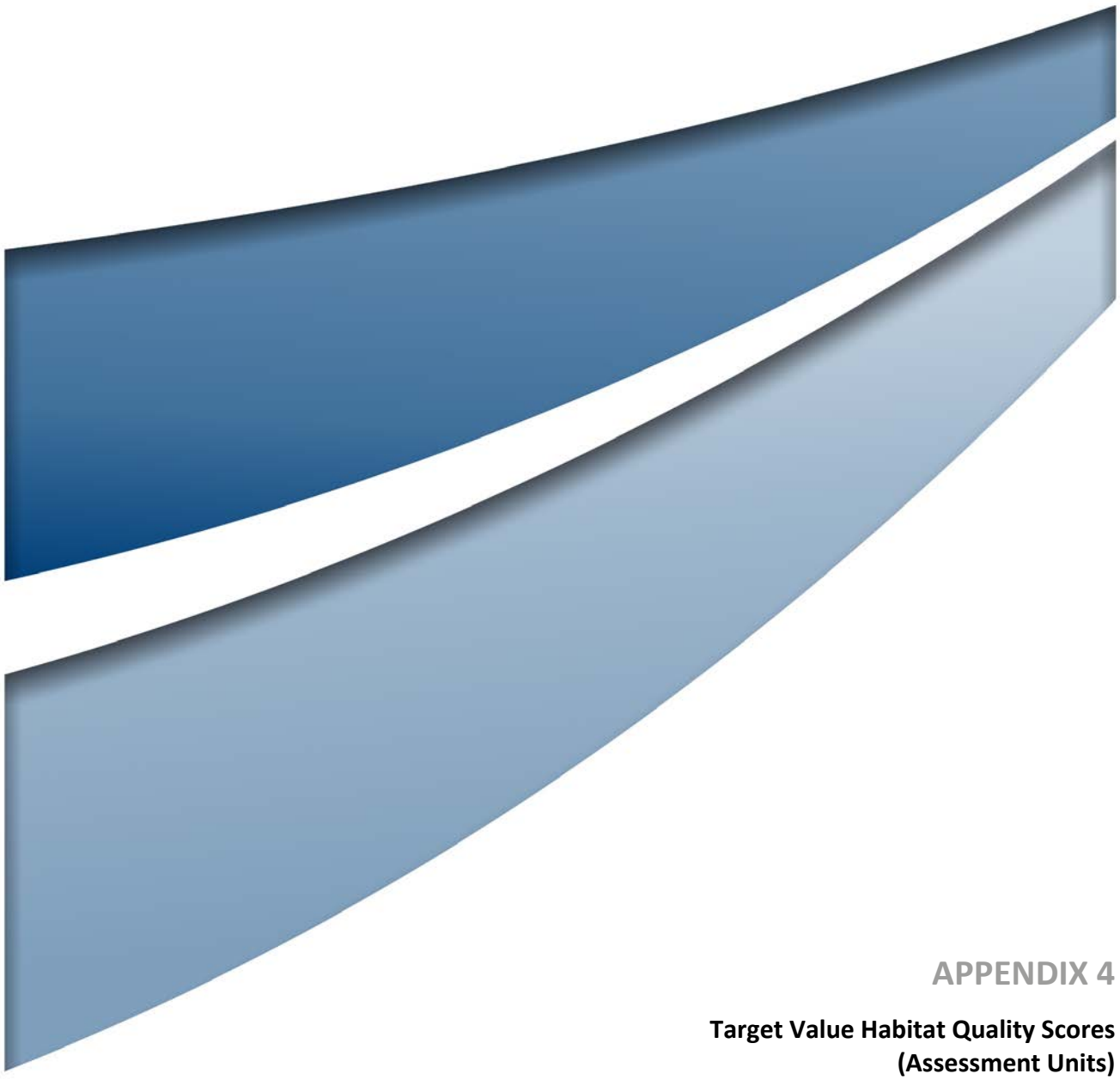
Attribute	Maximum Score	Sampling Site								
		AU2	AU2	AU1	AU8	AU8	AU3	AU4	AU9	AU9
		11.12.1a	11.12.1a	11.12.1a	11.5.20	11.5.20	11.7.6	11.7.6	11.3.2	11.3.2
		B10	B11	B12	B13	B14	B15	B16	B17	B18
Quality and availability of food and habitat required for foraging	25	20	16.7	20	11.7	15	10	16.7	20	10
Quality and availability of habitat required for shelter and breeding	25	15	16.7	15	8.3	11.7	11.7	11.7	13.3	11.7
Quality and availability of habitat required for mobility	25	15	15	10	15	15	17.5	17.5	15	15
Absence of threats	25	6	6	8	6	6	6	6	6	6
Total		**56**	**54.3**	**53**	**41**	**47.7**	**45.2**	**51.8**	**54.3**	**42.7**
Site Condition Score	80	55.5	57	60.5	46	49	63.5	41	50.5	64.5
Site Context Score	20	13	11	9	13	9	16	7	9	2
Species Index Score	100	56	54.3	53	41	47.7	45.2	51.8	54.3	42.7
Habitat Quality Score (Measured)		**124.5**	**122.3**	**122.5**	**100**	**105.7**	**124.7**	**99.8**	**113.8**	**109.2**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**6.2**	**6.1**	**6.1**	**5.0**	**5.3**	**6.2**	**5.0**	**5.7**	**5.5**

Nyctophilus corbeni (south-eastern long-eared bat) (continued)

Attribute	Maximum Score	Sampling Site								
		AU13	AU13	AU2	AU2	AU11	AU8	AU2	AU1	AU12
		11.3.25	11.3.25	11.12.1a	11.12.1a	11.4.3	11.5.20	11.12.1a	11.12.1a	11.3.25
		B19	B20	B21	B22	B24	B25	B26	B27	B30
Quality and availability of food and habitat required for foraging	25	8.3	20	15	16.7	8.3	10	25	20	15
Quality and availability of habitat required for shelter and breeding	25	8.3	13.3	11.7	10	10	6.7	18.3	16.7	20
Quality and availability of habitat required for mobility	25	17.5	17.5	17.5	17.5	17.5	17.5	22.5	17.5	25
Absence of threats	25	8	8	8	8	6	8	8	6	8
Total		**42.2**	**58.8**	**52.2**	**52.2**	**41.8**	**42.2**	**73.8**	**60.2**	**68**
Site Condition Score	80	60	55.5	51	49.5	45	61.5	51.5	67.5	56
Site Context Score	20	11	9	13	11	11	13	15	13	19
Species Index Score	100	42.2	58.8	52.2	52.2	41.8	42.2	73.8	60.2	68
Habitat Quality Score (Measured)		**113.2**	**123.3**	**116.2**	**112.7**	**97.8**	**116.7**	**140.3**	**140.7**	**143**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.7**	**6.2**	**5.8**	**5.6**	**4.9**	**5.8**	**7.0**	**7.0**	**7.2**

Nyctophilus corbeni (south-eastern long-eared bat) (continued)

Attribute	Maximum Score	Sampling Site								
		AU10	AU6	AU6	AU15	AU15	AU15	AU15	AU1	AU15
		11.4.3	11.5.1	11.5.1	11.12.3	11.12.3	11.12.3	11.12.3	11.12.1a	11.12.3
		B31	B32	B33	B34	B35	B36	B37	B38	B40
Quality and availability of food and habitat required for foraging	25	6.7	13.3	16.7	18.3	18.3	18.3	13.3	21.7	11.7
Quality and availability of habitat required for shelter and breeding	25	8.3	8.3	13.3	11.7	15	11.7	10	16.7	11.7
Quality and availability of habitat required for mobility	25	12.5	12.5	12.5	17.5	17.5	17.5	15	22.5	12.5
Absence of threats	25	4	6	6	6	6	6	8	6	6
Total		**31.5**	**40.2**	**48.5**	**53.5**	**56.8**	**53.5**	**46.3**	**66.8**	**41.8**
Site Condition Score	80	63.5	50.5	58.5	44.5	45.5	44	36.5	60	47
Site Context Score	20	9	11	11	13	11	11	17	17	13
Species Index Score	100	31.5	40.2	48.5	53.5	56.8	53.5	46.3	66.8	41.8
Habitat Quality Score (Measured)		**104**	**101.7**	**118**	**111**	**113.3**	**108.5**	**99.8**	**143.8**	**101.8**
Habitat Quality Score (Maximum)		**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
Habitat Quality Score/10		**5.2**	**5.1**	**5.9**	**5.6**	**5.7**	**5.4**	**5.0**	**7.2**	**5.1**



APPENDIX 4

Target Value Habitat Quality Scores
(Assessment Units)

Brigalow (Acacia harpophylla) dominant and co-dominant TEC	AU5	AU10	AU11
Average Habitat Quality Score	5.9	7.3	5.9
Area-Weighted Habitat Quality Score	1.3	0.6	3.3
Total	**5.2**		

Adclarkia cameroni	AU5	AU10	AU11
Average Habitat Quality Score	5.8	6.9	4.3
Area-Weighted Habitat Quality Score	1.3	0.6	3.3
Total	**5.2**		

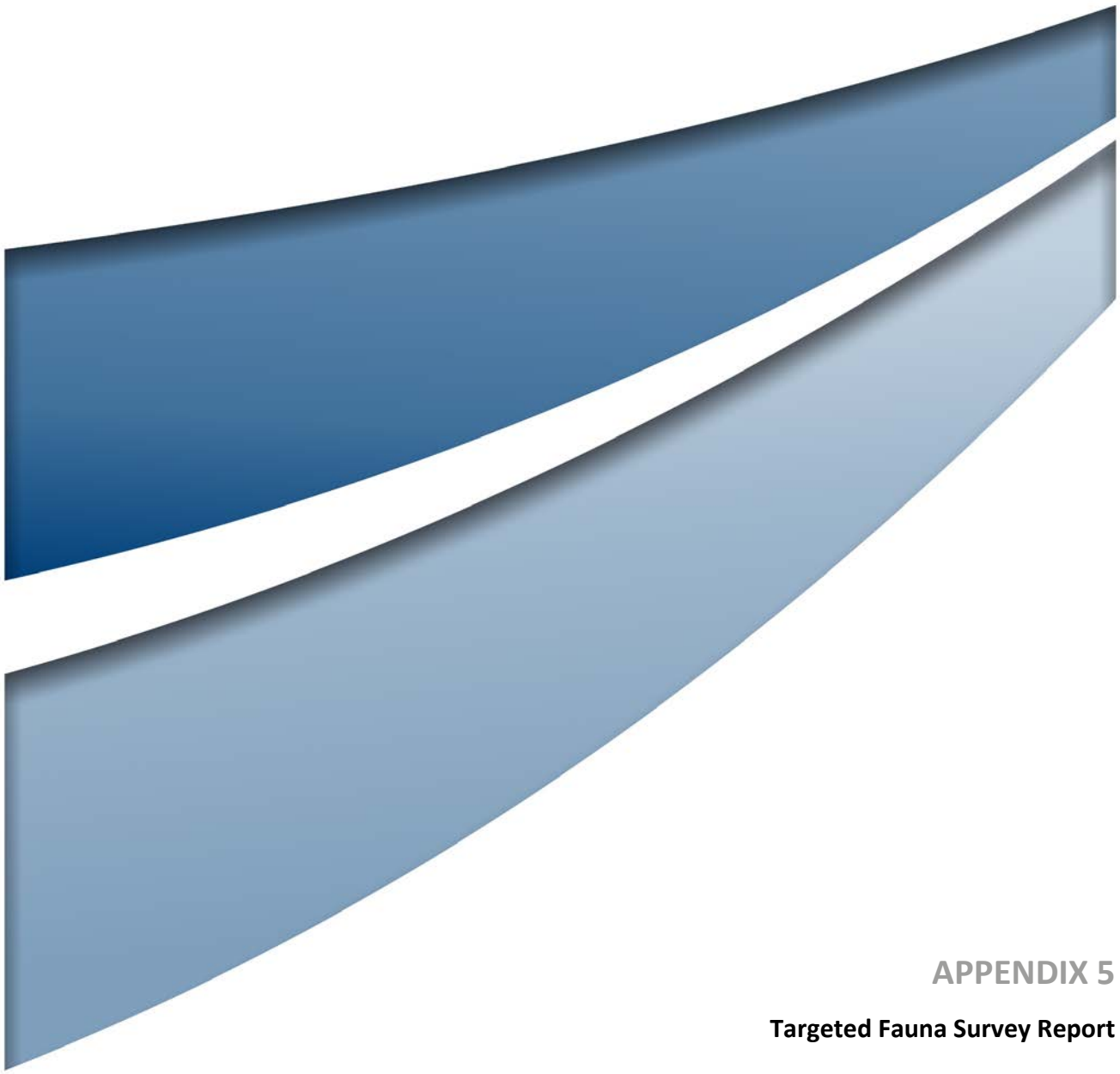
Furina dunmalli	AU3	AU4	AU5	AU6	AU7	AU8	AU10	AU11
Average Habitat Quality Score	6.6	5.3	5.3	6.1	5.0	5.4	6.1	4.3
Area-Weighted Habitat Quality Score	0.4	1.8	0.23	1.13	0.21	0.90	0.10	0.63
Total	**5.5**							

