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Ecology Assessment Report

Vegetation Assessment and Predictive MNES Fauna Habitat Mapping for Waddy Brae Holding (Lot 5 on Plan SP261934), Fairview Gas Field.

Compiled by BOOBOOK for Santos

Revision	Date	Description	Author	Verifier	Approved
A	6/2/2017	Draft issued to client for review	C. Eddie	-	C. Eddie
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Executive Summary and Caveat

This report provides a description of selected ecological values documented during a desktop assessment and field survey undertaken by BOOBOOK Ecological Consulting (BOOBOOK) at Waddy Brae Holding (hereafter referred to as 'the Site') from 30 March - 2 April 2015 and 14 - 18 September 2015. The Site is a 4468 ha grazing property described as Lot 5 on Plan SP261934 and is located approximately 40 km northeast of Injune, southern inland Queensland. The ecological assessment was originally conducted to assist Santos in determining the Site's value in terms of meeting offset requirements of disturbances associated with Santos Gladstone Liquefied Natural Gas (GLNG) projects in Queensland (BOOBOOK 2015a). As such this report focuses on vegetation mapping and predictive Matters of National Environmental Significance (MNES) threatened fauna mapping.

The desktop and field assessments included identification of remnant and regrowth regional ecosystems (RE), condition assessment (using the BioCondition methodology) and fauna habitat values assessment. BioCondition assessments were completed at 10 sites which were pre-selected by Santos within Queensland government mapped regional ecosystem types and at a further 3 sites selected in the field.

A desktop review of aerial imagery and partial ground-truthing detected 12 RE types at the Site. Note that not all vegetation was ground-truthed hence confidence ratings were applied to each RE polygon (refer to spatial data associated with this report). Confidence ratings applicable to vegetation polygons should be checked prior to the use of this mapping for planning purposes. Further on-ground assessments may be required within areas having low levels of confidence.

The presence of two Threatened Ecological Communities (TECs) was confirmed these being:

- Brigalow (*Acacia harpophylla* dominant and co-dominant): 88.8 ha; and
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions: 373.0 ha.

Areas of young regrowth of Brigalow (174.1 ha) and young and advanced regrowth of semi-evergreen vine thicket (SEVT) (135.2 ha) were identified which may represent future potential TEC with appropriate rehabilitation and management.

No comprehensive fauna surveys were performed under this Scope of Works. Fauna surveys were limited to incidental observations at BioCondition sites. One fauna species listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) and *Nature Conservation Act 1992* (NC Act) was detected during the field survey this being Squatter Pigeon (*Geophaps scripta scripta*).

Fauna habitat and likelihood of occurrence assessments were conducted for 16 threatened fauna species nominated by Santos under the Scope of Works. This assessment considered that habitat is potentially suitable for 13 of the nominated species at the Site acknowledging that three of these species (Northern Quoll, Eastern Star Finch and Black-throated Finch) are, or are likely to be, locally extinct:

- *Dasyurus hallucatus* (Northern Quoll) – 1527.8 ha;
- *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat) – 1527.8 ha;
- *Turnix melanogaster* (Black-breasted Button-quail) – 517 ha;
- *Erythrotriorchis radiatus* (Red Goshawk) – 1527.8 ha;
- *Rostratula australis* (Australian Painted Snipe) – 6.3 ha;
- *Delma torquata* (Collared Delma) – 1090.9 ha;
- *Geophaps scripta scripta* (Squatter Pigeon (Southern)) – 1072.9 ha;
- *Egernia rugosa* (Yakka Skink) – 1090.9 ha;
- *Furina dunmalli* (Dunmall's Snake) – 1072.9 ha;
- *Nyctophilus corbeni* (Eastern Long-eared Bat) – 1097.2 ha;
- *Neochmia ruficauda ruficauda* (Eastern Star Finch) – 6.3 ha;
- *Botaurus poiciloptilus* (Australasian Bittern) – 6.3 ha; and

- *Poephila cincta cincta* (Black-throated Finch) – 6.3 ha.

Areas of young regrowth of several vegetation communities were identified which may represent future potential habitat for threatened fauna with appropriate rehabilitation and management.

Note that this report utilises data obtained from desktop searches conducted in 2015. Desktop search results presented in this report should therefore not be relied upon for planning and management purposes.

List of Abbreviations

ALA	Atlas of Living Australia
AU(s)	Assessment Unit (s)
DBH	diameter at breast height
DEHP	Department of Environment and Heritage Protection
DERM	Department of Environment and Resource Management
DEWHA	Department of Environment, Water, Heritage and the Arts
Dia.	diameter
DNRM	Department of Natural Resources and Mines
DoTE	Department of the Environment
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GLNG	Gladstone Liquefied Natural Gas
GPS	Global Positioning System
ha	hectare (s)
km	kilometre (s)
m	metre (s)
NC Act	*Nature Conservation Act 1992*
NP	National Park
PMST	Protected Matters Search Tool
RE	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
SPRAT	Species Profile and Threats Database
TEC (s)	Threatened Ecological Community (ies)
TSSC	Threatened Species Scientific Committee

1. Introduction

1.1. Purpose and Scope

This report provides a description of REs and MNES fauna habitat documented during a desktop assessment and field surveys undertaken by BOOBOOK Ecological Consulting (hereafter BOOBOOK) at 'Waddy Brae' (hereafter referred to as 'the Site'), southern inland Queensland. The results are based on an initial desktop assessment, involving examination of imagery, followed by field surveys to confirm type and extent of vegetation communities, presence of habitat features which may support threatened fauna, and determination of potential extent of threatened fauna species habitat.

This report forms part of an assessment undertaken at two additional properties both contiguous with The Site these being 'Fairview' (BOOBOOK 2015b) and 'Springwater' (BOOBOOK 2015c). The properties have very similar geology, topography and vegetation and also share a similar land use history. Preliminary locations of BioCondition sites were determined by initial examination of aerial imagery (Santos Quickbird), RE mapping (DNRM and ground-truthed datasets) and review of data collected from previous field surveys at the Site, 'Fairview' (BOOBOOK 2015b) and 'Springwater' (BOOBOOK 2015c).

1.2. Site Description

The Site is a 4468 ha grazing property described as Lot 5 on Plan SP261934 which is located approximately 40 km northeast of Injune, southern inland Queensland (Appendix A). The Site is accessed via Fairview Road (off the Carnarvon Developmental Road) and is under the jurisdiction of the Maranoa Regional Council. The Site is located within subregion 24 (Carnarvon Ranges) of the Brigalow Belt South bioregion (Sattler and Williams 1999). Current land uses at the Site include cattle grazing and coal seam gas extraction. The northern end of the Site is adjoined by Expedition (Limited Depth) National Park (NP). Waddy Brae is owned and managed by Santos and situated within tenements operated by Santos these being PL91 and PL92.

Surface geology mapping for the Site shows that it is comprised entirely of Lower Jurassic sediments (Forbes 1968). In the north of the Site the terrain is rugged with outcropping of Precipice Sandstone forming steep cliffs and a gorge dissected by Baffle Creek. Soils in this region are coarse sands with expansive areas of surface rock especially within close proximity to Baffle Creek. Vegetation in the north is dominated by dry sclerophyll *Eucalyptus* and *Acacia* woodlands with pockets of semi-evergreen vine thicket (SEVT) in sheltered parts of the Baffle Creek gorge. The dominant land zone (Sattler and Williams 1999) in this area is land zone 10 (coarse-grained sediments) with a small area of land zone 3 (alluvium) along Baffle Creek.

A plateau comprised of the Boxvale Sandstone Member is the most prominent geological feature in the central part of the Site and forms the divide between northern and southern drainages. Soils on the plateau are brown to pale brown sands or reddish-brown sandy loams derived from coarse-grained sediments (Land Zone 10). However, some evidence of the former presence of land zone 7 (duricrust) in the form of deep cracking red clay loams with ironstone gravel at the surface is present on the plateau. The scarp slopes are steep and contain sandy soils and clays with numerous surface rocks and boulders. These are derived from inter-bedded fine- and coarse-grained sedimentary rocks (siltstones, mudstones and sandstones) of the Boxvale Member. Thus, although dominant geology nominally identifies the slopes as being on Land Zone 10, at the finer scale both Land Zones 9 and 10 are present. This finer-scale variation in soil parent material impacts on vegetation classification. Vegetation on the plateau has mostly been cleared and formerly comprised *Eucalyptus* spp. woodlands. Vegetation on the scarp is mostly intact and comprises mainly ironbark (*Eucalyptus crebra* and *E. melanophloia*) woodlands on the north-facing slopes and primarily SEVT with small pockets of Brigalow (*Acacia harpophylla*) woodland and open forest on the south-facing slopes. Dominant land zones associated with the plateau and scarps include land zone 9 (fine-grained sediments) and land zone 10 (coarse-grained sediments).

Topography at the southern end of the Site comprises a series of narrow valleys with low undulating sandstone hills formed by the Evergreen Formation. These valleys have soils ranging from sands and loams to clays. The valleys and hill slopes have been largely cleared and formerly comprised *Eucalyptus* spp. woodlands with patches of Brigalow and SEVT.

Within the south-eastern end of the Site Bullock Gully and its major tributary occur within an area of Precipice Sandstone. This region is far less rugged than areas with similar geology to the north of the Site. The dominant land zone in the southeast of the Site is land zone 10 (coarse-grained sediments) with a small area of land zone 3 (alluvium) along Hutton Creek.

The northern boundary of the Site is bounded by Baffle Creek. The south-eastern corner of the Site adjoins Hutton Creek. These are stream order 4 and 6 watercourses respectively. Streams within the northern half of the Site drain into Baffle Creek while those in the south drain into Hutton Creek. Baffle and Hutton Creeks both flow into the Dawson River and are therefore part of the Fitzroy River Basin. Other named streams within the Site include Lambing Gully in the north and Bullock Gully in the south.

The nearest weather station to the Site is at Injune within 40 km of the Site. Yearly average temperatures range from a maximum of 33.6°C in January to a minimum of 3.1°C in July (BOM 2015). Average annual rainfall is 636.3 mm, with the highest monthly average rainfall occurring in December (89.1 mm) and the lowest occurring in August (25.2 mm) (BOM 2015).

1.3. Survey Team

A preliminary field survey of the Site was conducted by Craig Eddie (Principal Ecologist), Richard Johnson (Senior Ecologist), Rosamund Aisthorpe (Botanist) and Ella Mulholland (Graduate Ecologist) between 30th March and 2nd April 2015. A second field survey of the Site was conducted by Rosamund Aisthorpe (Botanist) and Angela Bendall (Field Technician) in the period 13-18th September 2015. Additional information relevant to ground-truthing of vegetation, BioCondition and fauna habitat assessment was also derived from field survey of the adjacent Santos-owned properties 'Fairview' and 'Springwater' in the period 3-14th August 2015.

2. Methodology

2.1. Desktop Assessment

A desktop assessment was conducted to inform the field survey. Sources of information utilised during the desktop assessment included the following:

- EPBC Act Protected Matters Search Tool (PMST) (DoTE 2015a);
- Queensland Department of Environment and Heritage Protection (DEHP) Wildlife Online database (DEHP 2015a);
- Atlas of Living Australia (ALA) database (ALA 2015);
- remnant and regrowth REs at the property scale (DNRM 2015a); and
- Essential Habitat (EH) (DNRM 2015b) and Essential Regrowth Habitat (ERH) mapping (DNRM 2015c).

Data searches were performed using the property lot/plan number or using a 10km buffer around the coordinates -25.6422°S, 148.9197°E (these equate to the approximate centre point of the Site).

2.2. Field Survey

2.2.1. BioCondition Survey

To assist in the evaluation of the Site's ecological function and condition a series of BioCondition assessments were undertaken. During the initial field survey BioCondition assessments were completed at 10 sites which were pre-selected by Santos within each mapped Assessment Unit (AU) or RE type (DNRM 2015a). Subsequently, a further three assessments were undertaken at the Site during the second field survey. BioCondition data relevant to REs at the Site was also obtained in field surveys at the adjacent 'Fairview' and 'Springwater' properties. Pooling of data for REs on the three properties, which are contiguous and occur on similar topography, have similar vegetation and

patterns of land use, allowed for development of condition benchmarks for several REs which lack published benchmarks (DSITIA 2014).

