niche
Environment and Heritage

BIODIVERSITY CERTIFICATION ASSESSMENT REPORT

Brimbin New Town

August 2013

DOCUMENT CONTROL

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ABBREVIATIONS

BCAM (or 'the Methodology') - Biodiversity Certification Assessment Methodology

BCCC (or 'the Calculator') – Biodiversity Certification Credit Calculator

BVT – Biometric Vegetation Type (revised)

DSEWPaC – Commonwealth Department of Sustainability, Environment, Water, Population, and Communities

EP&A Act – NSW *Environmental Planning and Assessment Act 1979*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

GTCC (or the Council) – Greater Taree City Council

OEH – Office of Environment and Heritage

PCT – Plant Community Type

TEC – Threatened Ecological Community (as listed on the TSC and/or EPBC Acts)

TSC Act – NSW *Threatened Species Conservation Act 1995*

EXECUTIVE SUMMARY

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Roche Group Pty Ltd (Roche Group) to conduct a Biodiversity Certification Assessment of the Brimbin New Town site under direction from Greater Taree City Council, as the approval mechanism for future development on the site.

Advice from the Office of Environment and Heritage is that a Biodiversity Certification assessment entails a two stage reporting process:

1. The *Biodiversity Certification Assessment Report*; and
2. The *Biodiversity Certification Strategy*.

This report constitutes the *Biodiversity Certification Assessment Report* (the Assessment Report) and contains a description of the proposal, the survey methodology and results, and provides the Ecosystem and Species Credit calculations. The way in which the development may meet an improve or maintain outcome for biodiversity values is briefly outlined (i.e., the conservation measures required), and a full description and justification of these measures and red flag variations is provided in the *Biodiversity Certification Strategy* (the Strategy).

Field Survey

Niche conducted field surveys of the Brimbin New Town site over three discrete survey periods in June 2010, August 2010 and October 2011. Surveys of the site by other consultants have been conducted in February 2004 and December 2009. Collectively, these surveys included vegetation mapping and validation, bushland condition and resilience assessment, threatened flora random meanders, threatened plant population estimates (*Eucalyptus seeana*), Biobanking plots and a variety of threatened fauna surveys. The surveys undertaken for the assessment were consistent with the requirements of the Biodiversity Certification Assessment Methodology (BCAM or 'the Methodology).

Key ecological features of the Assessment Area

The Assessment Area (the Development Area and the Conservation Area collectively) contain three Threatened Ecological Communities (TECs) as listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act). They include Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest and Subtropical Coastal Floodplain Forest. Of these TECs, 10.2 hectares is within the Development Area, while 112.9 hectares is in the Conservation Area.

Threatened Flora

One endangered population as listed on the TSC Act, *Eucalyptus seeana* (Narrow-leaved Red Gum) in the Greater Taree LGA, is located both within the Development Area and the Conservation Area.

A single individual of the threatened plant, *Corybas dowlingii* (Red Helmet-orchid), which is listed as endangered on the TSC Act, was detected in the proposed Conservation Area only.

Nine individuals of the threatened plant, *Eucalyptus glaucina* (Slaty Red Gum), which is listed as vulnerable on the TSC Act and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), were detected in the Conservation Area and Riparian and Steep lands (retained lands).

Threatened Fauna

Twenty threatened fauna species were recorded within the Assessment Area, including; Glossy Black-cockatoo, Varied Sittella, Little Lorikeet, Scarlet Robin, Square-tailed Kite, Powerful Owl, Masked Owl, Black-necked Stork, Comb-crested Jacana, Koala, Squirrel Glider, Brush-tailed Phascogale, Grey-headed Flying-fox, Little Bentwing-bat, Eastern Bentwing-bat, Yellow-bellied Sheath-tailed Bat, East-coast Freetail Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat and Large-footed Myotis.

A further nine migratory species listed on the EPBC Act have been recorded from the Certification area, including; Australian Wood Duck, Pacific Black Duck, Black-shouldered Kite, Whistling Kite, Wedge-tailed Eagle, Nankeen Kestrel, White-throated Needle-tail, Cattle Egret and Great Egret.

Wildlife Corridors and Key Habitat

The Lower Manning Valley regional wildlife corridor runs through the southern part of the site and connects extensive areas of vegetation east and west of the Assessment Area. This will largely be protected in the Conservation Area.

The Lower Manning Valley sub-regional wildlife connects vegetation in the south of the Assessment Area to vegetation outside of the Assessment Area and over the Dawson River to the west.

Credit Calculations

Final credit calculations using the *Biodiversity Certification Credit Calculator,* as released by OEH in April 2013, were conducted. These calculations demonstrated that, through the retirement of Ecosystem and Species Credits, approval of a red flag variation and also an approval of a minor variation to the offsetting rules under the Methodology, the proposal was likely to lead to an improvement in biodiversity values.