Grantiella picta	AU1	AU2	AU3	AU4	AU6	AU7	AU10	AU11	AU15
Average Habitat Quality Score	6.0	5.8	7.6	5.3	5.4	5.2	6.7	5.5	4.3
Area-Weighted Habitat Quality Score	1.4	3.2	0.1	0.3	0.2	0.04	0.02	0.1	0.3
Total	**5.7**								

Petauroides volans	AU1	AU2	AU3	AU4	AU6	AU7	AU8	AU9	AU12	AU13	AU15
Average Habitat Quality Score	5.8	5.1	7.5	4.5	5.7	4.8	5.2	5.1	7.5	5.9	4.5
Area-Weighted Habitat Quality Score	1.3	2.7	0.1	0.3	0.2	0.03	0.1	0.03	0.05	0.1	0.4
Total	**4.9**										

Phascolarctos cinereus	AU1	AU2	AU3	AU4	AU6	AU7	AU8	AU9	AU12	AU13	AU15
Average Habitat Quality Score	6.2	5.6	7.5	4.8	6.0	5.0	5.4	5.6	7.5	6.3	5.1
Area-Weighted Habitat Quality Score	1.4	3.0	0.1	0.3	0.2	0.04	0.2	0.03	0.05	0.1	0.4
Total	**5.7**										

Nyctophilus corbeni	AU1	AU2	AU3	AU4	AU6	AU7	AU8	AU9	AU10	AU11	AU12	AU13	AU15
Average Habitat Quality Score	6.8	6.2	6.2	5.2	5.7	4.6	5.4	5.6	5.2	5.1	7.2	5.9	5.3
Area-Weighted Habitat Quality Score	1.5	3.2	0.1	0.3	0.2	0.03	0.2	0.03	0.01	0.1	0.04	0.1	0.4
Total	**6.1**												



APPENDIX 5

Targeted Fauna Survey Report

umwelt

Inspired people | Dedicated team
Quality outcomes

earthtrade

TARGETED FAUNA SURVEY REPORT

Killara Offset Area

FINAL

December 2020

TARGETED FAUNA SURVEY REPORT

Killara Offset Area

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Earthtrade

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Report No.	20054/R02
Date:	December 2020

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	David Gatfield	10 July 2020	David Gatfield	14 July 2020
2	David Gatfield	4 August 2020	David Gatfield	4 August2020
3	David Gatfield	11 December 2020	David Gatfield	14 December 2020

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1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) has been commissioned by Earthtrade Pty Ltd (Earthtrade) to undertake a targeted assessment of threatened fauna species potentially occurring within four land parcels located near Durong, Queensland (QLD) approximately 50 kilometres (km) north west of Kingaroy, Qld. This assessment seeks to support the identification of potentially suitable habitat for threatened fauna to be used for offsets. The species targeted in this assessment along with their relevant *Nature Conservation Act 1994* (NC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing status are provided in **Table 1.1.**

Table 1.1 Target Threatened Species

Common Name	Scientific Name	NC Act Status	EPBC Act Status
Brigalow woodland snail	*Adclarkia cameroni*	Vulnerable	Endangered
Dunmall's snake	*Furina dunmalli*	Vulnerable	Vulnerable
Painted honeyeater	*Grantiella picta*	Vulnerable	Vulnerable
South-eastern long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable
Greater Glider	*Petauroides volans*	Vulnerable	Vulnerable

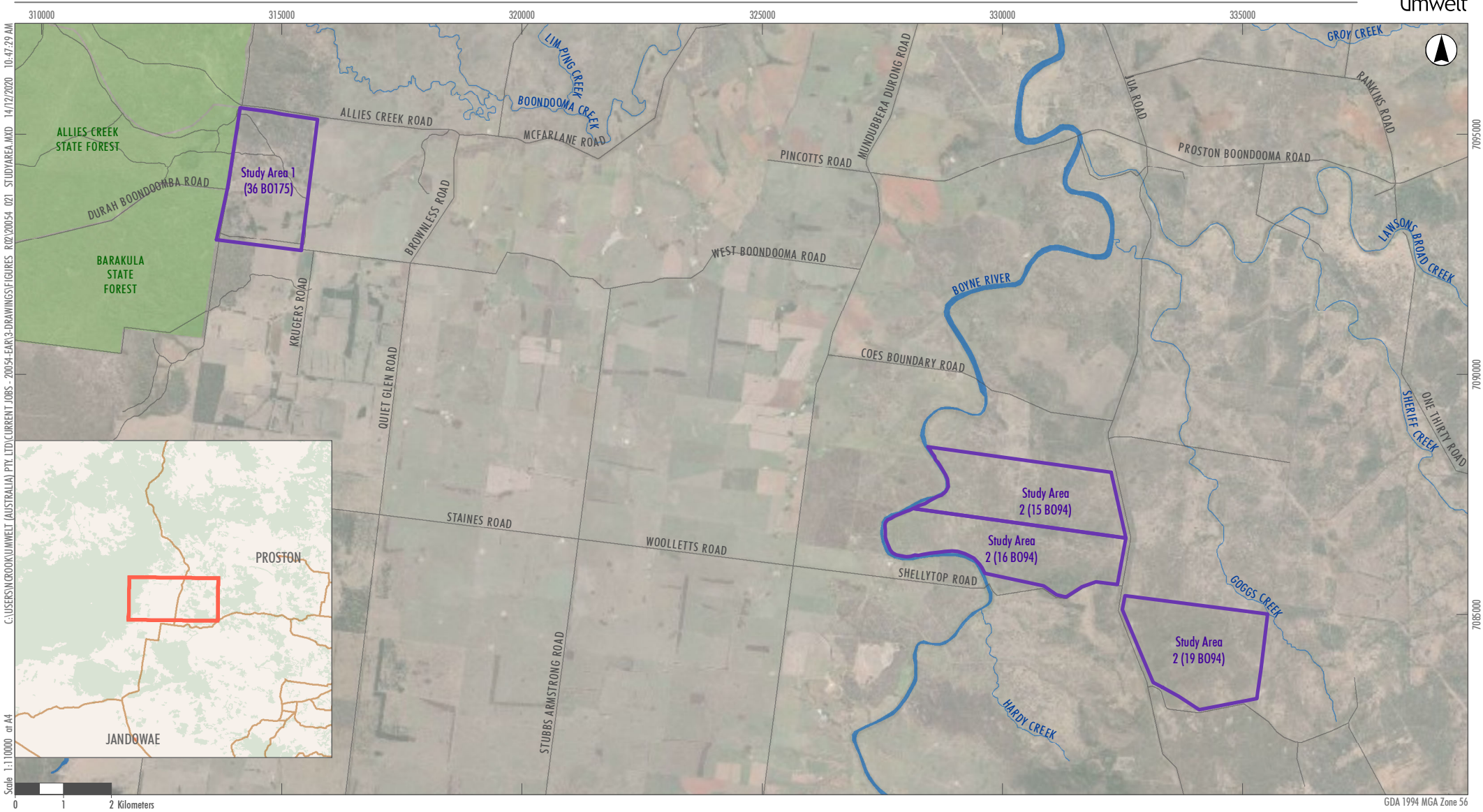
1.1 Study Area

The targeted assessment was conducted across four land parcels which have been provisionally identified by Earthtrade as being suitable for biodiversity offsets. The four land parcels are collectively known as 'Killara'. Two of these land parcels (15 BO94 and 16 BO94) are connected north to south while the remaining two are separated by approximately 25 km with the most western (36 BO175) bordering the Barakula State Forest and the Allies Creek State Forest.

Because of the geographical separation between the land parcels, two Study Areas are discussed herein as Study Area 1 and Study Area 2. The relevant Lot and Plan code for each Study Area is provided in **Table 1.2** below. The location of the Study Areas is provided in **Figure 1.1**.

Table 1.2 Study Area

Study Area 1	Study Area 2
Land Parcels: 36BO175	Land Parcels: 15BO94, 16BO94, 19BO94



Legend

- Study Areas
- State Forest
- Roads
- Watercourse

FIGURE 1.1

Study Area

Image Source: ESRI (2020) Data source: Qspatial (2020)

1.2 Scope of Works

The aim of the survey was to determine the status and extent of threatened species (including habitat) within the Study Areas. In achieving this aim, the following scope of works was undertaken:

- A desktop assessment, including an analysis of threatened fauna species records within the region
- Targeted surveys in accordance with the EPBC Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011) and the EPBC Act referral guidelines for the vulnerable koala (Department of the Environment, 2014) to determine the potential use of the Study Areas for offsets for these species
- Validation of fauna species habitat criteria outlined by AECOM (2018) and Habitat Quality Assessment (Umwelt 2020).

1.2.1 Offset Suitability Assessment

An Offset Suitability Assessment was completed within the Study Areas by AECOM in October, 2018 (AECOM, 2018). The findings of this assessment relevant to this study are summarised below.

- One koala scat was recorded within *Eucalyptus crebra* (narrow-leaved ironbark) woodland (11.12.1a) at the base of a *Corymbia citriodora* (spotted gum) within land parcel Study Area 2
- Based on fauna habitat criteria and vegetation community mapping, habitat area for the koala and greater glider was found to be 1310.8 ha with a habitat quality score for each species of 6 (**Table 1.3**). Following the revision of vegetation mapping

Table 1.3 Fauna Habitat Criteria (AECOM, 2018)

Species	Habitat Criteria
Koala (*Phascolarctos cinereus*)	11.3.2, 11.3.25, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3
Greater glider (*Petauroides volans*)	11.3.2, 11.3.25, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3
Brigalow woodland snail (*Adclarkia cameroni*)	11.3.1, 11.4.3
Dunmall's snake (*Furina dunmalli*)	11.3.1, 11.4.3, 11.5.1, 11.5.1a, 11.5.20, 11.7.6
Painted honeyeater (*Grantiella picta*)	11.4.3, 11.5.1, 11.5.1a, 11.7.6, 1.12.1a, .12.3, 1.12.6b
South-eastern long-eared bat (*Nyctophilus corbeni*)	11.3.2, 11.3.25, 11.4.3, 11.5.1, 11.5.1a, 11.5.20, 11.7.6, 11.12.1a, 11.12.3, 11.12.6b

2.0 Methodology

2.1 Desktop Assessment

Existing ecological data within the Study Areas was compiled through a review of the following key references:

- DAWE EPBC Protected Matters Search Tool
- DES Wildlife Online database
- Department of Natural Resource, Mines and Energy (DNRME) Vegetation Management Supporting Map including Essential Habitat mapping
- The Queensland Herbarium Regional Ecosystem Description Database (REDD) (Version 11.1)
- Atlas of Living Australia (ALA) database
- Existing literature and ecological reports.