BioCondition assessments were undertaken as per the methodologies described by Eyre *et al*. (2011, 2015). This involved the establishment of a 100 m x 50 m transect containing five assessment areas (plots/quadrats) to record values for defined ecological attributes. These values were used as indicators to provide a quantitative measure for the performance of ecosystem function within the context of biodiversity conditions.

The following information was recorded at each BioCondition site:

- Date;
- Observers;
- Description of location (bioregion, general description, co-ordinates for plot origin and centre, plot bearing and alignment);
- General habitat description and RE type;
- Median height for canopy, emergent and subcanopy strata;
- Slope position/slope degree and slope aspect;
- Tree species richness (within 100 m x 50 m plot);
- Native plant species richness (within 50 m x 10 m plot);
- Non-native plant cover (within 50 m x 10 m plot);
- Total length of coarse woody debris (length >10 cm diameter and >0.5 m long within 50 m x 20 m plot);
- Number and average diameter at breast height (DBH) of large eucalypt and non-eucalypt trees (within 100 m x 50 m plot);
- Recruitment of canopy species (within the 100 m x 50 m plot);
- Tree and shrub canopy cover (within 100 m transect);
- Ground cover within 1 m x 1 m plots (native perennial grass and organic litter cover in the ground layer);
- Disturbances (severity, last event and observation type).

Large tree DBH thresholds for each RE were used where benchmark documents were available, otherwise the default >30 cm DBH for eucalypts and >20 cm DBH for non-eucalypts was applied. For SEVT-dominant communities (i.e. RE 11.9.4, 11.10.8), the threshold for RE 11.9.4 (>17 cm DBH for non-eucalypts) was applied to all sites due to similarities in vegetation structure and composition.

Site photographs were taken using a Canon digital camera in accordance with Eyre *et al*. (2011, 2015) (i.e. one photograph at plot origin and north, east, south and west photographs at the plot centre). Photograph numbers were recorded. Locations of BioCondition sites were determined using a handheld Global Positioning System (GPS) (Garmin GPSmap 78S) and BioCondition assessment data was captured by mobile GIS devices (Motion CFT-003 tablet device).

Field data was recorded using the BioCondition reference site sheet template (Eyre *et al*. 2011) to ensure data was collected consistently for all sites regardless of whether a benchmark document was available for any particular RE or not. Canopy recruit and non-native plant cover attributes are not normally recorded on this template, however this data was added to field sheets so it could be used for calculating BioCondition scores. Site data has been presented as either BioCondition assessment or reference form templates to differentiate between sites with or without published benchmarks. Due to the remoteness and terrain of the BioCondition site locations permanent 0 m and 50 m markers were not established using steel fence posts as described in the methodology Eyre *et al*. (2011, 2015).

Scores for BioCondition sites were calculated in accordance with Eyre *et al*. (2015) which compares the values obtained at each survey site with values in the benchmark document for that particular RE (DSITIA 2014). Sub-scores

are awarded to each site and landscape attribute then are added together and divided by the maximum possible score for that RE. This provides a numeric value along a continuum of biodiversity condition, where scores closer to 0 indicates that sites are 'dysfunctional', and those closer to 1 indicates that sites have 'functional' condition.

2.2.2. Vegetation Assessment and Mapping

High resolution aerial photography was provided for the Site by Santos in 2015. Detailed review of this imagery enabled a desktop vegetation assessment to be conducted. Potential RE types and their extent were identified as well as determining highly disturbed areas. Examination of imagery enabled vegetation to be divided into four categories:

- Remnant: woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner et al. 2012).
- Advanced Regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing well advanced woody vegetation floristically and structurally consistent with the RE but typically <70% of the height and <50% density of the RE. Such regrowth with appropriate management will likely achieve remnant status (potentially <30 years).
- Young Regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing varying densities of woody vegetation floristically consistent with the RE type. Such regrowth lacks structural elements typical of the RE but with appropriate management may eventually achieve remnant status (likely >30 years).
- Non-remnant: areas previously cleared or otherwise significantly disturbed which have little or no woody vegetation present.

Vegetation assessments were undertaken within 50 m x 50 m plots at the BioCondition sites for the purpose of typifying the vegetation community under assessment. Vegetation assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

At each quaternary vegetation assessment site the following was recorded:

- height (median and maximum/minimum) and % cover of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
- dominant flora in each stratum of vegetation;
- RE type mapped and observed;
- geology, landform and soil descriptions;
- presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
- a list of all other flora encountered at the survey site.

Determination of RE type and status (as per the Regional Ecosystem Description Database (REDD) DEHP 2015b)) was possible for areas at and immediately adjoining formal survey sites. REs were also able to be described and mapped for a range of other areas traversed within the Site and areas that were visible from suitable vantage points. Data relating to vegetation type was also utilised from another survey undertaken concurrently at the Site (BOOBOOK 2015a). Locations of each vegetation survey site were determined using a handheld Global Positioning System (GPS) (Garmin GPSmap 78S) and/or a Motion CFT-003 tablet device. Locations of vegetation survey sites are shown in Appendix A. Representative photographs were taken at each quaternary survey site using Canon digital cameras.

Information obtained from the quaternary assessments was also used to identify TEC by comparison of field assessment results with TEC technical descriptions which include floristic, structural and condition criteria (TSSC 2013, Environment Australia 2003).

Mapping protocols applied to remnant RE within this assessment are as follows:

- Two SEVT communities/REs were recognised as present at the Site. SEVT on coarse-grained sedimentary rocks (RE 11.10.8) was present on colluvium on the lower slopes of gorges (e.g. Baffle Creek) associated with the Precipice Sandstone, where it was readily differentiated and mapped. This RE also occurred on sheltered scarp crests where rocky terrain protected the vegetation from fire. Many of these occurrences were patches too small to be mapped. In many areas this RE was contiguous with larger patches of SEVT present on scarp slopes and growing on soils derived from fine-grained sedimentary rocks (Land Zone 9) and attributable to RE 11.9.4. In this situation, where possible the two RE have been mapped separately but where mapping scale issues prevent differentiation between the two RE, the vegetation is mapped as the dominant RE present.
- Remnant *Eucalyptus crebra* dominated communities were mapped for the purposes of this assessment as RE 11.10.7 or 11.10.7a (where *Callitris glaucophylla* is co-dominant in the canopy or dominant in the subcanopy). These communities are mapped partly as RE 11.10.1 by DNRM (2015a).
- Remnant *E. melanophloia* dominated communities were also mapped as RE 11.10.7 (these are mapped partly as RE 11.3.39 by DNRM) as RE 11.10.7 may be dominated by *E. crebra* or *E. melanophloia*.
- Woodland communities dominated by a mix of *Eucalyptus*, *Corymbia* and *Acacia* spp. occurring on sandstone plateaux and scarps were mapped for the purposes of this assessment as RE 11.10.13. It is acknowledged that minor areas of other RE including 11.10.1, 11.10.3 and 11.10.4 may form components of areas mapped as RE 11.10.13. *Acacia burrowii*-dominated communities are likely to be an artefact of fire history at the Site and are included within the broader interpretation of RE 11.10.3.

Identification of categorised regional ecosystems forms the basis of Assessment Units as per the DEHP (2014) *Guide to determining terrestrial habitat quality*.

Where cited within this report species names for flora follow Bostock and Holland (2014).

2.2.3. Threatened Fauna Survey and Habitat Mapping

No comprehensive fauna surveys were undertaken under this Scope of Works. Fauna surveys were limited to incidental observations at BioCondition sites. All vertebrate fauna heard and seen at each BioCondition site were identified and recorded. Where time permitted active searches were conducted particularly targeting threatened reptiles. This included overturning rocks, logs, fallen bark and other ground debris raking leaflitter, peeling loose bark on trees/stumps, checking burrows and crevices with torches, looking for animal traces (scats, sloughs, shells, scratches, diggings and burrows) and scanning logs for basking reptiles.

Fauna habitat assessments were conducted for the following species nominated by Santos:

- *Dasyurus hallucatus* (Northern Quoll);
- *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat);
- *Turnix melanogaster* (Black-breasted Button-quail);
- *Erythrotriorchis radiatus* (Red Goshawk);
- *Rostratula australis* (Australian Painted Snipe);
- *Delma torquata* (Collared Delma);
- *Geophaps scripta scripta* (Squatter Pigeon (Southern));
- *Denisonia maculata* (Ornamental Snake);
- *Egernia rugosa* (Yakka Skink);
- *Furina dunmalli* (Dunmall's Snake);
- *Nyctophilus corbeni* (Eastern Long-eared Bat);
- *Neochmia ruficauda ruficauda* (Star Finch);
- *Botaurus poiciloptilus* (Australasian Bittern);
- *Poephila cincta cincta* (Black-throated Finch);

- *Petrogale penicillata* (Brush-tailed Rock-wallaby); and
- *Rheodytes leukops* (Fitzroy River Turtle).

Fauna habitat assessments were undertaken at each BioCondition site. Although BioCondition measures some microhabitat features, such as length of coarse woody debris, and leaflitter cover, not all fauna habitat features likely to be utilised by threatened fauna are measured under the BioCondition methodology. Presence/absence, abundance or density of habitat features was recorded within a 50 m x 50 m plot at each survey site including:

- embedded and loose rocks and boulders: (estimated % cover);
- logs (abundance);
- trees >18m height (abundance);
- logs with hollows (abundance);
- trees with hollows (abundance);
- trees and/or logs with loose bark (abundance);
- burrows, sinkholes and tunnel erosion (abundance);
- fallen bark (estimated % cover);
- shrub layer (estimated % cover);
- ground cover (estimated % cover);
- leaf litter (estimated % cover);
- termite mounds (abundance);
- mistletoe (abundance);
- rock structures (caves, overhangs and crevices);
- cliffs, escarpments and steep rocky slopes within 5km (presence);
- watercourses with permanent water, pools and riffles and abundant woody/rock cover (presence);
- cracking clays soils (presence);
- gilgai and ephemeral wetlands (presence); and
- canopy dominated by Myrtaceae species (presence).

Habitat feature data allowed assessment of the likelihood of occurrence of the listed fauna at each survey site and, by inference, within similar vegetation (REs) at the Site. Mapping of threatened fauna habitat is based on preliminary remnant and regrowth RE polygons identified during this survey. Field data collected for each fauna habitat assessment has been supplied in electronic format to the client separately.

Where cited within this report species names for fauna follow those used by the Queensland Government's Wildlife Online database (DEHP 2015a).

2.2.4. Survey Limitations

The field investigations undertaken were limited to passive techniques (e.g. no live trapping) and were undertaken in autumn only. Additional survey effort would be required to provide a more comprehensive inventory of fauna species, both threatened and common.

Due to the scale and accessibility of the Site and the resources available some vegetation polygons identified within this report have not been ground-truthed. However sufficient sampling of remnant and regrowth RE was conducted to give a high level of confidence in the extrapolation of these field assessments to vegetation in inaccessible areas.

Timing (season) and duration of the survey period during late March to early April and mid-September was favourable for BioCondition assessment (Eyre *et al*. 2011, 2015). As per the methodology, most sites were located

>50 m away from any major disturbances (e.g. road/track) (Eyre *et al*. (2015), however this may not have been possible for sites in RE with limited extents. This is important when undertaking BioCondition reference sites, or 'Best on Offer' (BOO) sites, which need to be carried out in mature and long undisturbed sites to calculate benchmark values averaged over several reference sites.

Five REs occurring at the Site did not have benchmark documents available, these being RE 11.10.1c, RE 11.10.2, RE 11.10.7, RE 11.10.7a and RE 11.10.8. To score these AUs, at least three reference BioCondition sites per unit should be sampled to generate thresholds for each RE. Survey sites should also be placed >3 km apart and within patches >5 ha (Eyre *et al*. 2011). This was not always practical during this survey due to limited access in parts of the Site. Note that, as described above, pooled data from reference sites on Waddy Brae, Fairview and Springwater was used to derive thresholds for each of these RE.