The assessment resulted in an overall surplus of 3,412 Ecosystem Credits. However, a deficit of 310 Ecosystem Credits exists for a single vegetation type, HU549 Grey Box - Forest Red Gum - Grey Ironbark open forest of the hinterland ranges of the North Coast, up to and including trading of credits at vegetation formation level (as allowed by the Methodology). As HU549 is not a red flag vegetation type it is proposed that, through the mechanism allowed in the Methodology for a minor variation to the offsetting rules, the deficit of 310 Ecosystem Credits (equating to 25.5 hectares) will be traded with the large surplus of credits from the PCTs that are aligned to TECs. Either Swamp Oak swamp forest (320 credits or 42.8 hectares available) or Swamp Mahogany swamp forest (737 credits or 55.4 hectares available) could be utilised for this trade of credits. It is considered that satisfying a credit deficit for a non-TEC vegetation type with credits of a TEC is an improved outcome for threatened biodiversity.

Subject to approval of a red flag variation (to be provided in the Strategy), *Eucalyptus seeana* can be more than adequately offset through the retirement of Species Credits (a surplus of 8,441 Species Credits). Neither *Corybas dowlingii* nor *Eucalyptus glaucina* are impacted by the proposed development and therefore no offsetting of these species is required.

Brush-tailed Phascogale and Koala are not predicted in Ecosystem Credits on the site and therefore retirement of Species Credits is required for each of these species. Although the Black-necked Stork and Comb-crested Jacana were both recorded within the study area and require Species Credits, habitat for these species only occurred within retained lands and therefore further consideration of these species was not required.

Red flags

Three red flag issues fall within the Development Area of this assessment:

1. The TECs, Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest; and
2. The *Eucalyptus seeana* Endangered Population.

A red flag variation will be provided in the Strategy.

1 INTRODUCTION

1.1 Project background

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Roche Group Pty Ltd (Roche Group) to survey their lands at Brimbin in order to gain an understanding of the ecological value of the area, guide future land use of the site and assist with the determination of the sites suitability as compensatory habitat for on-site and off-site developments. The *Biodiversity Certification Assessment Methodology* (the Methodology, DECCW 2011) has been utilised in this assessment for the purposes of providing the justification for conferring Biodiversity Certification on one particular development as proposed by Roche Group, the Brimbin New Town. The Brimbin New Town site is located approximately 8 kilometres north of Taree in the lower Manning River catchment (Figure **1**).

1.1.1 Purpose of this report

The purpose of the Assessment Report is to accompany the Strategy which must ultimately be collated and submitted by Greater Taree City Council (GTCC). The Assessment Report describes the procedures and assumptions used to calculate the offset requirement (in terms of biodiversity credits) and also explains how the assessment provides an improve or maintain outcome. The Strategy outlines how, when and by whom the conservation measures will be provided. Both the Assessment Report and the Strategy must be submitted to the Minister for the Environment for consideration and certification of the development proposal.

1.1.2 Objectives of this assessment

The specific objectives of Biodiversity Certification Assessment include the following:

- Undertake a review of relevant literature, a review of relevant databases and discussion with relevant experts;
- Undertake targeted surveys for threatened plant and animal species and their habitat in the Assessment Area;
- Accurately map the vegetation types occurring within the Assessment Area and align these types to previous classifications used, and the 'best fit' Plant Community Types (PCTs) used in the Biodiversity Certification Credit Calculator (the Calculator);
- Provide a description of the ecological values of the Assessment Area, including threatened biodiversity and red flags; and
- Assess the ecological value in terms of Ecosystem and Species Credit Status using the Calculator.

1.2 Brimbin New Town Biodiversity Certification Assessment Area

Throughout the report there is reference to the Development Area which is illustrated in the Brimbin New Town Draft Structure Plan (Figure **2**), and outlines the various land uses for the proposed development, including conservation. In this report it is assumed that all Development Areas within the Brimbin New Town Draft Structure Plan will be developed, although some areas may remain undeveloped once the proposal is finalised. Some additional, though negligible, impacts will be associated with future roads and associated infrastructure. Areas set aside for conservation within the Brimbin New Town Draft Structure Plan are divided into four categories:

1. Conservation (E1 National Park);
2. Conservation Replanting (E2 Council Reserve);
3. Riparian Land; and
4. Steep Land.

Although the Riparian and Steep lands would not be developed, they do not currently form part of the offset package and have therefore been considered as 'retained lands' and are not assessable. Approximately 178 hectares of the Conservation lands (E1 National Park) have already been set aside as an offset for a previous development and do not form part of the Conservation Area for the certification of the Brimbin New Town Development. This 178 hectare portion of the conservation lands is mapped in Figure **3** and has been excluded from the Conservation Area in this assessment.