2.2 Field Survey

2.2.1 Timing

The fauna assessment was conducted over 12 days across two field surveys, being 16-19 June 2020 (inclusive) and 13-20 October 2020 (inclusive). The focus of the June 2020 survey was to undertake targeted assessment for koala and greater glider, focussing on koala scat detection, habitat assessment and spotlighting. The October 2020 survey characterised baseline fauna values and completed the targeted assessment of all threatened fauna listed in **Table 1.1.**

2.2.2 Approach

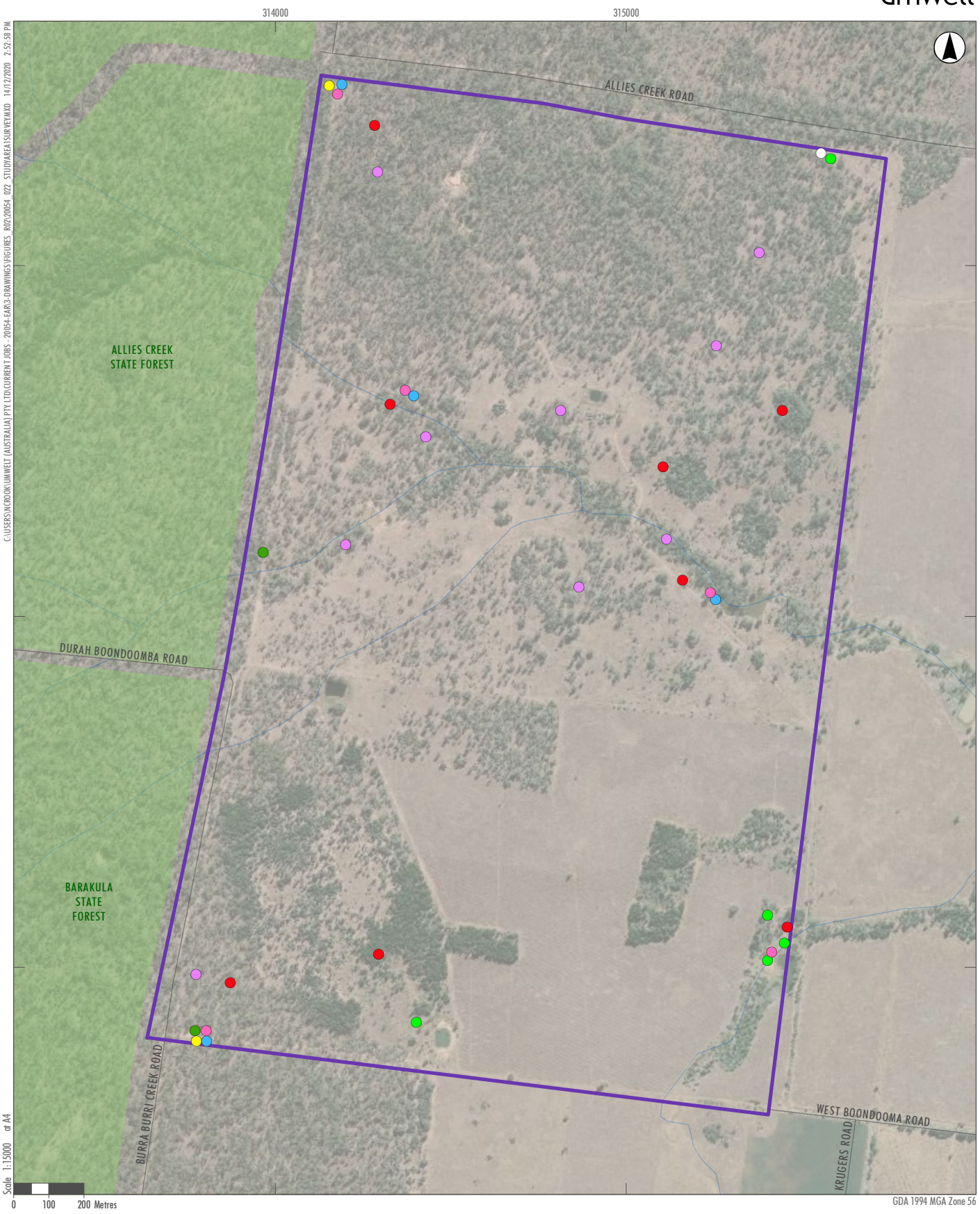
Targeted fauna methodologies were employed to detect the presence of targeted fauna species potentially occurring within the Study Areas. These methodologies were conducted in accordance with the following Commonwealth documents and guidelines.

- Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles (DSEWPaC, 2011)
- Conservation Advice *Adclarkia cameroni* brigalow woodland snail (TSSC, 2016)
- Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC, 2011b)
- Survey Guidelines for Australia's Threatened Bats (DEWHA, 2010a)
- Survey Guidelines for Australia's Threatened Birds (DEWHA, 200b)
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC, 2011)

Survey techniques and effort are described in **Table 2.1** below, while survey locations at each of the Study Areas are presented as **Figure 2.1** and **Figure 2.2**

Table 2.1 Survey Methods and Effort

Technique	Description	Survey Effort
Bird Survey	Diurnal birds were sampled using an area census method, supplemented by broad observational surveys throughout the Study Areas. This involved actively identifying birds both visually and aurally at a given location for a period of approximately 30 minutes. Bird surveys were generally conducted early in the morning or late in the afternoon when bird activity is greatest.	12 hours
Spotlighting	Spotlighting was undertaken on foot using head torches and hand-held spotlights within areas of suitable and representative habitat for targeted species. Spotlighting was also undertaken from the passenger window of a slow-moving vehicle while travelling between spotlight sites. Animals are readily detected from eyeshine reflected from the torch light beam.	40 hours (18 hours in July and 22 hours in October)
Active Searches	Active diurnal searches were undertaken within suitable microhabitats across the board ranges of habitat types for targeted species. This involved searching beneath microhabitat such as rocks and fallen timber, digging through leaf litter and soil at tree bases. Identifying tracks and traces such as scats and tree scratches.	4 hours
Spot Assessment Technique	Koala presence was assessed throughout the Study Areas using the Spot Assessment Technique (SAT) (Phillips and Callaghan, 2011). This assessment technique relies on the detection of koala faecal pellets (scats) to confirm the presence or absence of koala at a given location. Across the Study Areas, 20 koala SAT assessments were conducted, across seven regional ecosystems.	20 SAT assessments
Pitfall Trapping	Pitfall trapping was undertaken using 20 L buckets dug into the ground until the top of the buckets is flush with the surface of the ground. Three buckets are used at each site separated by approximately 10 m. Between each bucket is a drift fence approximately 30 cm high used to direct small animals towards the pitfall traps	52 pitfall bucket nights (3 traplines)
Harp trapping	Two-bank harp traps were positioned in natural flyways and checked each morning to identify and release capture fauna.	20 trap nights
Acoustic Bat Call Detection	Anabat Swift units were deployed in representative habitats to record microchiropteran calls. These calls were later analysed by Balance! Environmental for species identification purposes. Detection was conducted across all habitat types. Where possible, detection units were positioned in natural flyways.	10 trap nights
Incidental Observations	All fauna observed incidentally throughout the Study Area were recorded. Observations of wildlife recorded outside of the main sampling sites were noted according to the habitat in which they were observed.	60 hours
Habitat Assessment	Detailed descriptions of the habitat values present within the Study Area were recorded using the fauna habitat assessment methodology. Micro-habitat was described at each location including abundance of tree hollows, fallen logs, exfoliating bark, leaf litter, native grass, rocks and boulders; disturbance present; distance to water sources; and any other vegetation values present.	39 locations
Habitat Assessment including hollow counts	Hollow density counts were conducted at 18 of the 20 koala SAT survey location to assess the suitability of the habitat for this species. Along a 50 meter (m) transect, trees less than 10 m on each side of the transect were visually inspected for hollows. The number of large and small hollows within each 50 m x 10 m transect was recorded	18 locations



Legend

- Study Area
- State Forest
- Roads
- Watercourse

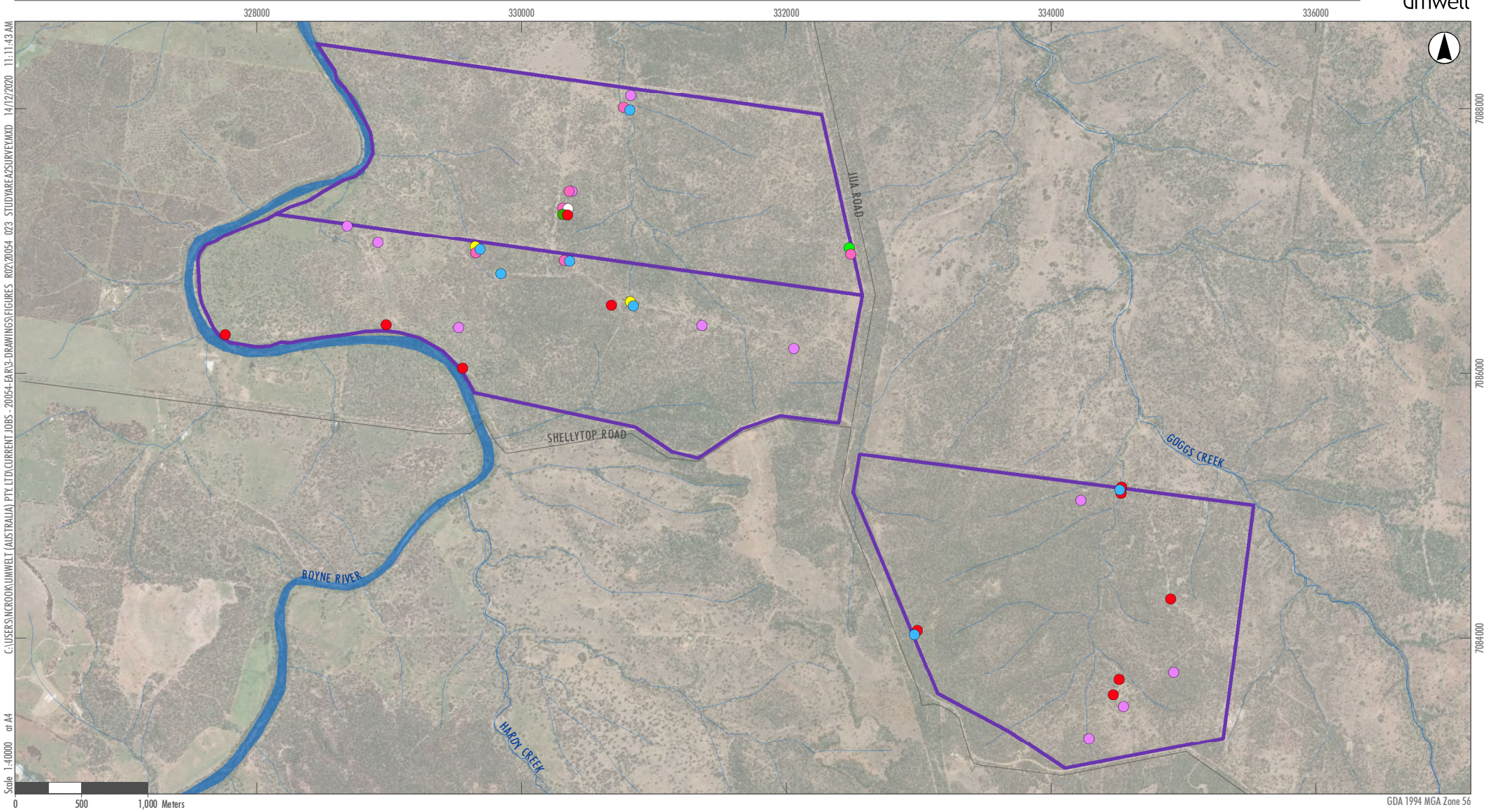
Survey Type

- Anabat
- Bird Survey
- Habitat Assessment
- Habitat Search
- Harp Trap
- Pitfall Trap
- Spotlight
- Koala SAT Sites

FIGURE 2.1

Study Area 1 Survey Locations

Image Source: ESRI (2020) Data source: Qspatial (2020); Umwelt (2020)



Legend

- Study Areas
- Roads
- Watercourse

Survey Type

- Anabat
- Bird Survey
- Habitat Assessment
- Habitat Search
- Harp Trap
- Pitfall Trap
- Spotlight
- Koala SAT Sites

FIGURE 2.2

Study Area 2 Survey Locations

Image Source: ESRI (2020) Data source: Qspatial (2020); Umwelt (2020)

3.0 Results

3.1 Desktop Assessment

3.1.1 Search Results and Historical Records

All target species were identified in the desktop searches, indicating their potential occurrence where suitable habitat exists within the Study Areas. A review of historical records for the targeted threatened fauna indicates that most species are known to be present or known from the broader regions (i.e. within 50 km of the Study Areas).