3. Results & Discussion

3.1. BioCondition Assessment

BioCondition assessments were completed at 13 locations at the Site (Appendix A). BioCondition site characteristics and scores are summarised in Table 1. Existing RE benchmark values (DSTIA 2014) were available for RE assessed at eight of the BioCondition sites. Five BioCondition reference sites were used to derive benchmarks, and therefore calculation of BioCondition scores, for RE without published benchmark data. Raw data for BioCondition assessment sheets are contained within Appendix B.

Scores for sites in RE 11.9.5 were derived from the comparison of values collected in the field and the 'western form' benchmark of the RE. The geographic locality of the Site (within subregion 24) which lies within the western zone and examples of remnant Brigalow (*Acacia harpophylla*) with average height approximately 16 m and average of 39 large trees per hectare at the Site supported using the western benchmark values.

Four BioCondition sites (G1-WB, W2-WB, WB01 and WB02) received high scores (>0.80) which indicated vegetation at these sites displayed 'functional biodiversity condition'. These sites represent examples of remnant RE 11.9.5, RE 11.10.3, RE 11.10.7a and RE 11.10.8.

The highest score, 0.88, corresponds to BioCondition site WB01, a site which assessed RE 11.10.8. This high score is based on a comparison with a benchmark derived from the average of three sites (the remaining two sampled on 'Fairview'), which due to the small sample size will have skewed the scores towards 1. Similarly, sites assessed in RE 11.10.1c, RE 11.10.7 and RE 11.10.7a were also measured against benchmarks created from averages of values from two or three sites each and their scores may be affected similarly. A larger number of reference sites and/or comparison with future-published benchmark documents to account for local variances in vegetation, aspect, geology and disturbance history would provide scores with a higher degree of confidence around their functional biodiversity condition.

The lowest score, 0.45, was calculated for BioCondition site G2-WB, located in a patch of young RE 11.10.7 regrowth. However no sites received low scores (<0.40) and thus indicated vegetation at none of the sites displayed 'dysfunctional biodiversity condition'.

Apart from BioCondition site G2-WB, all assessment sites had above average functional biodiversity condition, i.e. 12 BioCondition sites achieved scores >0.60. All of these sites were within remnant vegetation except for BioCondition sites R1-WB and WB03 that were within patches of good quality regrowth RE 11.10.13 and RE 11.10.11, respectively.

Generally, these scores reflect exposure to various disturbances. For example, the three lowest scoring BioCondition assessments at the Site were recorded in regrowth that all had achieved low values for number of large trees, canopy height and canopy cover. These low scores are likely to be associated with disturbances present at these sites, namely historic clearing and wildfire.

Table 1: Summary of BioCondition sites at Waddy Brae and their calculated scores.

BioCondition Survey Site	Site Type	RE	Structural Class/ Condition	Field Vegetation Description	Site Score	Landscape Score	BioCondition Score
B1-WB	Assessment	11.9.4	Remnant	Semi-evergreen vine thicket	0.78	0.55	0.74
B2-WB	Assessment	11.9.10	Remnant	*Casuarina cristata* and *Eucalyptus populnea* woodland; midlayer dominated by *Geijera parviflora, Carissa ovata* and numerous softwood spp.; grassy ground layer composed of *Ancistrachne uncinulata* and *Cenchrus ciliaris.*	0.84	0.55	0.79
G1-WB	Assessment	11.9.5	Remnant	*Acacia harpophylla* woodland; midlayer dominated by canopy recruits, *Geijera parviflora, Acalypha eremorum* and *Carissa ovata;* grassy ground layer dominated by *Ancistrachne uncinulata*.	0.86	0.65	0.82
G2-WB	Assessment	11.10.7	Young regrowth	*Aristida* sp. and *Cenchrus ciliaris* grassland; scattered regrowth *Eucalyptus melanophloia* and *Eremophila mitchellii*.	0.32	0.95	0.45
R1-WB	Assessment	11.10.13	Young regrowth	*Acacia sparsiflora* low woodland with associated *Eucalyptus exserta* and *Corymbia trachyphloia*; sparse lower layer of *Allocasuarina inophloia* and *Alphitonia excelsa*; grassy ground layer dominated by *Setaria surgens*.	0.59	0.80	0.64
R2-WB	Reference	11.10.1c	Remnant	*Eucalyptus fibrosa* woodland; a low tree layer of *Acacia leiocalyx*; grassy ground layer dominated by *Eulalia aurea*.	0.69	0.95	0.75
W1-WB	Reference	11.10.7a	Remnant	*Callitris glaucophylla* open forest with emergent *Corymbia clarksoniana*, *Angophora leiocarpa* and *Eucalyptus crebra*; very sparse *Acacia longispicata* shrub layer; grassy ground layer.	0.76	0.45	0.70
W2-WB	Reference	11.10.7a	Remnant	*Eucalyptus crebra, Corymbia clarksoniana* and *Angophora leiocarpa* woodland; lower tree layer of *Callitris glaucophylla, Acacia longispicata* and *Lysicarpus angustifolius*; sparse shrub layer of *A. longispicata* recruits and *Alstonia constricta*; grassy ground layer dominated by *Aristida caput-medusae* and *Setaria surgens*	0.98	0.35	0.86
WB01	Reference	11.10.8	Remnant	Semi-evergreen vine thicket	0.86	0.95	0.88
WB02	Reference	11.10.3	Remnant	*Acacia shirleyi* and *Eucalyptus crebra* woodland; low shrub layer composed of *A. shirleyi, A. longispicata* and *Dodonaea triangularis*; grassy ground layer composed of *Cleistochloa subjuncea*, *Digitaria* sp., *Scleria sphacelata* and *Hibiscus sturtii*.	0.81	0.95	0.85
WB03	Assessment	11.10.11	Young regrowth	*Eucalyptus populnea* low woodland; midlayer composed of *Eremophila mitchellii, Dodonaea viscosa* subsp. *spatulata* and *Acacia omalophylla*; grassy ground layer composed of *Cymbopogon refractus*, *Aristida* sp., *Bothriochloa decipiens* and *Cenchrus ciliaris.*	0.68	0.45	0.64
Y1-WB	Assessment	11.10.13	Remnant	*Eucalyptus* sp. (ironbark), *E. tenuipes*, *Callitris endlicheri* woodland; regenerating shrub layer of numerous native species; sparse to mid-dense grassy ground layer dominated by *Cleistochloa subjuncea* and *Dimorphochloa rigida*.	0.74	0.95	0.79
Y2-WB	Assessment	11.10.13	Remnant	*Eucalyptus panda* and *Acacia sparsiflora* woodland; low shrub layer of *A. sparsiflora* recruits; grassy ground layer dominated by *Cleistochloa subjuncea*.	0.69	0.95	0.75

A total of 25 AUs were identified for the Site. BioCondition assessments were conducted for all AUs present at the Site, though only 11 of these were conducted at the Site (Table 1) with the remainder conducted on Fairview and Springwater. Scores collected from 'Fairview' and 'Springwater' BioCondition assessment sites of AUs mapped at the Site are summarised in Table 2. Detailed discussion and site attributes are presented in the Biodiversity Offsets Assessment Reports for each property (BOOBOOK 2015b, 2015c).

Table 2: Summary of BioCondition scores for AU/REs occurring at the Site.

RE	Structural Class/ Condition	Survey Site Code*	Site Scores	Landscape Scores	BioCondition Scores
11.3.25	Remnant	SW06*, SW20*	0.71 0.87	1 0.95	0.78 0.89
11.9.4	Young regrowth	FV19*	0.59	0.20	0.52
	Advanced regrowth	SW07*	0.69	0.10	0.58
	Remnant	B1-WB	0.84 0.80	0.90 1	0.86 0.85
11.9.5	Young regrowth	FV17*	0.43	0.40	0.42
	Advanced regrowth	FV16*	0.74	0.55	0.71
	Remnant	G1-WB	0.85 0.91	0.55 0.90	0.80 0.91
11.9.7	Young regrowth	SW13*	0.53	0.20	0.47
11.10.1c	Remnant	R2-WB	0.94 0.89	0.75 0.90	0.91 0.90
11.10.2	Remnant	FV06*, FV11*	0.76 0.95	1 1	0.81 0.97
11.10.3	Advanced regrowth	SW03*	0.80	1	0.85
11.10.7	Young regrowth	G2-WB	0.57 0.57	0.95 0.90	0.65 0.64
	Advanced regrowth	SW23*	0.78	0.80	0.79
	Remnant	FV04*, FV09*, FV20*	0.76 0.83 0.95	0.90 0.90 0.55	0.80 0.85 0.88
11.10.8	Remnant	WB01, FV03*, FV07*	0.75 0.76	1 1	0.80 0.82
11.10.13	Advanced regrowth	SW04*	0.61	0.80	0.66
	Remnant	Y1-WB, Y2-WB	0.61 0.78 0.63	1 1 1	0.69 0.83 0.71

**represents survey sites completed on adjoining properties 'Fairview' and 'Springwater'*

3.2. Vegetation Mapping

3.2.1. Desktop Mapping

DNRM (2015a) mapped remnant REs are described (as mapped) in Table 3 and shown in Appendix C.

Table 3: Description of remnant REs mapped by DNRM within the Site.

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015b)	Extent (ha)	Notes
11.10.1 / 11.10.13	LC/LC	NCAP/NCAP	*Corymbia citriodora* woodland on coarse-grained sedimentary rocks. / *Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	445.9	Mapped as 11.10.1/11. 10.13a
11.10.3 / 11.3.25	LC/LC	NCAP/OC	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps / *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	234.6	
11.10.4 / 11.10.7	LC/LC	NCAP/NCAP	*Eucalyptus decorticans*, *Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks. / *Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	336.2	
11.10.7	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	16.6	
11.3.39	LC	NCAP	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils.	19.2	
11.3.39 / 11.3.2	LC/OC	NCAP/OC	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils. / *Eucalyptus populnea* woodland on alluvial plains.	1.9	
11.9.4	E	E	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	462.4	Mapped as 11.9.4a

DNRM (2015a) mapped regrowth REs are described (as mapped) in Table 4 and shown in Appendix C.

Table 4: Description of remnant REs mapped by DNRM within the Site.

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015b)	Extent (ha)
11.10.1 / 11.10.13a	LC/LC	NCAP	*Corymbia citriodora* woodland on coarse-grained sedimentary rocks. / *Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	47.1
11.10.7	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	2.7
11.3.39 / 11.3.2	LC/OC	NCAP / OC	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils. / *Eucalyptus populnea* woodland on alluvial plains.	0.6
11.3.39 / 11.4.7	LC/E	NCAP / E	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils. / *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains	2.3
11.9.4a	E	E	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understory on fine-grained sedimentary rocks	68.6

3.2.2. Ground-truthed Mapping

Ground-truthing and examination of aerial imagery identified 12 remnant and 13 regrowth RE types at the Site. Regrowth RE were assessed as either advanced or young regrowth. Quaternary vegetation assessment data is presented in Appendix D. Mapping of remnant and regrowth REs based on desktop interpretation and field analysis is presented in Appendix E. The extent (total area) of each mapped remnant and regrowth RE is summarised in Table 5. These RE essentially represent Assessment Units for the Site as defined by the *Guide to Determining Terrestrial Habitat Quality* (DEHP 2014).

Table 5: Summary of extent of individual mapped REs from ground-truthing and imagery analysis within the Site.

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015b)	Extent - remnant (ha)	Extent – advanced regrowth (ha)	Extent – young regrowth (ha)
11.3.25	LC	OC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	6.3	Not identified	Not identified
11.9.4	OC	E	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understory on fine-grained sedimentary rocks	373.0	49.9	85.3
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	49.6	24.7	130.7
11.9.5a	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	24.3	8.8	43.4
11.9.7	OC	OC	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	Not identified	Not identified	92.3
11.9.10	OC	E	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	11.7	Not identified	Not identified
11.10.1c	LC	NCAP	*Eucalyptus fibrosa* woodland on coarse-grained sedimentary rocks	68.1	Not identified	Not identified
11.10.2	OC	OC	Tall open forest in sheltered gorges on coarse-grained sedimentary rocks	1.9	Not identified	Not identified
11.10.3	LC	NCAP	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	11.2	11.6	Not identified
11.10.7	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	100.2	4.9	544.3
11.10.7a	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	164.8	Not identified	Not identified
11.10.8	OC	OC	Semi-evergreen vine thicket on medium to coarse-grained sedimentary rocks	7.7	Not identified	Not identified
11.10.11	LC	NCAP	*Eucalyptus populnea, E. melanophloia ± Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	Not identified	Not identified	50.0
11.10.13	LC	NCAP	*Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	591.7	17.3	406.2

This assessment identified eight remnant RE types which were not mapped by DNRM (2015a) namely:

- RE 11.9.5;
- RE 11.9.5a;
- RE 11.9.7;
- RE 11.9.10;
- RE 11.10.1c;
- RE 11.10.2;
- RE 11.10.7a; and
- RE 11.10.8.

This assessment did not identify the presence of five remnant RE types which were mapped by DNRM (2015a) namely:

- RE 11.3.2;

- RE 11.3.39;
- RE 11.4.7;
- RE 11.10.1; and
- RE 11.10.4.

3.2.3. Threatened Ecological Communities

The field survey confirmed the presence of two TECs at the Site. The TEC 'Brigalow (*Acacia harpophylla* dominant and co-dominant)' is represented at the Site by RE 11.9.5, while the TEC 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' is represented by RE 11.9.4. Note that the SEVT RE 11.10.8, also present at the Site, is not defined as a component RE in this TEC (TSSC 2001). The mapped extent of TEC at the Site is shown within Appendix F. Note that not all areas of TEC have been ground-truthed, however, there is a high degree of confidence relating to the location and extent of TEC.

For the purposes of this assessment all remnant and advanced regrowth RE that are a listed component of the TEC are mapped as TEC for Brigalow (TSSC 2013) with the exception of some areas of RE 11.9.5 that were dominated by Belah (*Casuarina cristata*). To qualify as this TEC the vegetation must be Brigalow (*Acacia harpophylla*) dominant or co-dominant (TSSC 2013).

There are currently no condition criteria for SEVT regrowth (DoTE 2015b) therefore no SEVT regrowth is mapped as TEC. Table 6 describes the extent (ha) of each TEC. BioCondition site data for remnant RE equivalent to TEC is presented within Appendix B.

Table 6: Description and extent of TEC within the Site.

TEC Description	RE Code	Extent of REs Listed as TEC (ha)	Potential future TEC (ha)
Brigalow (*Acacia harpophylla* dominant and co-dominant)	11.9.5 / 11.9.5a	88.8*	174.1
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	11.9.4	373.0	135.2**

**includes remnant and advanced regrowth of the RE*

*** includes advanced and young regrowth of the RE*

RE 11.9.5 is a component RE of the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (TSSC 2013). To be classified as TEC vegetation conforming to the RE description vegetation must also meet certain structural, floristic and condition criteria. Regrowth vegetation must contain the species composition and structural elements found in undisturbed (remnant) RE. Typically, regrowth greater than 15 years old is considered to contain these features (TSSC 2013). Both remnant and regrowth must be in good condition. Butler (2007) defined component RE in poor condition as having one or more of the following characteristics: vegetation that has been cleared within 15 years; vegetation in which exotic perennial plants have more than 50% cover, assessed in a minimum area of 0.5 ha; and individual patches of Brigalow that are smaller than 0.5 ha.

Areas of advanced and young regrowth of RE 11.9.5 were sampled during the field survey. General field observations noted that young regrowth comprises a layer of Brigalow shrubs from 1 to 5 metres height. A lower shrub layer has not yet formed and the species associated with the subcanopy (e.g. *Geijera parviflora*, *Eremophila mitchellii*) and emergent layers are absent or very rare. Though this vegetation has the potential in time to develop to remnant status young regrowth does not currently meet TEC criteria in that it lacks some of the structural elements typical of the RE (TSSC 2013). For the purposes of this assessment all identified advanced Brigalow regrowth is mapped as TEC.

3.3. Threatened Fauna

3.3.1. Likelihood of Occurrence Assessment

Searches of Wildlife Online (DEHP 2015a) and Atlas of Living Australia (ALA 2015) databases did not indicate the recorded presence of any EPBC Act or NC Act listed fauna. One species of bird listed as Vulnerable under both the EPBC Act and NC Act was detected at the Site this being Squatter Pigeon (*Geophaps scripta scripta*). Six birds were

observed during the afternoon of 30/3/2015 on a vehicle track within remnant RE 11.10.13. The location of this sighting was beside BioCondition site Y2-WB (Appendix A). Representative photographs of birds from this flock and the habitat at the sighting location is provided in Figures 1a-b.

Figure 1a, b: Squatter Pigeons *Geophaps scripta scripta* detected beside survey site Y2-WB (left); habitat surrounding the detection site of Squatter Pigeon (right).

General habitat requirements and distribution for all EPBC Act and NC Act species nominated for assessment under the Scope of Works is provided in Table 7.

Table 7: General habitat requirements and distribution of threatened fauna assessed for the Site.

Class	Scientific/ Common Name	NC Act Status	EPBC Act Status	PMST Likelihood of Occurrence (DoTE 2015a)	General Habitat Requirements	Site Distribution Context
Birds	*Erythrotriorchis radiatus* Red Goshawk	E	V	species or species habitat likely to occur within area	Woodlands and open forests, especially near permanent water bodies; high prey bird populations; tall trees for nest site (Marchant and Higgins 1993).	Within (at limits of) species known range (Birdlife Australia 2015).
	Geophaps scripta scripta Squatter Pigeon (southern)	V	V	species or species habitat likely to occur within area	Grassy woodlands with open areas for foraging habitat; usually nearby water source (Higgins and Davies 1996).	Within species known range (Birdlife Australia 2015).
	Neochmia ruficauda ruficauda Star Finch (eastern, southern)	E	E	species or species habitat likely to occur within area	Tall grasslands often associated with watercourses (DoTE 2015b).	Within species known historical range (Birdlife Australia 2014) but the subspecies is possibly extinct (Garnett *et al.* 2011).

Class	Scientific/ Common Name	NC Act Status	EPBC Act Status	PMST Likelihood of Occurrence (DoTE 2015a)	General Habitat Requirements	Site Distribution Context
	Poephila cincta cincta Black-throated Finch	E	E	-	Grassy open woodlands and forests typically dominated by *Eucalyptus*, *Corymbia* and *Melaleuca* and occasionally in tussock grasslands (DoTE 2015b) usually within a few kilometres of a water source (Grice 2012).	Within species known historical range (Birdlife Australia 2014) but there are no recent records from southern Queensland (DoTE 2015b).
	Rostratula australis Australian Painted Snipe	V	E	species or species habitat may occur within area	Forages at shallow edges and adjacent vegetated margins of freshwater wetlands (DoTE 2015b).	Within species known range (Birdlife Australia 2015).
	Turnix melanogaster Black-breasted Button-quail	V	V	-	SEVT and other closed forest types with dense leaflitter and low shrubs (DoTE 2015b, Mathieson and Smith 2009).	At edge of species known range (Birdlife Australia 2015).
Mammals	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	species or species habitat likely to occur within area	Forages in open forests and woodlands and roosts in adjacent caves and overhangs of cliffs and rocky hills; occasionally shelters in disused Fairy Martin nests (Hoye and Schultz 2008).	Within species known range (Churchill 2008);
	Dasyurus hallucatus Northern Quoll	LC	E	species or species habitat known to occur within area	Shelter in crevices in rocky hills and escarpments; forage in associated woodland and forest habitats (DoTE 2015b).	Within species historical range (Oakwood 2008) though recent records are lacking (DEHP 2015a).
	Nyctophilus corbeni South-eastern Long-eared Bat	V	V	species or species habitat may occur within area	*Eucalyptus* and *Callitris* woodlands and roosts in tree hollows and crevices and under loose bark (DoTE 2015b).	Within species known range (Churchill 2008).
	Petrogale penicillata Brush-tailed Rock-wallaby	V	V	-	Rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks (DoTE 2015b).	Outside of species known range (Lundie-Jenkins 2012).
Reptiles	*Delma torquata* Collared Delma	V	V	species or species habitat may occur within area	Occupies eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2005).	Within species known/predicted range (DSEWPaC 2011) though occupancy within range apparently patchy.
	Denisonia maculata Ornamental Snake	V	V	species or species habitat may occur within area	Woodland and grassland with cracking clay soils, usually in close proximity to at least seasonally wet areas e.g. billabongs, gilgais, floodplains, riparian corridors (DoTE 2015b).	At edge of species known range (DSEWPaC 2011).
	Egernia rugosa Yakka Skink	V	V	species or species habitat may occur within area	Woodland and open forests also derived grassland with regrowth trees; requires suitable soils for burrows, sinkholes, abandoned rabbit warrens or large fallen woody material for shelter (Eddie 2012).	Within species known range (Wilson 2005).
	Furina dunmalli Dunmall's snake	V	V	species or species habitat may occur within area	*Eucalyptus*, *Acacia* and *Callitris* woodlands and open forests; may be reliant on presence of abundant fallen woody debris (Hobson 2012).	Within species known range (DSEWPaC 2011);
	Rheodytes leukops Fitzroy River Turtle	V	V	species or species habitat may occur within area	Dependent on permanent streams with a preference for deep pools often with intervening riffle zones (DoTE 2015b).	Outside of known range (not recorded within upper drainages of the Fitzroy River catchment) (Limpus *et al*. 2011).

An assessment of fauna microhabitat features observed and recorded at each BioCondition site is summarised in Table 8. The presence or absence (and abundance) of fauna microhabitat features as well as incorporation of local distribution information and expert knowledge has also informed the likelihood of occurrence assessment for threatened fauna at the Site (Table 7). In the case of regrowth vegetation that typically lacked many essential microhabitat features, the predicted occurrence of threatened fauna includes both those likely to be present in the RE in its current condition, and potential future occurrence if the habitat value of the RE is restored.

Table 8: Fauna microhabitat features and predicted occurrence of nominated threatened fauna in RE at the Site.