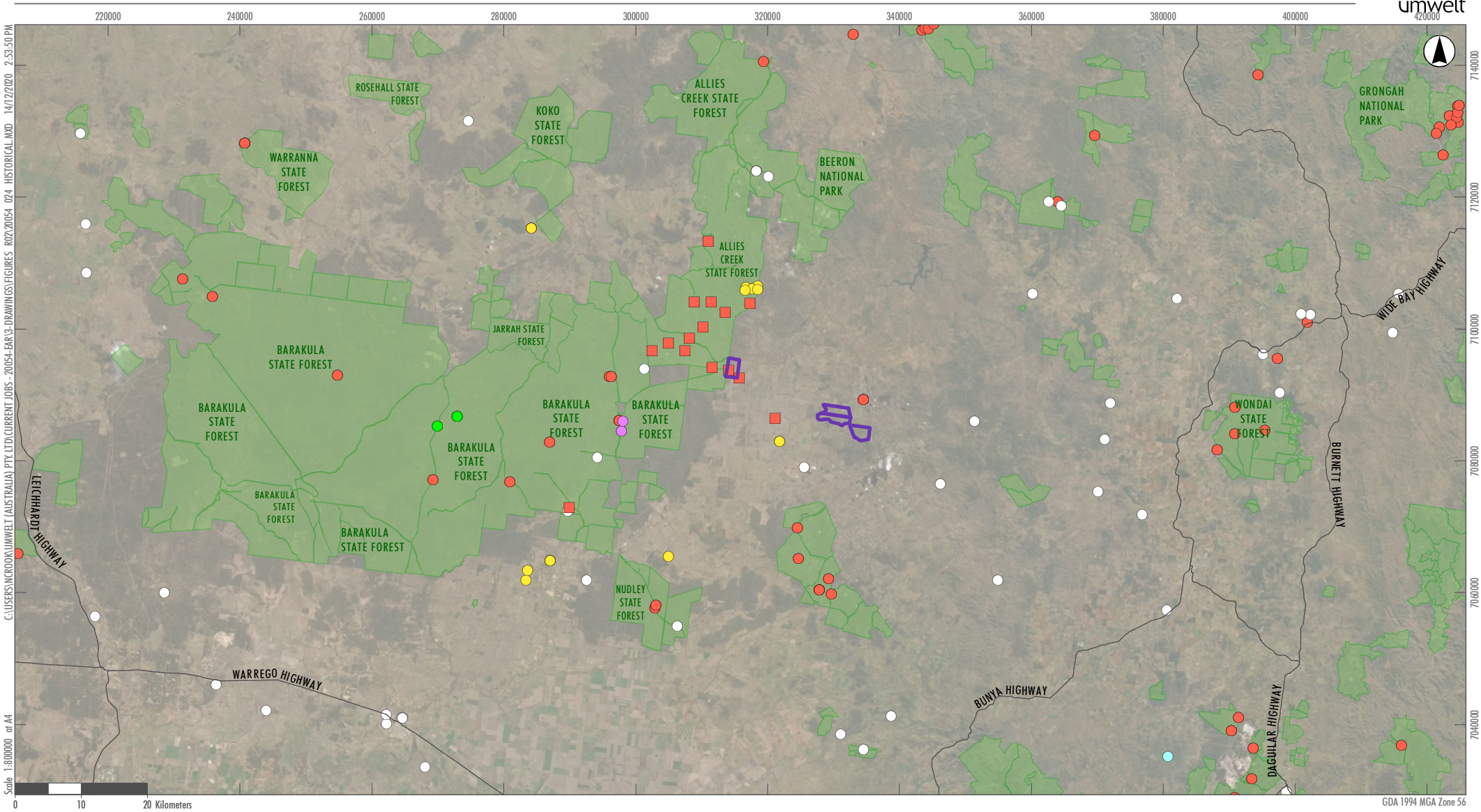
- Painted honeyeater records from the Project region are common, occurring within the Allies Creek State Forest and within roadside patches of vegetation between 6-11 km southwest of the Study Areas.
- Dunmall's snake records from the region are rare, with no occurrences within 50 km of the Study Areas. The closest records are approximately 60 km south east of the Study Area near Tarong, Queensland.
- Brigalow woodland snail records exist 40 km west from the Study Areas in the Barakula State Forest. No other records of this species occur within 50 km of the Study Areas.
- Numerous records of the greater glider exist within 20 km of the Study Areas. Numerous records are contained in the Barakula State Forest, west of Study Area 1.
- Koala records exists throughout the region including within the Barakula State Forest and near tributaries of the Boyne River.

The locations of these records in the context of the Study Areas is provided in **Figure 3.1**.

3.1.2 Home Range and Habitat Use of Greater Gliders in the Barakula State Forest

Smith et al. (2007) investigate the home range extent and habitat use of greater glider within Barakula State Forest, situated immediately west of Study Area 1 and approximately 17 km west of Study Area 2. In this study, the following key results relevant to this assessment was noted:

- Greater gliders were seen foraging and denning in myrtaceous tree species only, using mostly *Eucalyptus moluccana* (grey box), *Eucalyptus fibrosa* (red ironbark) and *Corymbia citriodora* (lemon-scented gum).
- Greater gliders preferred larger (>50 cm DBH) and older trees as denning sites
- Dead trees made up 16% of denning trees used by this population
- The density of stems containing hollows was less than one stem per hectare in some areas
- The study summarised that the Barakula state forest study area has a low availability of den sites potentially contributing to larger home ranges and low population density of the greater glider.



Legend

- Study Area
- Roads

Atlas of Living Australia Records

- Brigalow Woodland Snail
- Painted Honeyeater
- South-eastern Long-eared Bat
- Dunmall's Snake
- Greater Glider
- Koala
- Landholder Koala Records

FIGURE 3.1

Historical Records of Target Species

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); ALA (2020); Umwelt (2020)

3.2 Field Survey Results

3.2.1 Fauna Diversity

Across both field surveys, 119 fauna species were recorded, comprising of 75 birds, 27 mammals, 14 reptiles and 6 amphibians. Considering all species recorded, 74% are represented within Study area 1, 42% in Study area 2, whilst 8.4% were incidentally recorded near Study area 1 (within Barakula State Forest or along immediate access roads).

Two threatened fauna which were actively targeted during this fauna assessment were confirmed:

- Greater glider
- Koala (**Plate 3.1**).

One threatened reptile, golden-tailed gecko (*Strophurus taenicauda*) listed as Near Threatened under the NC Act, was also recorded from Study Area 1, within *Acacia harpophylla* (brigalow) regrowth (**Plate 3.2**).

Both Study Areas were found to support introduced fauna, including cane toad (*Bufo marinus*) and house mouse (*Mus musculus*).

Plate 3.1 Koala (*Phascolarctos cinereus*) foraging within *Eucalyptus crebra* (narrow-leaved ironbark)

Plate 3.2 Golden-tailed gecko (*Strophurus taenicauda*) within *Acacia harpophylla* (brigalow) regrowth woodland

3.2.1.1 Microbat call analysis and Harp Trapping

Two microbat species were recorded from harp traps: little pied bat (*Chalinolobus picatus*) and Gould's long-eared bat (*Nyctophilus gouldi*). Little pied bat was recorded twice; one record within *Eucalyptus crebra* (narrow-leaved ironbark) and *Eucalyptus melanophloia* (silver-leaved ironbark) mature regrowth woodland in the norther portions of Study Area 2. The second record was from a harp trap situated on track within *Eucalyptus crebra* (narrow-leaved ironbark) mature regrowth woodland, from the central portion of the Study Area 2. Gould's long-eared bat (*Nyctophilus gouldi*). was also recorded from this harp trap (**Plate 3.3**).

The analysis of acoustic data was completed by Balance! Environmental. At least 13 species were recorded with 11 call types being positively identified to unique species. Whereas the remaining calls were associated with two undifferentiated sets of related species the *Nyctophilus sp.* and *Scotorepens greyii/ Scotorepens sp.*

None of the positively identified species are listed under the NC Act or EPBC Act.

Plate 3.3 Gould's Long-eared Bat (Nyctophilus gouldi)

3.2.2 Fauna Habitat

The Study Areas support both remnant and mature regrowth woodlands, with dominant canopy species including *Eucalyptus crebra* (narrow-leaved ironbark), *Eucalyptus moluccana* (grey box) and *Eucalyptus tereticornis* (forest red gum). Fauna habitat within the Study Area can be broadly characterised into six habitat types as detailed in **Table 3.1.**

Table 3.1 Fauna Habitat Types

Habitat Description	RE ID	Short Description
Eucalyptus and/or Corymbia woodland on igneous rocks	11.12.1a	*Eucalyptus crebra* +/- *E. exserta* woodland. Occurs on undulating rises.
	11.12.3	*Eucalyptus crebra, E. tereticornis*, *Angophora leiocarpa* woodland on igneous rocks especially granite
Callitris glaucophylla woodland on igneous rocks (granite)	11.12.6	*Callitris glaucophylla* +/- *Eucalyptus spp*. woodland
Eucalyptus woodland on Cainozoic plains/ lateritic duricrust	11.5.1	*Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces
	11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer
	11.5.20	*Eucalyptus moluccana* woodland on Cainozoic sand plains
	11.7.6	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust

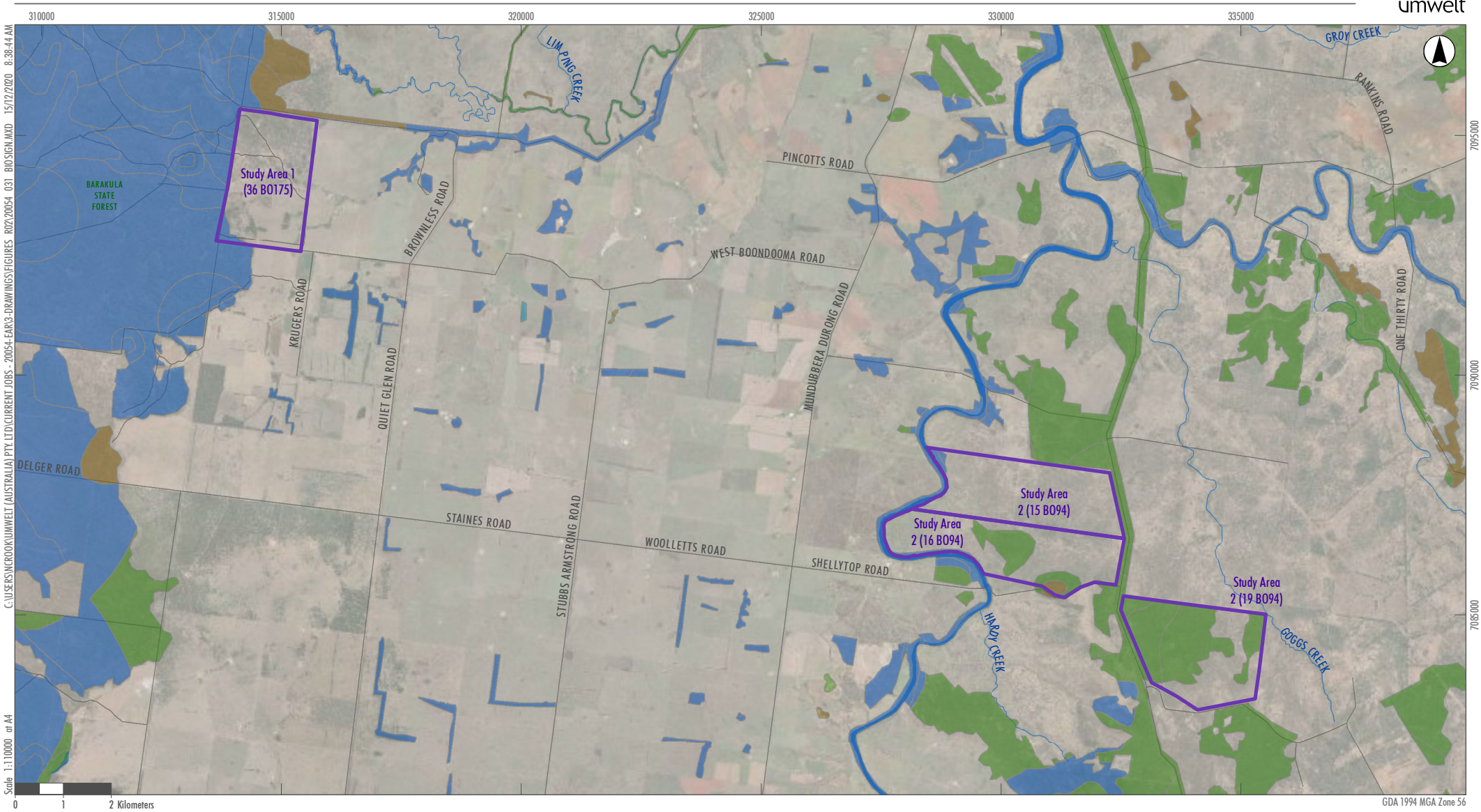
Habitat Description	RE ID	Short Description
Eucalyptus woodland on alluvial plains	11.3.2	*Eucalyptus populnea* woodland on alluvial plains
Eucalyptus woodland fringing drainage lines	11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
Acacia harpophylla and/or *Casuarina cristata* open forest	11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
	11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains

3.3 Connectivity

Large tracts of vegetation and habitat exist to the west of Study Area 1 (Barakula and Allies Creek State Forest), with connection into these areas (from the Study Area) afforded via regrowth and remnant vegetation. To the immediate east of Study Area 1, connectivity is limited to regrowth woodlands of *Acacia harpophylla* (brigalow) which predominately exists within the verge of local road corridors, often supporting gilgai formations.