Applicable BioCondition / Quaternary Survey Site	RE	Microhabitat features present (refer to Appendix D for density and abundance scores)	Predicted occurrence of threatened fauna based on microhabitat habitat features present
SW06 / SW20	11.3.25 (remnant)	Embedded/loose rocks; boulders; leaflitter; ground cover; small and large logs; trees >18m; hollow-bearing trees	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Red Goshawk, Squatter Pigeon, Australasian Bittern, Star Finch, Black-throated Finch
B1-WB / Q6-WB	11.9.4 (remnant)	Embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; small logs; trees with loose bark; termite mounds	Black-breasted Button-quail, Northern Quoll, Large-eared Pied Bat, Red Goshawk
SW07	11.9.4 (advanced regrowth)	Embedded/loose rocks; boulders; shrub layer; leaflitter; ground cover; crevices; small logs; hollow bearing trees; trees with loose bark	Northern Quoll, Large-eared Pied Bat, Red Goshawk Future potential: Black-breasted Button-quail
FV19	11.9.4 (young regrowth)	Embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; small logs; trees with loose bark; mistletoe	Nil Future potential: Black-breasted Button-quail, Northern Quoll, Large-eared Pied Bat, Red Goshawk
G1-WB / Q9-WB	11.9.5 (remnant)	Embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; small logs; hollow bearing trees; trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
FV16	11.9.5 (advanced regrowth)	Embedded/loose rocks; boulders; fallen bark; leaflitter; ground cover; small logs	Northern Quoll, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon Future potential: South-eastern Long-eared Bat, Large-eared Pied Bat
FV17	11.9.5 (young regrowth)	Shrub layer; ground cover; leaflitter; small logs	Nil Future potential: Northern Quoll, Dunmall's Snake, Yakka Skink, Squatter Pigeon, Red Goshawk, South-eastern Long-eared Bat, Large-eared Pied Bat, Collared Delma,
G1-WB / Q9-WB	11.9.5a (remnant)	Embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; small logs; hollow bearing trees; trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Red Goshawk
FV16	11.9.5a (advanced regrowth)	Embedded/loose rocks; boulders; fallen bark; leaflitter; ground cover; small logs	Northern Quoll Red Goshawk, South-eastern Long-eared Bat, Large-eared Pied Bat

Applicable BioCondition / Quaternary Survey Site	RE	Microhabitat features present (refer to Appendix D for density and abundance scores)	Predicted occurrence of threatened fauna based on microhabitat habitat features present
FV17	11.9.5a (young regrowth)	Shrub layer; ground cover; leaflitter; small logs	Nil Future potential: Northern Quoll, Red Goshawk, South-eastern Long-eared Bat, Large-eared Pied Bat
SW13	11.9.7 (young regrowth)	Fallen bark; shrub layer; leaflitter; ground cover; small & large logs; fallen bark	Nil Future potential: Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
B2-WB / Q10-WB	11.9.10 (remnant)	Embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; crevices; caves; small & large logs; hollow bearing trees; trees with loose bark; mistletoe	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
R2-WB / Q7-WB	11.10.1c (remnant)	Fallen bark, leaflitter, small & large logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
FV06 / FV11	11.10.2 (remnant)	Trees > 18m; embedded/loose rocks; boulders; fallen bark; shrub layer; leaflitter; ground cover; crevices and ledges; underhangs/overhangs/caves; small and large logs; hollow bearing trees; trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
WB02	11.10.3 (remnant)	Embedded/loose rocks; fallen bark; shrub layer; leaflitter; ground cover; small and large logs; hollow bearing trees; trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
SW03	11.10.3 (advanced regrowth)	Embedded & loose rocks, trees >18m, fallen bark, leaflitter, groundcover, small & large logs, hollow logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
FV04 / FV09 / FV20 / SW23	11.10.7 (remnant)	Embedded & loose rocks, fallen bark, leaflitter, groundcover, small & large logs, hollow logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
SW23	11.10.7 (advanced regrowth)	Embedded & loose rocks, fallen bark, leaflitter, groundcover, small & large logs, hollow logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
G2-WB / Q8-WB	11.10.7 (young regrowth)	Small logs; trees with loose bark	Nil Future potential: Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon

Applicable BioCondition / Quaternary Survey Site	RE	Microhabitat features present (refer to Appendix D for density and abundance scores)	Predicted occurrence of threatened fauna based on microhabitat habitat features present
W1-WB / Q3-WB	11.10.7a (remnant)	Loose rocks, fallen bark, leaflitter, ground cover, small & large logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
W2-WB / Q4-WB	11.10.7a (remnant)	Embedded & loose rocks, boulders, crevices/ledges, underhangs/caves, fallen bark, leaflitter, groundcover, small & large logs, hollow-bearing trees, trees with loose bark	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
WB01 / FV03 / FV07	11.10.8 (remnant)	Embedded & loose rocks, boulders, crevices/ledges, underhangs/caves, fallen bark, shrub layer; leaflitter, groundcover, small & large logs, hollow-bearing trees, trees with loose bark	Black-breasted Button-quail, Northern Quoll, Large-eared Pied Bat, Red Goshawk
WB03	11.10.11 (young regrowth)	Shrub layer; leaflitter, groundcover, small & large logs,	Nil Future potential: Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
Y1-WB / Q1-WB	11.10.13 (remnant)	Embedded & loose rocks; shrub layer; small logs; hollow-bearing trees; trees with loose bark; termite mounds	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
Y2-WB / Q2-WB	11.10.13 (remnant)	Embedded & loose rocks; fallen bark; shrub layer; leaflitter; groundcover; small & large logs; trees with loose bark; termite mounds	Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon
R1-WB / Q5-WB	11.10.13 (young regrowth)	Embedded & loose rocks, boulders, fallen bark, leaflitter, groundcover, small & large logs	Nil Potential future: Northern Quoll, South-eastern Long-eared Bat, Large-eared Pied Bat, Dunmall's Snake, Yakka Skink, Collared Delma, Red Goshawk, Squatter Pigeon

3.3.2. Threatened Fauna Predictive Habitat Mapping

Results of microhabitat analyses provided a basis for the indicative presence of threatened fauna based on the microhabitat requirements of each species. Predictive fauna habitat mapping based on these analyses and expert knowledge is shown within Appendix G. Summary data for the estimated extent of General Habitat and Potential Future Habitat for each fauna species is presented in Table 9. Habitat mapping rules for each species are also included in Table 9. As a rule remnant and advanced regrowth of RE in suitable condition (i.e. containing sufficient levels of essential microhabitat features) was deemed to be General Habitat. An exception was made for the Black-breasted Button-quail (*Turnix melanogaster*) where individual patches of potential General Habitat were excluded if the patch was small and thus unlikely to meet the requirements of a resident population or were distant from woody vegetation that would facilitate movement of the species to and from adjacent habitat. The absence or low levels of essential resources in young regrowth precluded mapping of this vegetation as General Habitat. Young regrowth may in time with appropriate management acquire sufficient levels of fauna habitat features. Recovery would be heavily dependent on the management of threatening processes such as weed invasion and inappropriate fire regimes.

Table 9: List of potentially suitable REs and estimated extent of potentially suitable habitat for nominated threatened fauna at the Site.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Mapped extent of Potential Future Habitat (ha)	Habitat Mapping Rules/Notes
Chalinolobus dwyeri Large-eared Pied Bat	11.3.25, 11.9.4, 11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.8, 11.10.11, 11.10.13	1527.8	1352.2	• Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter. Note that all remnant vegetation is in close proximity (≤ 5km) of potentially suitable roost habitat in cliffs and scarps. • Young regrowth of all REs represents Potential Future Habitat. • RE 11.9.4 and 11.10.8 are included on the basis that these RE may contain potentially suitable roost sites.
Dasyurus hallucatus Northern Quoll	11.3.25, 11.9.4, 11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.8, 11.10.11, 11.10.13	1527.8	1352.2	• Mapped General Habitat includes all remnant and advanced regrowth vegetation (includes foraging habitat and vegetation containing potentially suitable den sites). Note that all remnant vegetation is in close proximity (≤ 5km) of potentially suitable den sites associated with cliffs and rocky scarps. • Young regrowth of all REs represents Potential Future Habitat.
Nyctophilus corbeni South-eastern Long-eared Bat	11.3.25, 11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.11, 11.10.13	1097.2	1266.9	• Mapped General Habitat includes all areas of remnant vegetation and advanced regrowth that may be suitable for foraging or shelter. • Young regrowth of all REs represents Potential Future Habitat.
Petrogale penicillata Brush-tailed Rock-wallaby	N/A	0	0	• The Site is not within the range of this species (Lundie-Jenkins 2012).
Botaurus poiciloptilus Australasian Bittern	11.3.25	6.3	0	• Mapped General Habitat includes all remnant 11.3.25 but note that potentially suitable wetland habitat has not been ground-truthed within this RE. This species may also use the shallow vegetated margins of artificial water bodies such as stock dams but these have not been mapped.
Erythrotriorchis radiatus Red Goshawk	11.3.25, 11.9.4, 11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.8, 11.10.11, 11.10.13	1527.8	1352.2	• Mapped General Habitat includes all remnant and advanced regrowth of potentially suitable REs. • Young regrowth of all REs represents Potential Future Habitat with appropriate rehabilitation. • This species may also forage within non-remnant vegetation.
Geophaps scripta scripta Squatter Pigeon	11.3.25, 11.9.5, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.11, 11.10.13	1072.9	1223.5	• Mapped General Habitat includes remnant and advanced regrowth of potentially suitable REs. • Young regrowth of all REs represents Potential Future Habitat with appropriate rehabilitation. • This species may also forage within non-remnant vegetation.

Species name	Potentially Suitable REs	Mapped extent of General Habitat (ha)	Mapped extent of Potential Future Habitat (ha)	Habitat Mapping Rules/Notes
Neochmia ruficauda ruficauda Star Finch (Eastern)	11.3.25	6.3	0	• Mapped General Habitat includes remnant 11.3.25. • This species may potentially forage elsewhere on the Site. • Note that this subspecies is considered to be extinct in Queensland (Garnett *et al*. 2011).
Poephila cincta cincta Black-throated Finch	11.3.25	6.3	0	• Mapped General Habitat includes remnant 11.3.25. • This species may potentially forage elsewhere on the Site. • Note that there are no recent records for southern Queensland (DoTE 2015b, Birdlife Australia 2015).
Rostratula australis Australian Painted Snipe	11.3.25	6.3	0	• Mapped General Habitat includes all remnant RE 11.3.25 but note that potentially suitable wetland habitat has not been ground-truthed within this RE. This species may also use the shallow vegetated margins of artificial water bodies such as stock dams but these have not been mapped.
Turnix melanogaster Black-breasted Button-quail	11.9.4, 11.9.5a, 11.10.8	530.3	259.4	• Mapped General Habitat includes all remnant and advanced regrowth RE 11.9.4, 11.10.8 and 11.9.5a that have linkages to other woody vegetation. • Young regrowth of RE 11.9.4, 11.10.8 and 11.9.5a represents Potential Future Habitat with appropriate rehabilitation.
Delma torquata Collared Delma	11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.11, 11.10.13	1090.9	1266.9	• Mapped General Habitat includes all areas of remnant and advanced regrowth of all REs except RE 11.9.4. • Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
Denisonia maculata Ornamental Snake	nil	0	0	• No General Habitat has been mapped for this species (no suitable habitat is considered to be present).
Egernia rugosa Yakka Skink	11.9.5, 11.9.5a, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.11, 11.10.13	1090.9	1266.9	• Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs. • Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
Furina dunmalli Dunmall's Snake	11.3.25, 11.9.5, 11.9.7, 11.9.10, 11.10.1c, 11.10.2, 11.10.3, 11.10.7, 11.10.7a, 11.10.11, 11.10.13	1072.9	1266.**9**	• Mapped General Habitat includes all remnant vegetation and advanced regrowth of the nominated REs. • Young regrowth of potentially suitable REs has been mapped as Potential Future Habitat.
Rheodytes leukops Fitzroy River Turtle	N/A	0	0	• The Site is not within the range of this species (Limpus *et al*. 2011).

4. Recommendations

No fauna surveys in accordance with best practice state (Eyre *et al*. 2014, Ferguson and Mathieson 2014) and/or federal (DEWHA 2010, 2010c; DSEWPaC 2011b, 2011c) survey guidelines have been undertaken for the nominated species under this Scope of Works. It is recommended that surveys for the target fauna nominated as potentially occurring at the Site be conducted in accordance with state applicable survey guidelines at appropriate times. Such surveys would potentially confirm presence of additional threatened fauna populations, contribute to documentation of habitat utilisation and significant habitats for threatened species as well as potentially informing management planning documents.

5. Conclusions

The desktop assessment and preliminary field survey confirmed the following ecological values are present at the Site:

- Approximately 88.8 ha of Brigalow (*Acacia harpophylla* dominant and dominant) TEC.
- Approximately 373.0 ha of 'Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' TEC.
- Presence of 12 RE types.
- Confirmed presence of one species of threatened fauna listed as vulnerable under the EPBC Act and NC Act this being Squatter Pigeon.
- Confirmed presence of habitat potentially suitable for the following threatened fauna:
    - *Dasyurus hallucatus* (Northern Quoll) – 1527.8 ha;
    - *Chalinolobus dwyeri* (Large-eared Pied Bat, Large Pied Bat) – 1527.8 ha;
    - *Turnix melanogaster* (Black-breasted Button-quail) – 530.3 ha;
    - *Erythrotriorchis radiatus* (Red Goshawk) – 1527.8 ha;
    - *Rostratula australis* (Australian Painted Snipe) – 6.3 ha;
    - *Delma torquata* (Collared Delma) – 1090.9 ha;
    - *Geophaps scripta scripta* (Squatter Pigeon (Southern)) – 1072.9 ha;
    - *Egernia rugosa* (Yakka Skink) – 1090.9 ha;
    - *Furina dunmalli* (Dunmall's Snake) – 1072.9 ha;
    - *Nyctophilus corbeni* (Eastern Long-eared Bat) – 1527.8 ha;
    - *Neochmia ruficauda ruficauda* (Eastern Star Finch) – 6.3 ha;
    - *Botaurus poiciloptilus* (Australasian Bittern) – 6.3 ha; and
    - *Poephila cincta cincta* (Black-throated Finch) – 6.3 ha.

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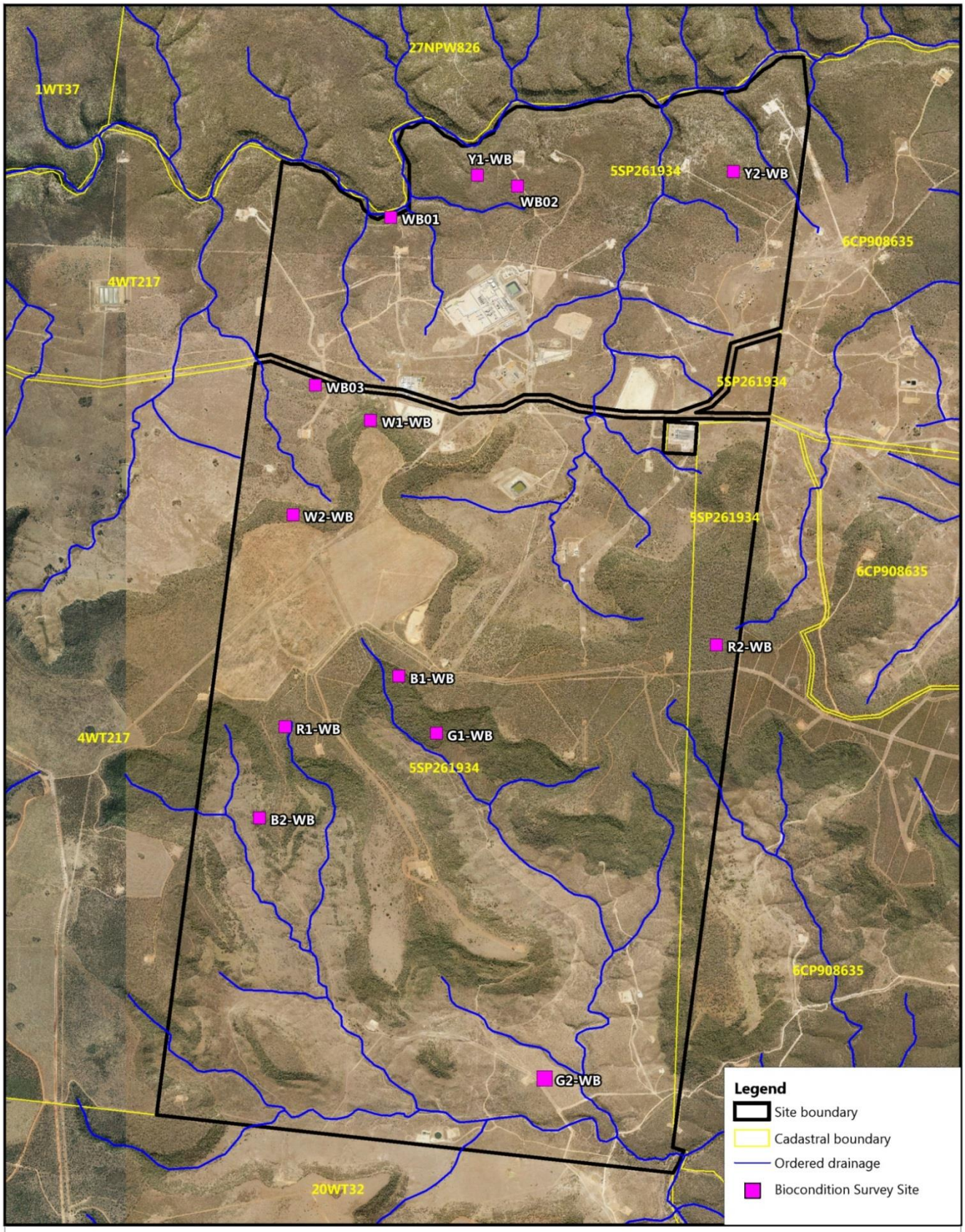
Appendix A. Site Location & Survey Sites.



Appendix A
Site Location
& Survey Sites

23 September 2015

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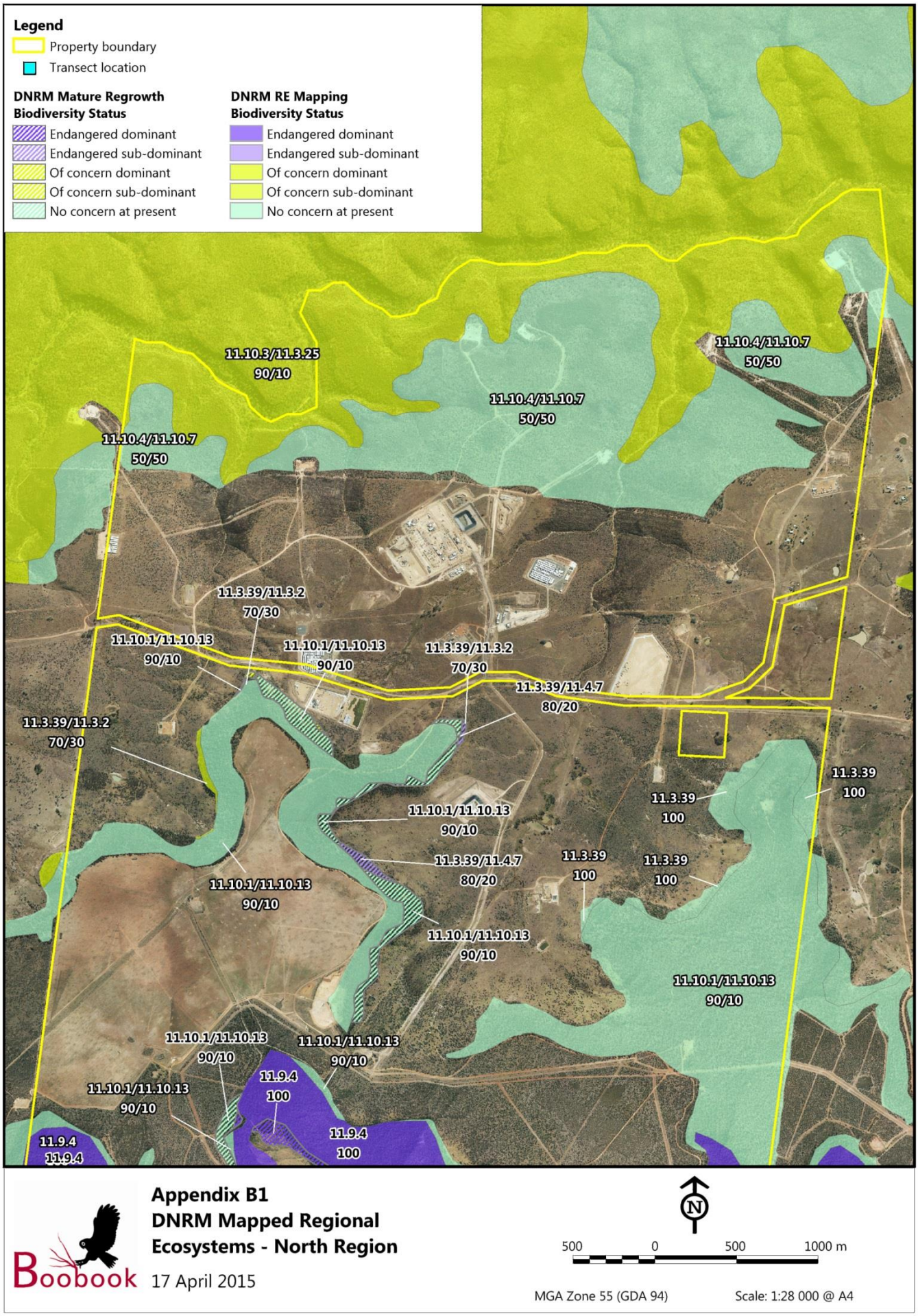
MGA Zone 55 (GDA 94) Scale: 1:45 000 @ A4

Appendix B. BioCondition Assessment Field Sheets.

Appendix C. DNRM Mapped Regional Ecosystems.


Legend
Property boundary
Transect location
DNRM Mature Regrowth Biodiversity Status
Endangered dominant
Endangered sub-dominant
Of concern dominant
Of concern sub-dominant
No concern at present
DNRM RE Mapping Biodiversity Status
Endangered dominant
Endangered sub-dominant
Of concern dominant
Of concern sub-dominant
No concern at present
11.10.3/11.3.25 90/10
11.10.4/11.10.7 50/50
11.10.4/11.10.7 50/50
11.10.4/11.10.7 50/50
11.3.39/11.3.2 70/30
11.10.1/11.10.13 90/10
11.10.1/11.10.13 90/10
11.3.39/11.3.2 70/30
11.3.39/11.4.7 80/20
11.3.39/11.3.2 70/30
11.3.39 100
11.3.39 100
11.10.1/11.10.13 90/10
11.3.39/11.4.7 80/20
11.3.39 100
11.3.39 100
11.10.1/11.10.13 90/10
11.10.1/11.10.13 90/10
11.10.1/11.10.13 90/10
11.10.1/11.10.13 90/10
11.10.1/11.10.13 90/10
11.9.4 100
11.10.1/11.10.13 90/10
11.9.4 100
11.9.4 11.9.4
Appendix B1
DNRM Mapped Regional Ecosystems - North Region
17 April 2015
Boobook
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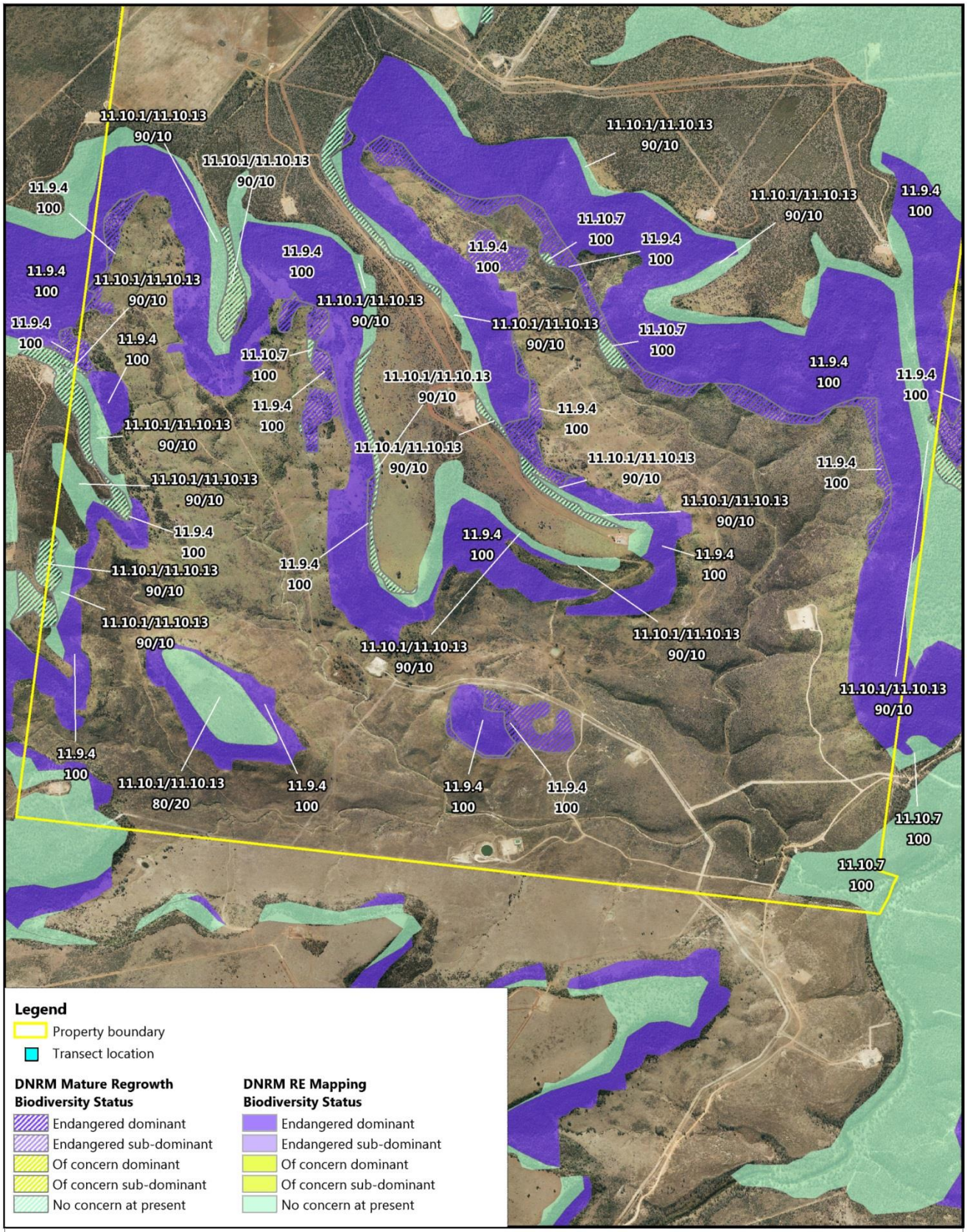
MGA Zone 55 (GDA 94)
Scale: 1:28 000 @ A4