Fauna movement within Study Area 2 is afforded by regrowth and remnant vegetation, predominately *Eucalyptus crebra* (narrow-leaved ironbark) woodlands. Fauna movement beyond the Study Area is likely to be concentrated along the Boyne River (State Significant Corridor) and Jua Road (Regional Significant Corridor). Both corridors provide north south movement opportunities for fauna, including hollow dependent fauna such as greater glider.

Mapped biodiversity corridors are depicted on **Figure 3.2.**



Legend

- Study Areas
- Roads
- Watercourse

Biodiversity Significance

- State Habitat for EVNT taxa
- State
- Regional
- Local or Other Values

FIGURE 3.2

State Biodiversity Corridors

Image Source: ESRI (2020) Data source: Qspatial (2020)

3.4 Potential Habitat for Threatened Species

3.4.1 Koala

3.4.1.1 Spot Assessment Technique

The Spot Assessment Technique was completed at 20 sites, targeting koala scats throughout the Study Areas. In total of 600 trees were searched as per the SAT methodology provided in **Section 2.2** . Of these trees, koala scats were recorded from 24 trees within four vegetation communities, collected under five different tree species and one hybrid tree. The results of this assessment are broken down in the following sections.

Vegetation Communities

The Study Areas support both remnant and regrowth woodlands, with the dominant canopy species including *Eucalyptus crebra* (narrow-leaved ironbark), *Eucalyptus moluccana* (grey box) and *Eucalyptus tereticornis* (forest red gum). Regrowth across the Study Areas was typically mature regrowth and generally supported Eucalypt trees with a DBH >10 cm. Koala scats were recorded within three regrowth and one remnant vegetation community. **Table 3.2** provides a summary of these results including the number of SAT sites completed within each vegetation community.

Table 3.2 SAT Results by Vegetation Community

RE ID	Remnant Status	Short Description	Sites	Sites with Scats
11.3.25	Regrowth	*Eucalyptus tereticornis* or *Eucalyptus camaldulensis* woodland fringing drainage lines	3	0
11.5.1	Regrowth	*Eucalyptus crebra* and/or *Eucalyptus populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces	1	0
11.5.1a	Regrowth	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer	2	2
11.5.20	Regrowth	*Eucalyptus moluccana* and/or *Eucalyptus crebra* woodland on Cainozoic sand plains	2	0
11.7.6	Remnant	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	1	0
11.7.6	Regrowth	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	2	0
11.12.1a	Remnant	*Eucalyptus crebra* +/- *Eucalyptus exserta* woodland. Occurs on undulating rises.	1	1
11.12.1a	Regrowth	*Eucalyptus crebra* +/- *Eucalyptus exserta* woodland. Occurs on undulating rises.	5	2
11.12.3	Remnant	*Eucalyptus crebra*, *Eucalyptus tereticornis*, *Angophora leiocarpa* woodland on igneous rocks especially granite	1	0
11.12.3	Regrowth	*Eucalyptus crebra*, *Eucalyptus tereticornis*, *Angophora leiocarpa* woodland on igneous rocks especially granite	2	1
Total			**20**	**6**

Tree Species Use

The 24 scat trees recorded during the study belong to five different tree species and one hybrid species (*Eucalyptus melanophloia/Eucalyptus crebra*). The species with the highest number of scat trees was *Eucalyptus tereticornis* (forest red gum), followed by *Eucalyptus crebra* (narrow-leaved ironbark). These two species are dominant across the landscape within both Study Areas. **Table 3.3** below details the number of each tree species where koala scats were identified from the 600 trees searched during the assessment.

Table 3.3 Scat Occurrences per Tree Species

Tree Species	Common Name	Number of Trees with Scats
Angophora leiocarpa	smooth-barked apple	1
Eucalyptus crebra	narrow-leaved ironbark	7
Eucalyptus melanophloia	silver-leaved ironbark	1
Eucalyptus melanophloia x Eucalyptus crebra	n/a	1
Eucalyptus populnea	poplar box	3
Eucalyptus tereticornis	Forest red gum	11
Total		**24**

Koala Activity Levels

The SAT methodology (Phillips and Callaghan, 2011) uses activity levels to quantify the use of an area by koalas. This is done by calculating the percentage of scat trees relative to the total number of trees searched per site. For example, at C3, three trees with scats were recorded out of 30 trees searched, so the activity level percentage is 10%.

The categorisation of this data into activity bands (as per Phillips and Callaghan, 2011) has not been undertaken given the variability in recorded activity levels and relatively low sample set. The activity levels calculated for each site are provided in **Table 3.4** below.

Table 3.4 Koala SAT Site Activity Levels

Site Name	Remnant Status	Study Area	Trees with Scats	Activity Level %
NW1	Regrowth	Study Area 1	0	0.0
NW2	Regrowth	Study Area 1	0	0.0
NW3	Regrowth	Study Area 1	0	0.0
NW4	Regrowth	Study Area 1	0	0.0
NW5	Regrowth	Study Area 1	0	0.0
NW6	Regrowth	Study Area 1	0	0.0
NW7	Regrowth	Study Area 1	0	0.0
NW8	Regrowth	Study Area 1	0	0.0
NW9	Remnant	Study Area 1	0	0.0
C1	Regrowth	Study Area 2	4	13.3
C2	Regrowth	Study Area 2	9	30.0

Site Name	Remnant Status	Study Area	Trees with Scats	Activity Level %
C3	Regrowth	Study Area 2	3	10.0
C4	Regrowth	Study Area 2	0	0.0
C5	Regrowth	Study Area 2	2	6.7
C6	Regrowth	Study Area 2	4	13.3
C7	Regrowth	Study Area 2	0	0.0
SE1	Regrowth	Study Area 2	0	0.0
SE2	Regrowth	Study Area 2	0	0.0
SE3	Remnant	Study Area 2	0	0.0
SE4	Remnant	Study Area 2	2	6.7

3.4.1.2 Potential Habitat

Eight vegetation communities are identified in the Offset Suitability Assessment (AECOM, 2018) as providing suitable habitat for koala. Data collected during this field survey confirmed the presence of the koala within five of these vegetation communities (**Table 3.2**). Habitat assessments conducted as part of this assessment confirmed suitable resources available within the remaining three REs.

Given the above, this Study confirms the habitat criteria for koala within the Study Areas defined by AECOM (2018). Mapping of koala habitat using suitable REs has determined that the total area of koala habitat within the Study Areas is 1,699 ha totalling 95% of the total Study Areas.

A breakdown of this area for each of the land parcels which make up the Study Areas is provided in **Table** 3.5 below. Mapping of koala habitat within the Study Areas is provided in **Figure 3.3** and **Figure 3.4**

Table 3.5 Koala Habitat Area

Koala Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.3.2	10.3	0
11.3.25	17.5	10.6
11.5.1	0	54.3
11.5.1a	0	12.2
11.5.20	49.1	0
11.7.6	120.5	0
11.12.1a	54.2	1228
11.12.3	0	142.7
Total	**251.6**	**1447.8**

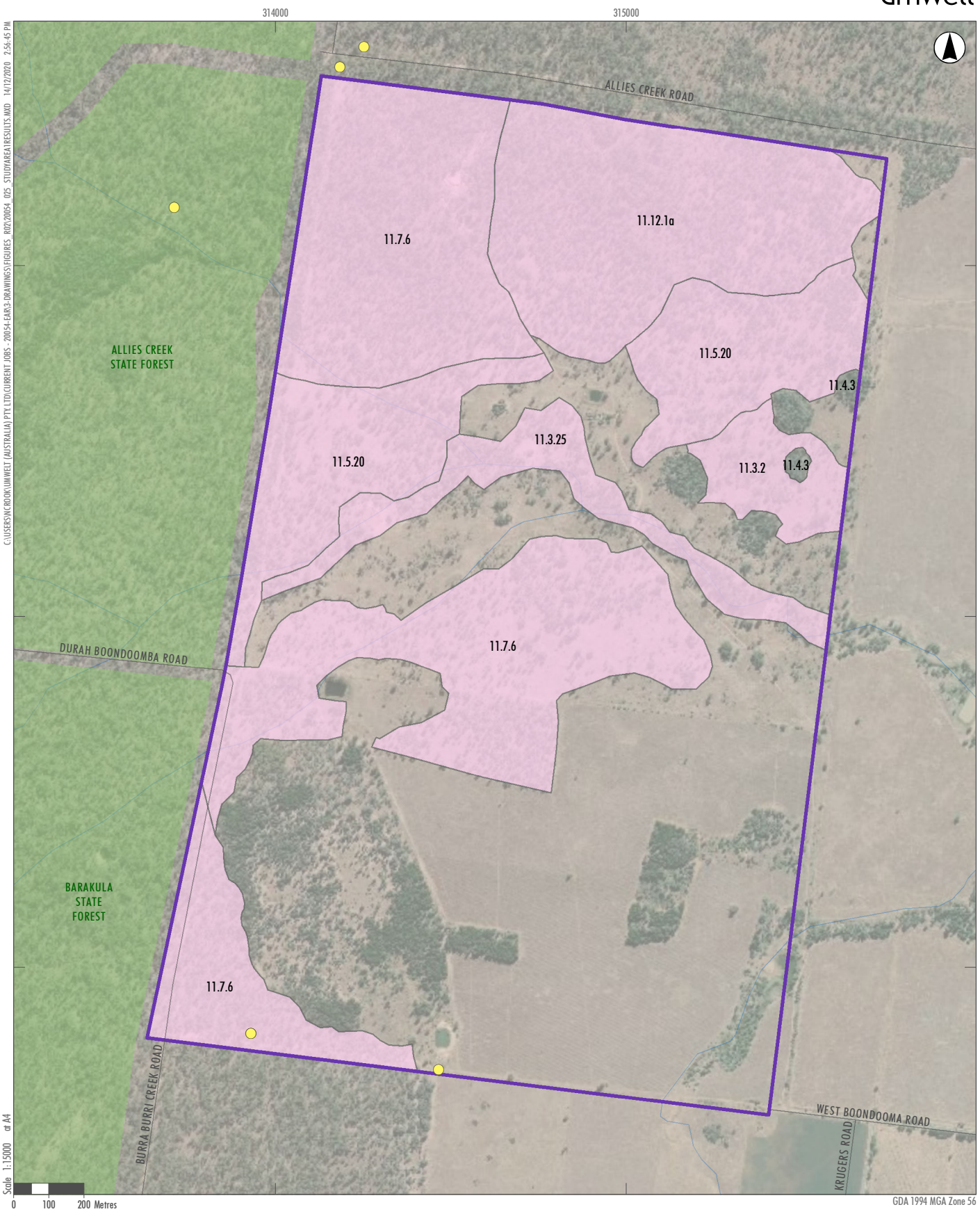


FIGURE 3.3

Study Area 1, Greater Glider and Koala Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

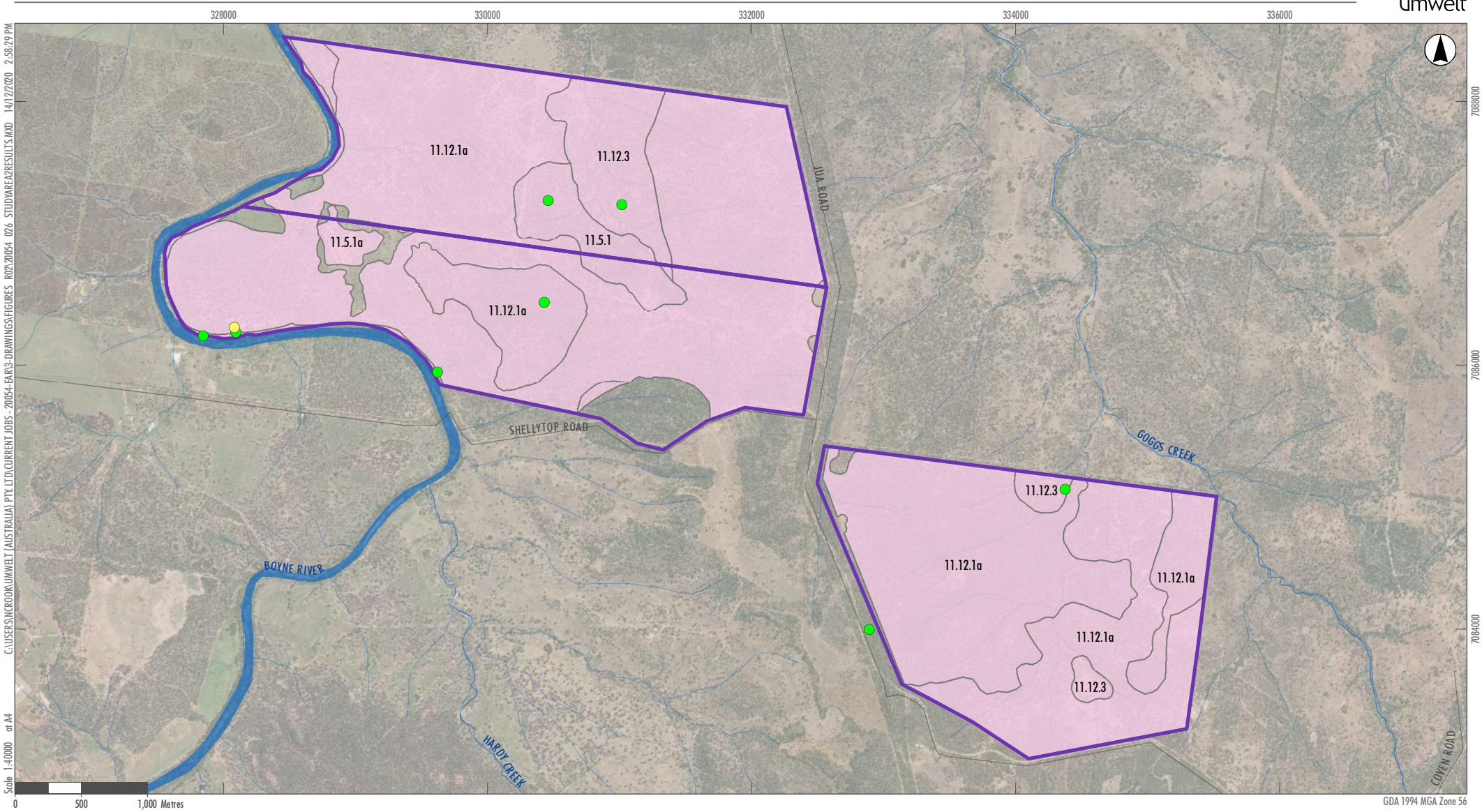


FIGURE 3.4

Study Area 2, Greater Glider and Koala Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

3.4.2 Greater Glider

3.4.2.1 Hollow Density Count

Hollow density counts were completed at 18 SAT sites during the field survey. These surveys collected hollow density information from a 50 m by 20 m transect. The total number of hollows within the site was multiplied to achieve an estimated hollow density per hectare.

The results of the hollow density count identified that:

- Hollows were recorded from three out of 18 sites during the assessment
- Each site containing hollows was within an individual regrowth vegetation community. No hollows were recorded in remnant woodland
- The greatest number of hollows was identified from a site located in regrowth *Eucalyptus tereticornis* (forest red gum) along a watercourse (RE 11.3.25). At this location, a density of 50 hollows per hectare was estimated
- The remaining hollows identified were recorded from *Eucalyptus crebra* (narrow-leaved ironbark) or *Eucalyptus populnea* (poplar box) regrowth woodland. These sites received an estimated hollow density of 10 hollows and 15 hollows per hectare, respectively.

These results indicate a low density of hollows throughout the vegetation communities of both Study Areas. This assessment is consistent with what was found in a study of habitat use of greater gliders in the Barakula State Forest (Smith, Mathieson and Hogan, 2007) (**Section 3.1.1**).

3.4.2.2 Potential Habitat

Greater gliders favour habitat which offers old or dead trees with large hollows (Lindenmayer et al., 1991), which provide necessary day-time denning sites. Within the Study Areas, suitable hollow-bearing trees were mostly contained to remnant Eucalypt dominated communities, with regrowth vegetation generally found to support a low abundance of hollows or hollows were absent.

The assessment confirms the habitat mapping criteria for greater glider as defined by AECOM (2018). It is noted that existing habitat within Killara is currently afforded by remnant and regrowth woodlands dominated by Myrtaceous vegetation offering or with the future potential to offer hollow bearing trees.

Inclusive of the vegetation communities detailed in **Table 3.6**, the total area of potential greater glider habitat within the Study Areas is 1699 ha totalling 95% of the total areas. A breakdown of this area for each of the land parcels which make up the Study Areas is provided in below.

Mapping of greater glider habitat as within the Study Areas is provided in **Figure 3.3**and **Figure 3.4**.

Table 3.6 Greater Glider Habitat

Greater Glider Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.3.2	10.3	0
11.3.25	17.5	10.6
11.5.1	0	54.3
11.5.1a	0	12.2
11.5.20	49.1	0

Greater Glider Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.7.6	120.5	0
11.12.1a	54.2	1228
11.12.3	0	142.7
Total	**251.6**	**1447.8**

3.4.3 Brigalow Woodland Snail

The presence of Brigalow woodland snail was not confirmed during field surveys. Although, the habitat assessments did confirm suitable resources available within *Acacia harpophylla* woodlands situated on Study Area 1. The Study Area is situated immediately north of the Condamine River floodplain, where this species is known. For this reason, habitat within the property is considered sub-optimal based on the recognised distribution of the species.

Noting the above, this assessment confirms the habitat mapping criteria as defined by AECOM (2018). Based on the above, potential habitat mapping within Study area 1 has determined that there is 60.9 ha of suitable habitat, comprising 3% of the total area. A breakdown of this area is provided in **Table 3.7**, while mapping is presented in **Figure 3.5**.

Table 3.7 Brigalow Woodland Snail Habitat

Brigalow Woodland Snail Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.3.1	12.8	0
11.4.3	48.1	0
Total	**60.9**	**0**

3.4.4 Dunmall's Snake

The Study Areas are situated within the DAWE mapped distribution of the species, although the nearest record is approximately 60 km to the south east. The species was not confirmed during field surveys, despite extensive spotlighting effort, active searches and pitfall trapping. Habitat assessments have confirmed that suitable resources for the species are available within seven REs. Suitable habitat includes *Acacia harpophylla* (brigalow) woodlands and Eucalypt woodland. Micro-habitat for the species includes ground timber, gilgai and cracking clay soils. The Study Areas were found to have suitable foraging potential, with numerous skinks and geckos recorded.

The assessment confirms the habitat mapping criteria as defined by AECOM (2018). Potential habitat mapping identifies 297 ha of suitable habitat within the Study Areas, comprising 15% of the total area. A breakdown of this area is provided in **Table 3.8**, while mapping is presented in **Figure 3.5** and **Figure 3.6**.

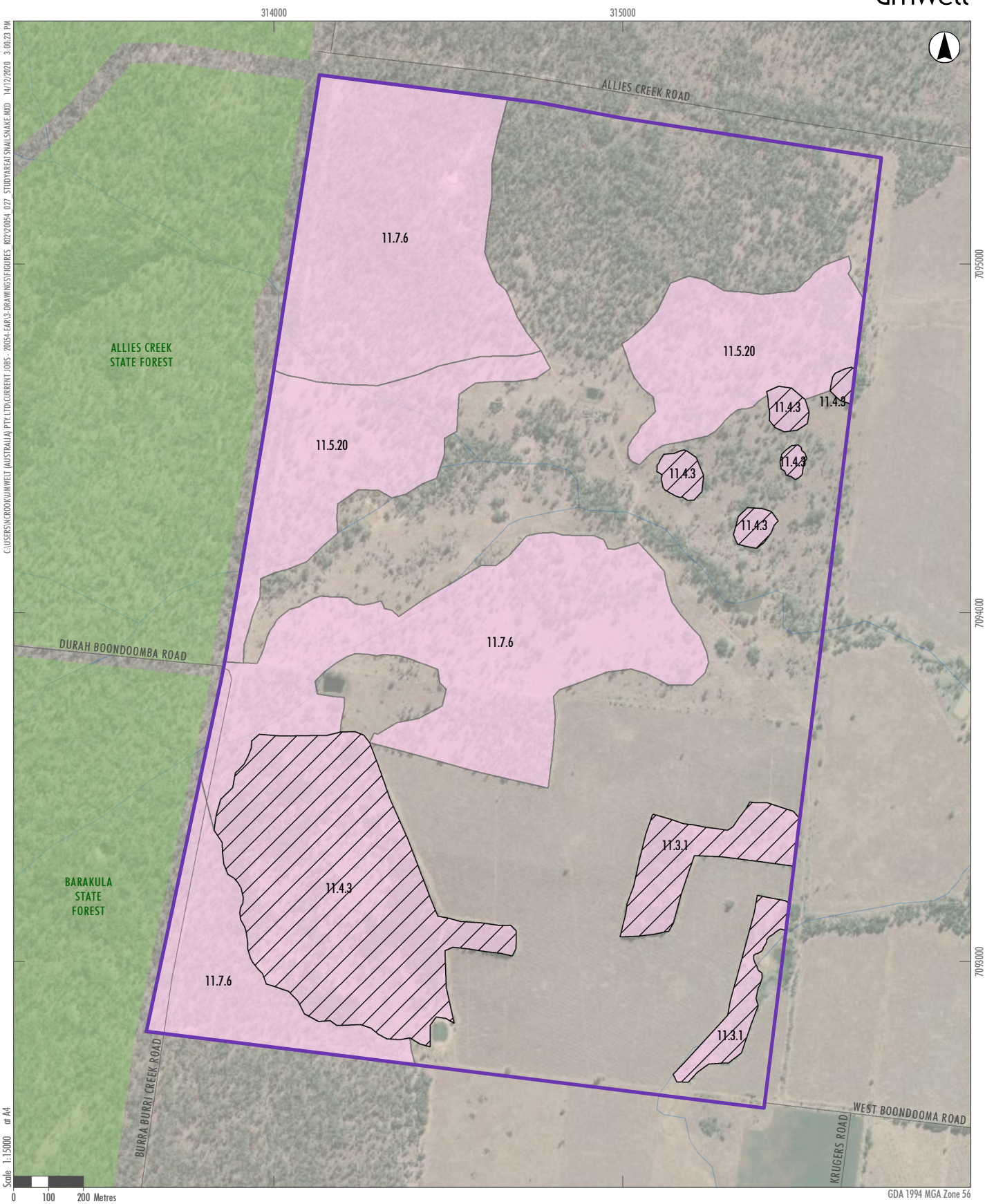


FIGURE 3.5

Study Area 1, Brigalow Woodland Snail and Dunmall's Snake Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

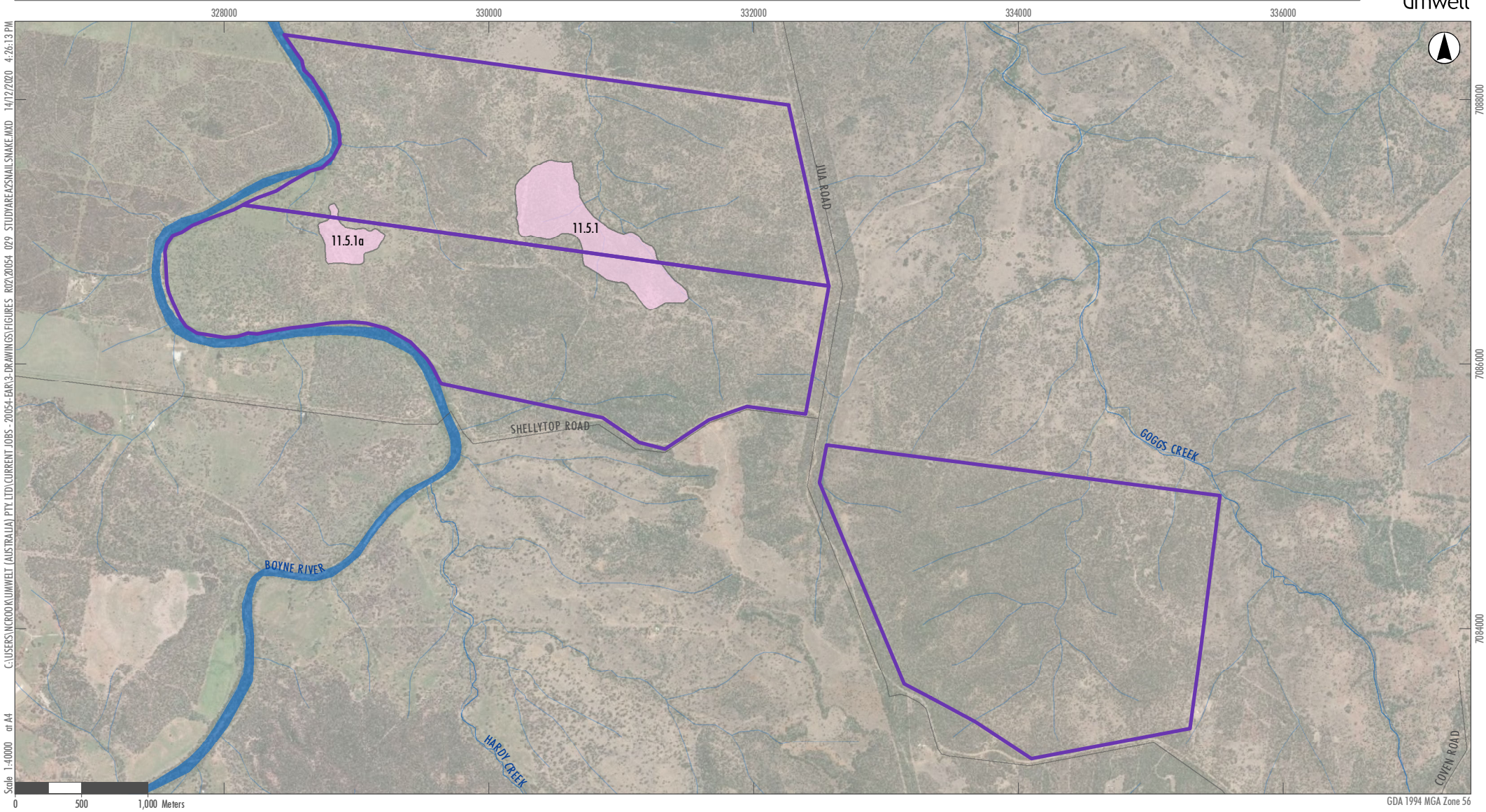


FIGURE 3.6

Study Area 2, Dunmall's Snake Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