11.10.1/11.10.13
90/10
11.9.4
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11.10.7
100
80/20
Legend
Property boundary
Transect location
DNRM Mature Regrowth Biodiversity Status
Endangered dominant
Endangered sub-dominant
Of concern dominant
Of concern sub-dominant
No concern at present
DNRM RE Mapping Biodiversity Status
Endangered dominant
Endangered sub-dominant
Of concern dominant
Of concern sub-dominant
No concern at present
Boobook
Appendix C1
DNRM Mapped Regional Ecosystems - North Region
17 April 2015
N
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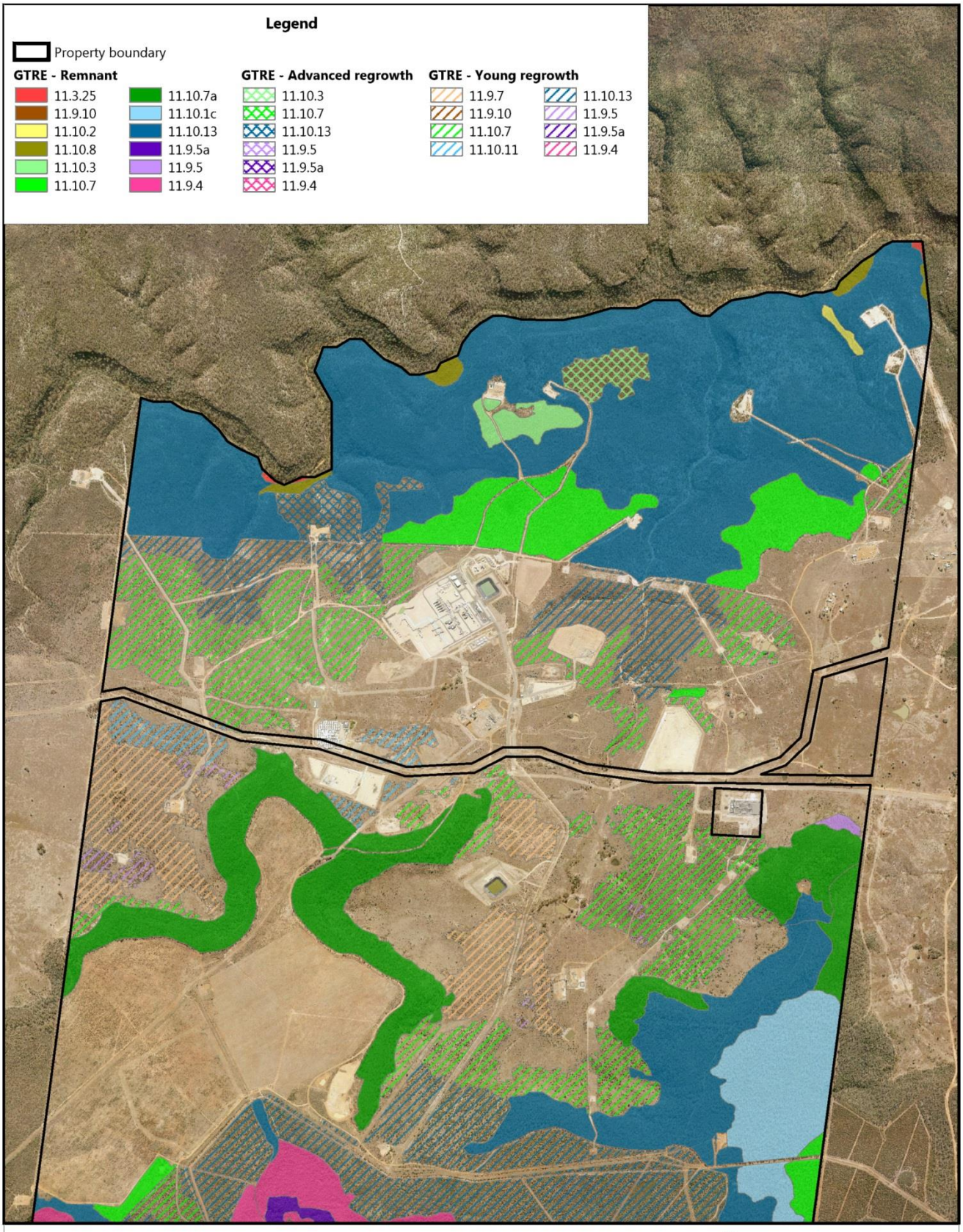
MGA Zone 55 (GDA 94)
Scale: 1:28 000 @ A4

Appendix D. Quaternary Site Assessments

Appendix E. Ground-truthed Vegetation Mapping



Appendix E1
Ground-truthed Regional Ecosystems - North Region

Boobook

23 September 2015

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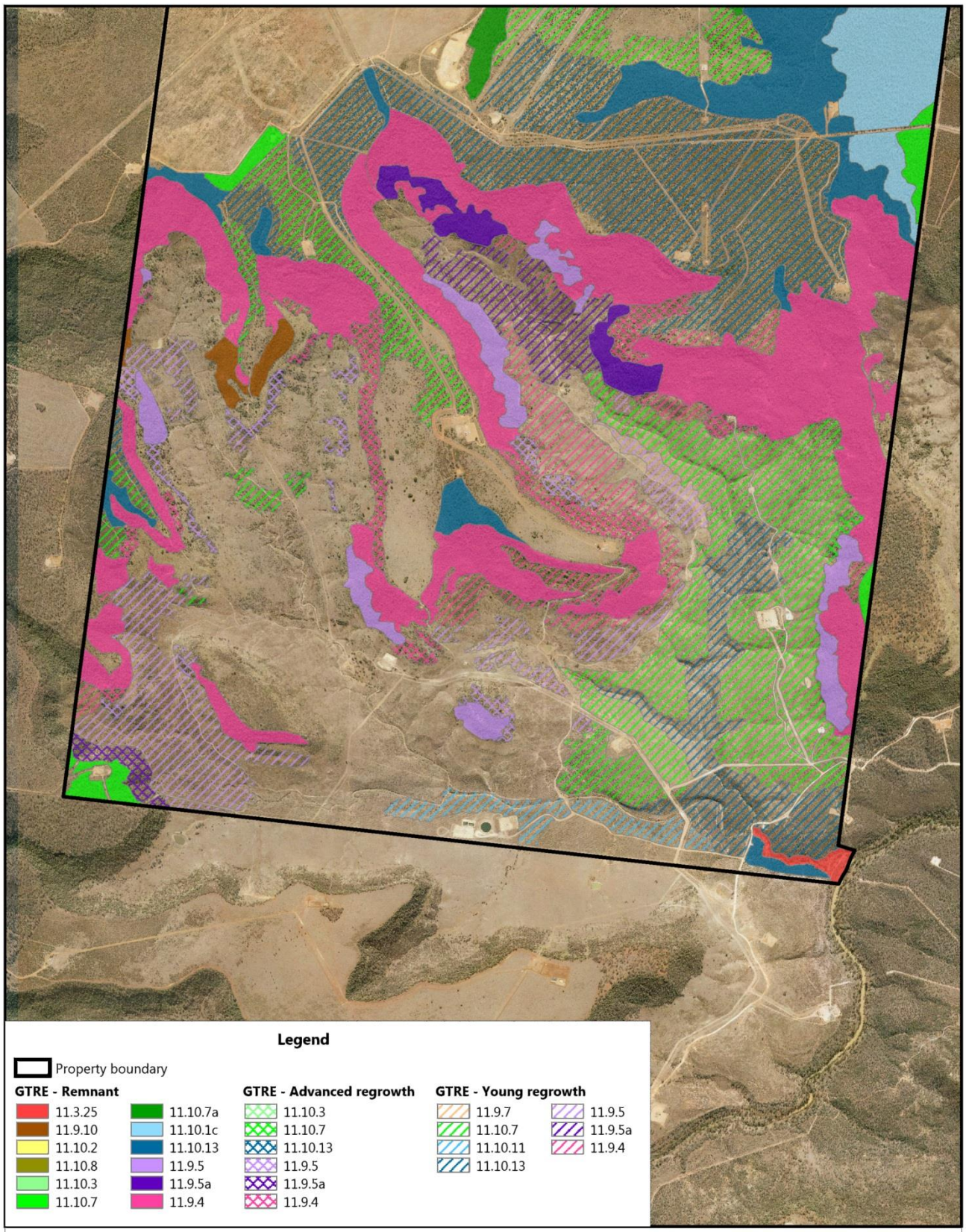
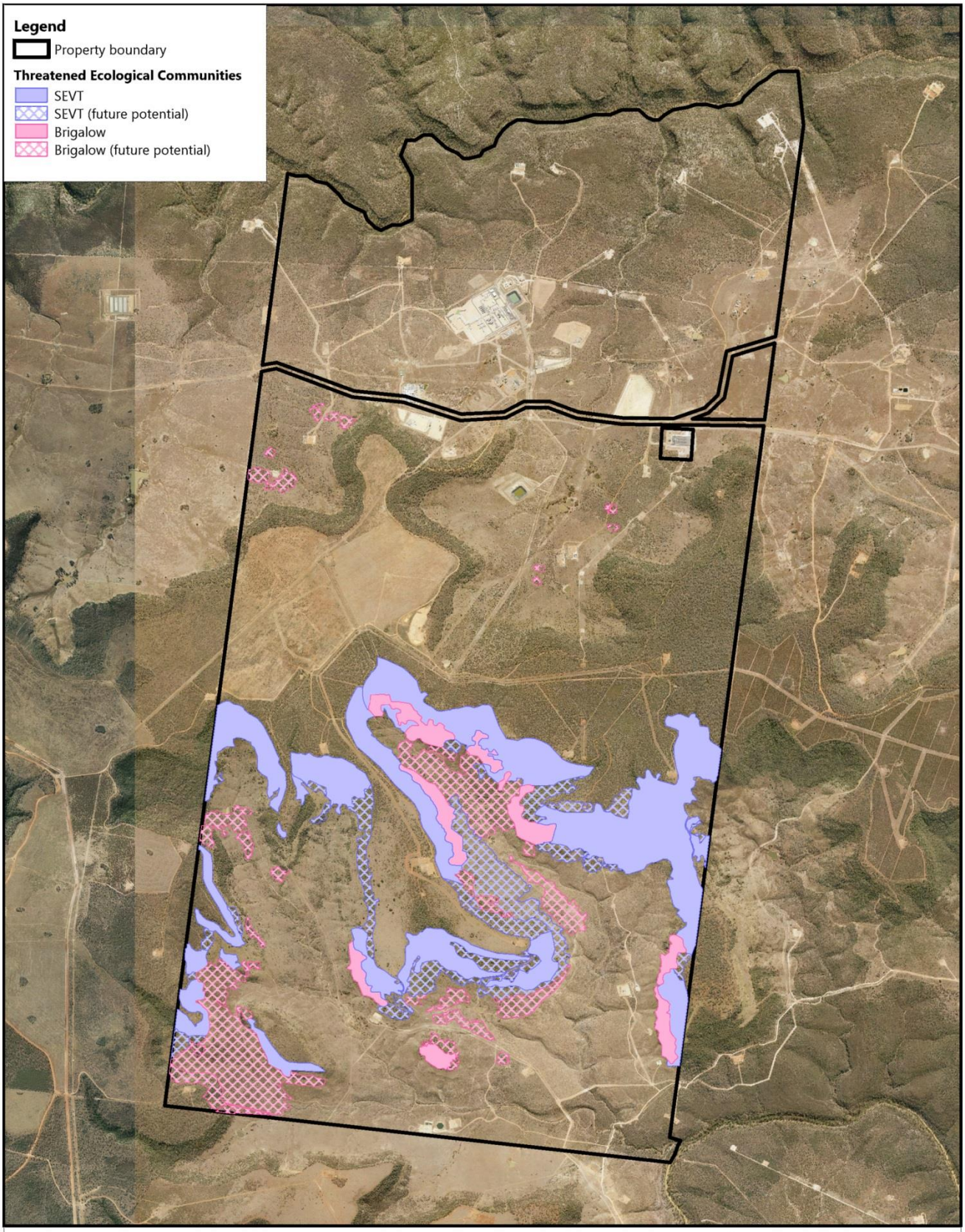
500 0 500 1000 m