Table 3.8 Dunmall's Snake Habitat

Dunmall's Snake Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.3.1	12.8	-
11.4.3	48.1	-
11.5.1	-	54.3
11.5.1a	-	12.2
11.5.20	49.1	-
11.7.6	120.5	-
Total	**230.5**	**66.5**

3.4.5 Painted Honeyeater

The Study Areas are situated within areas identified by DAWE as 'species or species habitat likely to occur'. This is supported by historical records for the species (**Figure 3.1**). Painted honeyeater was not confirmed during field surveys, however habitat assessments confirmed suitable resources are available, including abundant mistletoe within Acacia and Eucalypt dominated woodlands.

This assessment confirms the habitat mapping criteria as defined by AECOM (2018). Mapping has determined that there is 1694.2^{o} ha of suitable habitat within the Study Areas, comprising 85% of the total area. A breakdown of this area is provided in **Table 3.9** below, while mapping is presented in **Figure 3.7** and **Figure 3.8**.

Table 3.9 Painted Honeyeater Habitat

Painted Honeyeater Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.4.3	48.1	-
11.5.1	-	54.3
11.5.1a	-	12.2
11.7.6	120.5	-
1.12.1a	54.2	1,227.8
11.12.3	-	142.7
11.12.6b	-	34.4
Subtotal	**222.8**	**1471.4**

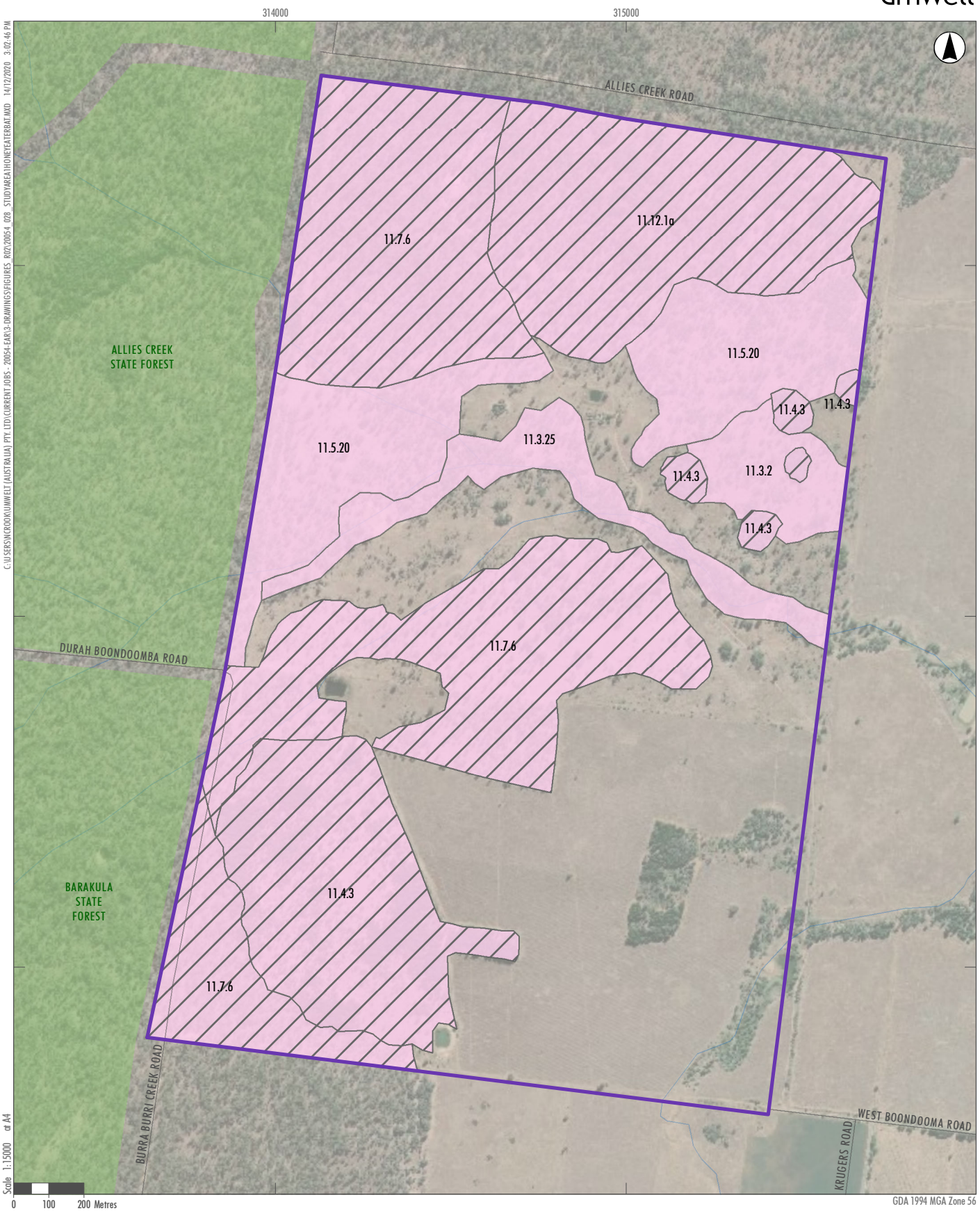


FIGURE 3.7

Study Area 1, Painted Honeyeater and South-Eastern Long-Eared Bat Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

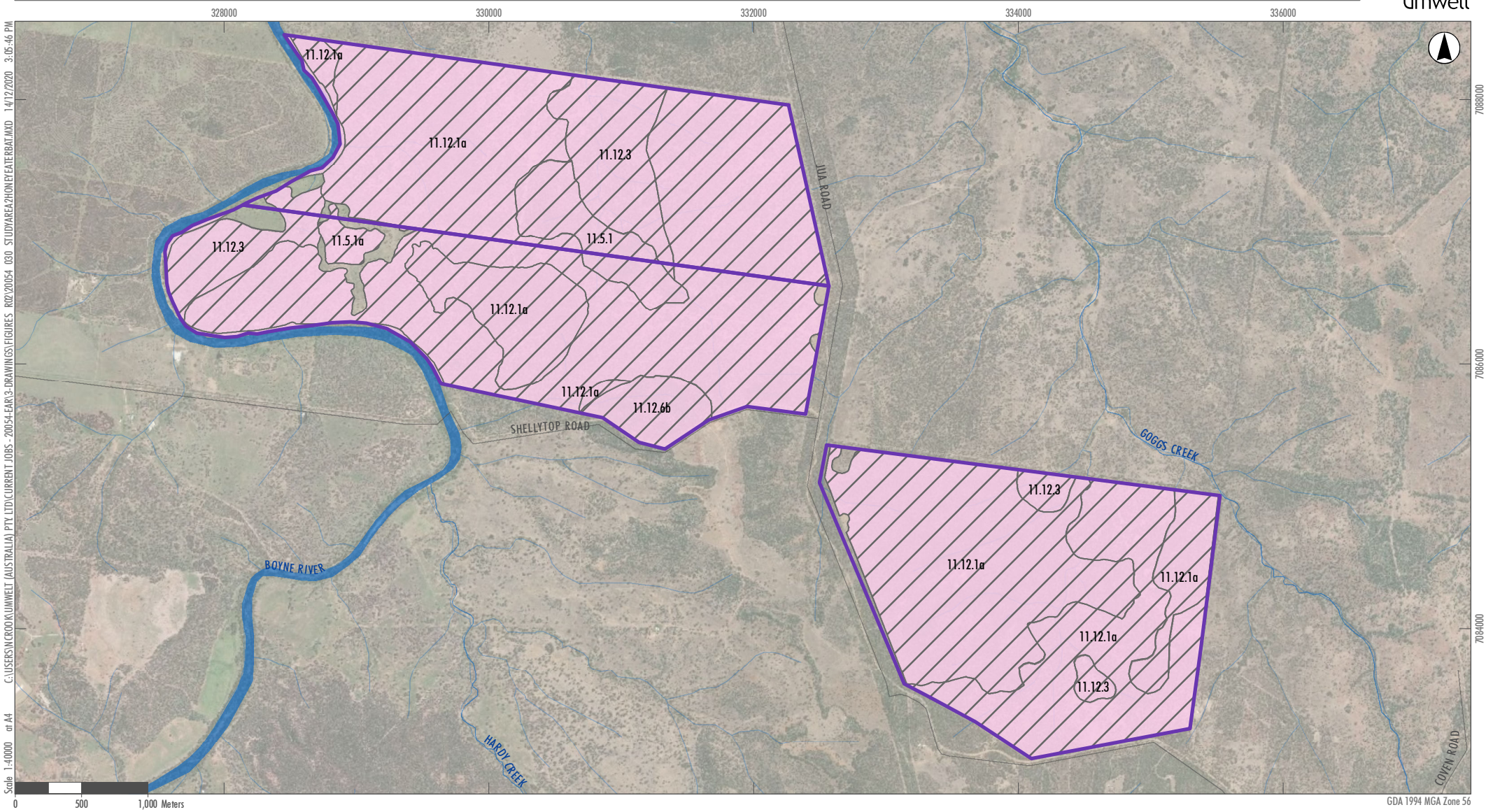


FIGURE 3.8

Study Area 2, Painted Honeyeater and South-Eastern Long-Eared Bat Habitat

Image Source: ESRI Imagery (2020) Data source: Qspatial (2020); Umwelt (2020)

3.4.6 South-eastern Long-eared Bat

The Study Areas are situated within areas identified by DAWE as 'species or species habitat may occur'. Records for the species are mapped within the Barakula State Forest (**Figure 3.1**). The south-eastern long-eared bat was not confirmed during field survey, although calls *Nyctophilus sp*. were recorded on anabat units.

This assessment confirms the habitat mapping criteria as defined by AECOM (2018). Potential habitat for the species includes Eucalypt woodland, particularly where extensive stands of vegetation occur. Habitat assessments and mapping of the Study Areas has identified 1781.7 ha of suitable habitat, comprising 90% of the total area. A breakdown of this area is provided in **Table 3.10**, while mapping is presented in **Figure 3.7** and **Figure 3.8**.

Table 3.10 South-eastern Long-eared Bat Habitat

South-eastern Long-eared bat Habitat RE	Study Area 1 (ha)	Study Area 2 (ha)
11.3.2	10.3	-
11.3.25	17.5	10.6
11.4.3	48.1	-
11.5.1	-	54.3
11.5.1a	-	12.2
11.5.20	49.1	-
11.7.6	120.5	-
11.12.1a	54.2	1,227.8
11.12.3	-	142.7
11.12.6b	-	34.4
Subtotal	**299.7**	**1482**

4.0 Conclusion

Umwelt was commissioned by Earthtrade to undertake a targeted fauna assessment to determine the status and extent of threatened species (including habitat) within the Study Areas. Threatened fauna species which were targeted during this assessment include:

- Koala *(Phascolarctos cinereus)*
- Greater glider *(Petauroides Volans)*
- Brigalow woodland snail *(Adclarkia cameroni)*
- Dunmall's snake *(Furina dunmalli)*
- Painted Honeyeater *(Grantiella picta)*
- South-eastern long-eared bat *(Nyctophilus corbeni).*

The fauna survey implemented multiple survey techniques and recorded a total of 119 fauna species, including 75 birds, 27 mammals, 14 reptiles and 6 amphibians. Only two of the targeted threated species were confirmed - koala and greater glider. Habitat for the remaining values were confirmed, although it is noted that the Study Areas is situated outside of the recently revised, DAWE accepted distribution for brigalow woodland snail (*Adclarkia cameroni*).

The survey confirmed large areas of koala and greater glider habitat are available for use as an offset. In addition, large areas of suitable habitat for the other targeted threatened species were confirmed within the Study Area, providing outlooks that these threated species may be present but were undetected during this survey.

Overall, there are various sections of the Study Areas which offer greater application for use by threatened species by providing:

- Increased connectivity through the landscape to other tracts of suitable habitat
- Increased availability of recourse such as improved abundance or quality of food trees and microhabitats
- Decreased risk of negative interactions with humans such as vehicles strikes
- Increased availability of water sources.

5.0 References

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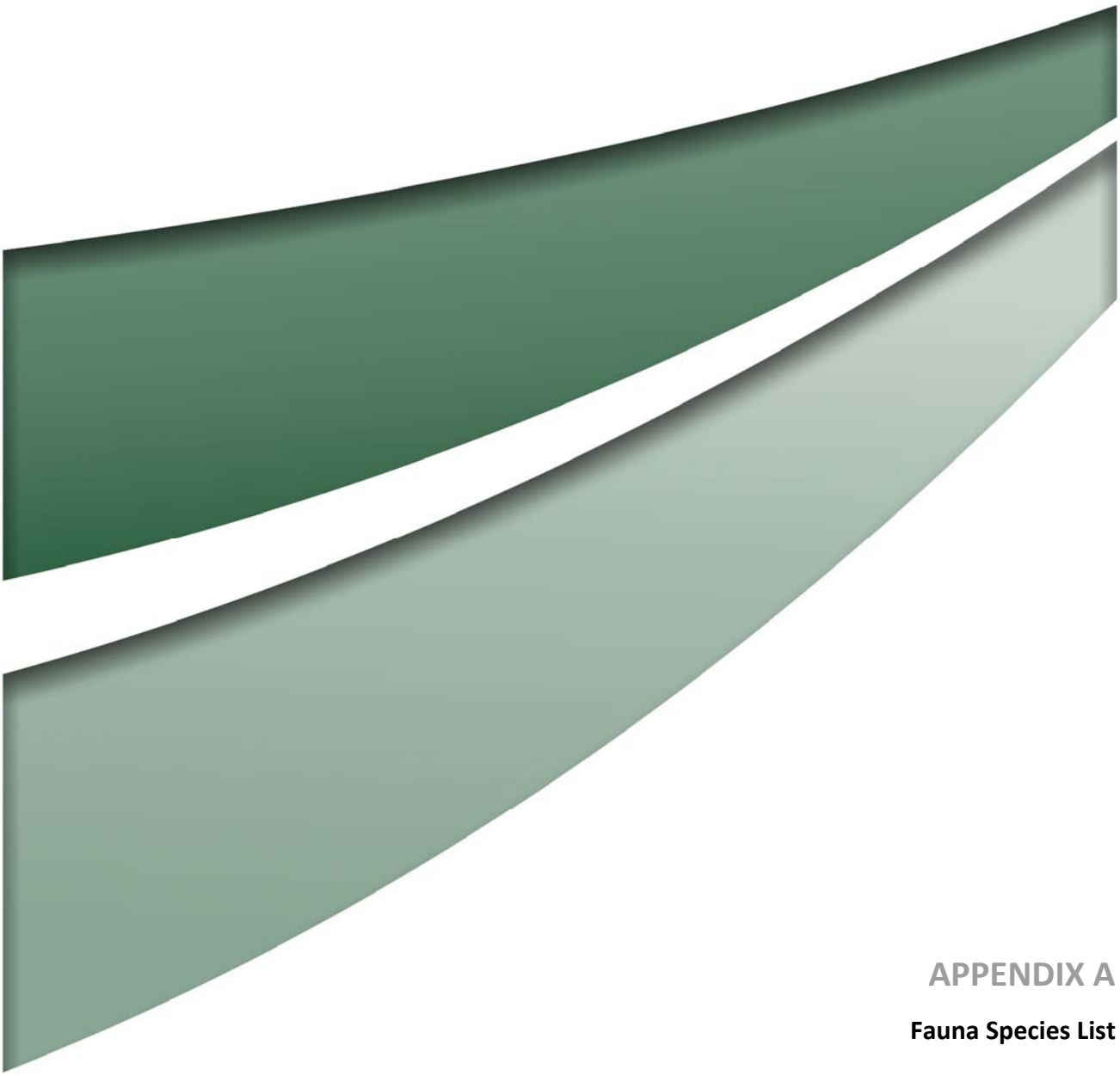

APPENDIX A

Fauna Species List

Common Name	Scientific Name	Study Area 1	Study Area 2	Incidental
Amphibian				
striped snake-eyed skink	*Cryptoblepharus virgatus*	x		x
common green treefrog	*Litoria caerulea*	x	x	
broad palmed rocketfrog	*Litoria latopalmata*	x		
striped rocketfrog	*Litoria nasuta*	x		
ruddy treefrog	*Litoria rubella*	x		
cane toad	*Bufo marinus*	x		
Reptile				
wood gecko	*Diplodactylus vittatus*	x	x	x
dubious dtella	*Gehyra dubia*	x	x	
timid slider	*Lerista timida*	x		
Steindachner's gecko	*Lucasium steindachneri*		x	
common dwarf skink	*Menetia greyii*	x		
carpet python	*Morelia spilota*	x		
southern spotted velvet gecko	*Oedura tryoni*	x		
bearded dragon	*Pogona barbata*		x	
red-bellied black snake	*Pseudechis porphyriacus*			x
eastern brown snake	*Pseudonaja textilis*	x		
dwarf litter-skink	*Pygmaeascincus timlowi*	x	x	
golden-tailed gecko	*Strophurus taenicauda*	x		
eastern blue-tongued lizard	*Tiliqua scincoides*		x	
lace monitor	*Varanus varius*	x		
Mammal				
rufous bettong	*Aepyprymnus rufescens*	x		
White-striped Free-tailed Bat	Austronomus australis	x	x	
dingo	*Canis familiaris dingo*	x		
Greater Northern Freetail-Bat	*Chaerephon jobensis*	x	x	
little pied bat	*Chalinolobus picatus*		x	
black-striped wallaby	*Macropus dorsalis*		x	
eastern grey kangaroo	*Macropus giganteus*	x	x	
whiptail wallaby	*Macropus parryi*		x	
red-necked wallaby	*Macropus rufogriseus*	x	x	
house mouse	*Mus musculus*	x	x	
Gould's long-eared bat	*Nyctophilus gouldi*		x	
	*Nyctophilus sp. **	x	x	x
rabbit	*Oryctolagus cuniculus*	x		

Common Name	Scientific Name	Study Area 1	Study Area 2	Incidental
Northern Free-tail Bat	*Ozimops lumsdenae*	x	x	
Ride's Free-tailed Bat	*Ozimops ridei*	x	x	
Yellow-Bellied Sheathtail-Bat	*Saccolaimus flaviventris*	x	x	
Inland Broad-Nosed Bat	*Scotorepens balstoni*	x		
Little Broad-Nosed Bat	*Scotorepens greyii/ Scotorepens sp.*	x	x	
greater glider	*Petauroides volans*	x		
squirrel glider	*Petaurus norfolcensis*		x	
koala	*Phascolarctos cinereus*		x	
short-beaked echidna	*Tachyglossus aculeatus*	x	x	x
common brushtail possum	*Trichosurus vulpecula*	x	x	
Inland Forest Bat	*Vespadelus baverstocki*	x	x	
Eastern Cave Bat	*Vespadelus troughtoni*		x	
Little Forest Bat	*Vespadelus vulturnus*	x	x	
swamp wallaby	*Wallabia bicolor*	x		
Bird				
spiny-cheeked honeyeater	*Acanthagenys rufogularis*	x		
yellow-rumped thornbill	*Acanthiza chrysorrhoa*	x		
yellow thornbill	*Acanthiza nana*	x	x	
Australian reed-warbler	*Acrocephalus australis*	x		
Australian owlet-nightjar	*Aegotheles cristatus*		x	
Australian king-parrot	*Alisterus scapularis*	x		
Pacific black duck	*Anas superciliosa*	x	x	
red-winged parrot	*Aprosmictus erythropterus*	x		
wedge-tailed eagle	*Aquila audax*		x	
white-necked heron	*Ardea pacifica*	x		
sulphur-crested cockatoo	*Cacatua galerita*	x	x	
pheasant coucal	*Centropus phasianinus*	x		
black-eared cuckoo	*Chalcites osculans*	x		
rufous songlark	*Cincloramphus mathewsi*	x		
grey shrike-thrush	*Colluricincla harmonica*	x	x	
black-faced cuckoo-shrike	*Coracina novaehollandiae*	x	x	
white-winged chough	*Corcorax melanorhamphos*		x	x
Torresian crow	*Corvus orru*	x	x	
pied butcherbird	*Cracticus nigrogularis*	x		
grey butcherbird	*Cracticus torquatus*		x	

Common Name	Scientific Name	Study Area 1	Study Area 2	Incidental
laughing kookaburra	*Dacelo novaeguineae*		x	
mistletoebird	*Dicaeum hirundinaceum*	x		
white-faced heron	*Egretta novaehollandiae*	x		
galah	*Eolophus roseicapilla*	x		
eastern yellow robin	*Eopsaltria australis*	x		
white-throated nightjar	*Eurostopodus mystacalis*	x	x	
dollarbird	*Eurystomus orientalis*	x		
brown falcon	*Falco berigora*	x		x
nankeen kestrel	*Falco cenchroides*	x		
Australian hobby	*Falco longipennis*	x		
bar-shouldered dove	*Geopelia humeralis*	x	x	
peaceful dove	*Geopelia striata*	x	x	
white-throated gerygone	*Gerygone olivacea*	x		
magpie-lark	*Grallina cyanoleuca*	x		
Australian magpie	*Gymnorhina tibicen*	x	x	
whistling kite	*Haliastur sphenurus*	x		
brown honeyeater	*Lichmera indistincta*	x		
brown cuckoo-dove	*Macropygia amboinensis*		x	
superb fairy-wren	*Malurus cyaneus*	x		x
variegated fairy-wren	*Malurus lamberti*	x		
red-backed fairy-wren	*Malurus melanocephalus*	x		
noisy miner	*Manorina melanocephala*		x	
white-throated honeyeater	*Melithreptus albogularis*		x	
rainbow bee-eater	*Merops ornatus*		x	
jacky winter	*Microeca fascinans*	x		
leaden flycatcher	*Myiagra rubecula*	x		
scarlet honeyeater	*Myzomela sanguinolenta*	x		
plum-headed finch	*Neochmia modesta*	x		
white-eared honeyeater	*Nesoptilotis leucotis*	x	x	
southern boobook	*Ninox boobook*	x		
cockatiel	*Nymphicus hollandicus*	x	x	
crested pigeon	*Ocyphaps lophotes*	x		
olive-backed oriole	*Oriolus sagittatus*	x		
rufous whistler	*Pachycephala rufiventris*	x	x	x
striated pardalote	*Pardalotus striatus*		x	
common bronzewing	*Phaps chalcoptera*	x	x	

Common Name	Scientific Name	Study Area 1	Study Area 2	Incidental
little friarbird	*Philemon citreogularis*	x		
noisy friarbird	*Philemon corniculatus*	x	x	
striped honeyeater	*Plectorhyncha lanceolata*	x		
tawny frogmouth	*Podargus strigoides*	x	x	
grey-crowned babbler	*Pomatostomus temporalis*	x	x	
red-rumped parrot	*Psephotus haematonotus*	x		
speckled warbler	*Pyrrholaemus sagittatus*	x		
grey fantail	*Rhipidura albiscapa*	x	x	x
rufous fantail	*Rhipidura rufifrons*			x
weebill	*Smicrornis brevirostris*	x	x	
pied currawong	*Strepera graculina*	x	x	
apostlebird	*Struthidea cinerea*	x		
Australasian grebe	*Tachybaptus novaehollandiae*	x		
double-barred finch	*Taeniopygia bichenovii*	x	x	
zebra finch	*Taeniopygia guttata*	x		
scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	x		
rainbow lorikeet	*Trichoglossus haematodus*	x	x	
painted button-quail	*Turnix varius*		x	
silvereye	*Zosterops lateralis*	x		

NB - * Three *Nyctophilus* species potentially occur in the Study Areas, including the threatened *N. corbeni* and two widespread species, *N. geoffroyi* and *N. gouldi*.

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