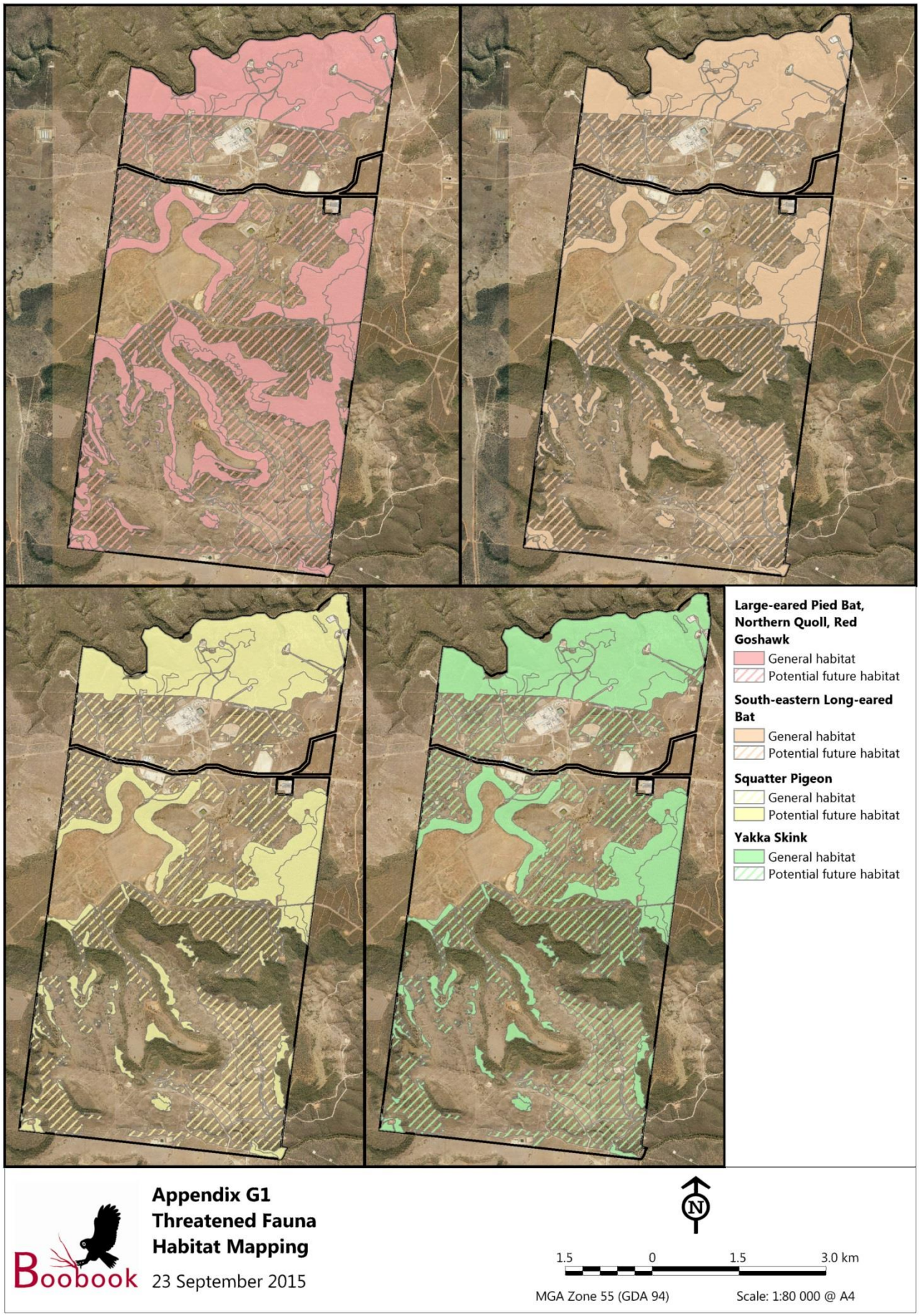
MGA Zone 55 (GDA 94) Scale: 1:28 000 @ A4

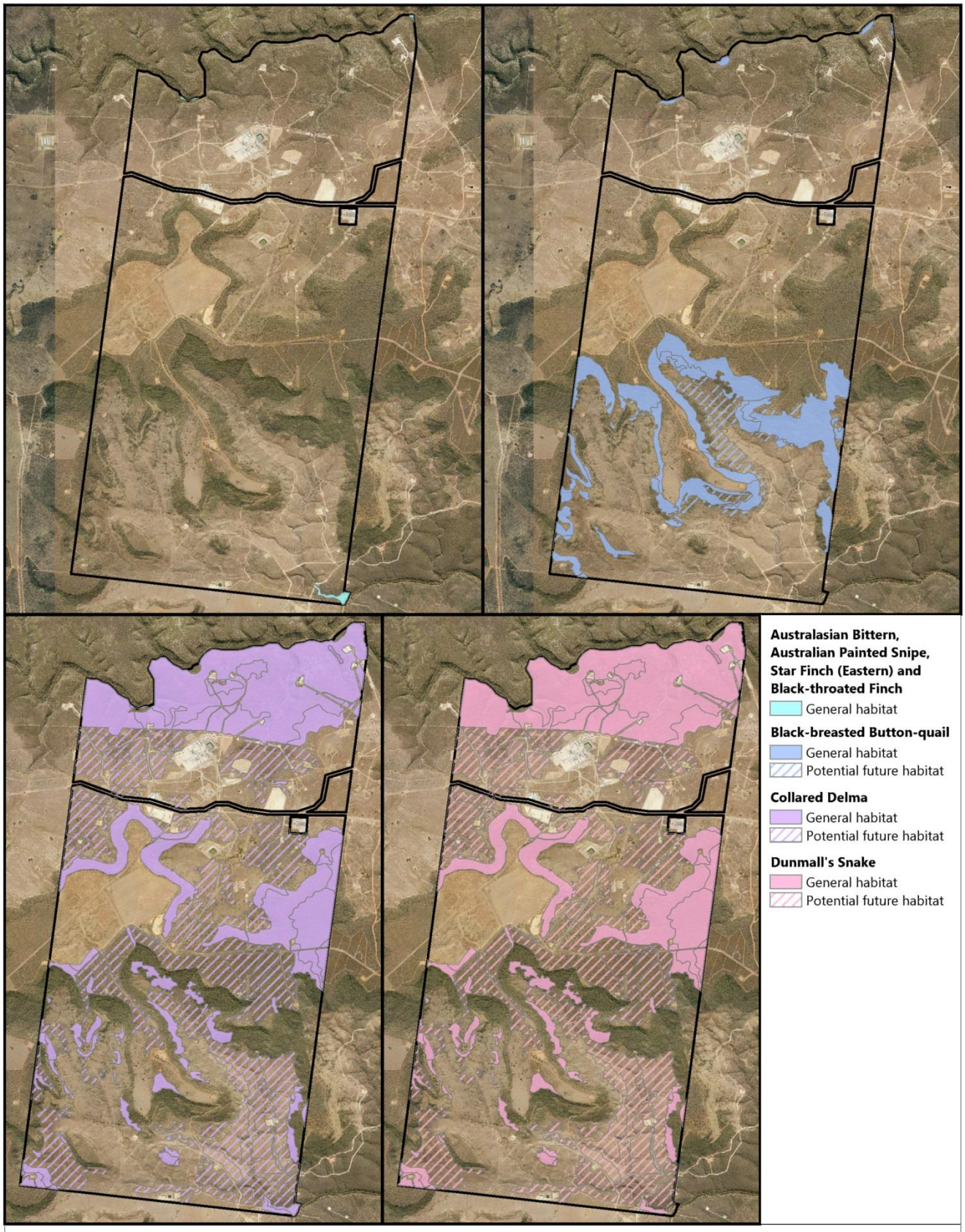

Legend
Property boundary
GTRE - Remnant
11.3.25
11.9.10
11.10.2
11.10.8
11.10.3
11.10.7
11.10.7a
11.10.1c
11.10.13
11.9.5
11.9.5a
11.9.4
GTRE - Advanced regrowth
11.10.3
11.10.7
11.10.13
11.9.5
11.9.5a
11.9.4
GTRE - Young regrowth
11.9.7
11.10.7
11.10.11
11.10.13
11.9.5
11.9.5a
11.9.4
Boobook
Appendix E2
Ground-truthed Regional Ecosystems - South Region
23 September 2015
N
500 0 500 1000 m
MGA Zone 55 (GDA 94)
Scale: 1:28 000 @ A4

Appendix F. Extent of Threatened Ecological Communities


Legend
Property boundary
Threatened Ecological Communities
SEVT
SEVT (future potential)
Brigalow
Brigalow (future potential)
Boobook
Appendix F
Threatened Ecological Communities
23 September 2015
N
800
0
800
1600 m
MGA Zone 55 (GDA 94)
Scale: 1:45 000 @ A4

Appendix G. Threatened Fauna Habitat Mapping


Large-eared Pied Bat, Northern Quoll, Red Goshawk
General habitat
Potential future habitat
South-eastern Long-eared Bat
General habitat
Potential future habitat
Squatter Pigeon
General habitat
Potential future habitat
Yakka Skink
General habitat
Potential future habitat
Boobook
Appendix G1
Threatened Fauna
Habitat Mapping
23 September 2015
N
1.5 0 1.5 3.0 km
MGA Zone 55 (GDA 94)
Scale: 1:80 000 @ A4


Australasian Bittern, Australian Painted Snipe, Star Finch (Eastern) and Black-throated Finch
General habitat
Black-breasted Button-quail
General habitat
Potential future habitat
Collared Delma
General habitat
Potential future habitat
Dunmall's Snake
General habitat
Potential future habitat
Boobook
Appendix G2
Threatened Fauna
Habitat Mapping
23 September 2015
N
1.5 0 1.5 3.0 km
MGA Zone 55 (GDA 94)
Scale: 1:80 000 @ A4