As required by the Methodology, the land uses in the Draft Structure Plan have been classed into the Development Area (lands on which Certification will be conferred), Conservation Area (land utilised to offset the development) and Retained Lands (non-assessable at this stage). Figure **3** maps these three components within the Assessment Area. The Development Area is 1,627 hectares in total, of which 274.5 hectares is native vegetation (either in mature or regrowth form) and 1,352.5 hectares is cleared land. The Conservation Area is 949.2 hectares in total, of which 908.4 hectares is native vegetation, while 40.8 hectares is cleared land that will be replanted.

2 METHODS

2.1 Offsetting methodology

The current assessment utilises the *Biodiversity Certification Assessment Methodology*, after advice from GTCC and OEH. During the field survey a total of 65 Biobanking Plots (50 x 20 metres) were conducted. The required data for the parameters in 'Appendix 2 – Field methodology for measuring condition attributes in Site Value' of DECCW (2009) were collected within each plot. This more than meets the requirements of the Methodology. Some indicative plots have been utilised in the Calculator for vegetation zones that were not sampled, under certain assumptions. For instance, all replanting areas are in exotic paddocks and therefore have been assumed to have no native over-storey or mid-storey cover, a low native groundcover, a moderate exotic plant cover, no logs and no trees with hollows.

2.2 Literature and database review

2.2.1 Previous surveys

A number of previous surveys have been undertaken within the site and its environs for flora and fauna, including:

- Connell Wagner (February 2004), *LES Baseline Environmental Assessment*;
- Connell Wagner (September 2004), *LES Stage 2 Impact Assessment Report*;
- Andrews Neil (October 2006), *Biometric and Analysis of Environmental Trade-Offs*;
- Andrews Neil (2008), *Brimbin Biometric and Constraints Analysis*;
- Whelans Insites (December 2009), *Preliminary Ecological Constraints Report for Specific Areas*; and
- Niche (2011), *Brimbin Flora and Fauna Assessment*.
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The field survey effort and results of these assessments and reports have been summarised in Table 1.

Table 1. Summary of previous surveys

Report	Survey methods	Results
Connell Wagner (February 2004) *LES Baseline Environmental Assessment*	• Review of existing information and databases; • Field survey 17 Nov – 5 Dec 2003; • Targeted threatened plant random meanders; • Plot-based floristic surveys; • Diurnal bird and animal searches; • Nocturnal surveys (spotlighting, call playback); • Owl broadcast survey; • Ultrasonic bat detection;	• Five vegetation communities identified, none nominated as TECs; • Presence of *Eucalyptus seeana* (narrow-leaved red gum) Endangered Population; • Threatened animals recorded included; Square-tailed Kite, Glossy Black-cockatoo, Brush-tailed Phascogale, Squirrel Glider, Koala, Grey-headed Flying Fox, Little Bent-wing Bat, Large Bent-wing Bat and Yellow-bellied Sheath-tailed Bat.

Report	Survey methods	Results
	• Elliot trapping; and, • Hair tubes.	
Connell Wagner (September 2004) *LES Stage 2 Impact Assessment Report*	No additional survey work conducted. Assessment of likely impact on natural environment	• Proposal was likely to have a significant impact on the natural environment and therefore mitigation, offsetting and compensatory habitat measures recommended for the unavoidable residual impact.
Andrews Neil (October 2006) *Biometric and Analysis of Environmental Trade-Offs*	• Desktop investigations related to previous works and mapping; and, • Use of the PVP Developer to calculate 'Improve or Maintain' offsetting requirement of the proposed development (altered since 2006).	• The system of improve or maintain offsets as proposed in 2006 were sufficient subject to an overall management strategy incorporating the offsets proposed (rejected by Greater Taree City Council).
Andrews Neil (2008) *Biometric and Constraints Analysis*	• Largely desktop analysis with some vegetation validation.	• Identified the presence of Subtropical Coastal Floodplain Forest and the *Eucalyptus seeana* Endangered Population within the study area
Whelans Insites (December 2009) *Preliminary Ecological Constraints Report for Specific Areas*	• Preliminary Site Inspection with OEH; • Ecological Survey, 2-6 November 2009; • 3 nocturnal surveys including Elliot trapping, harp trapping, Anabat and remote camera; • Habitat searches and diurnal bird surveys; • Threatened plant random meander surveys; • 20 x 20 m floristic plots using Braun-Blanquet cover-abundance; • Updated flora species list; and, • Vegetation mapping validation	• Seven vegetation communities identified including the TECs Subtropical Coastal Floodplain Forest and Swamp Sclerophyll Forest; • Presence of *Eucalyptus seeana* (narrow-leaved red gum) Endangered Population. • Threatened animals recorded included; Little Lorikeet, Koala (scat), East-coast Freetail Bat, Eastern False Pipistrelle, Large-footed Myotis, Greater Broad-nosed Bat, Little Bentwing Bat, Eastern Bentwing Bat.

2.2.2 Other data sources

Biodiversity datasets and associated literature for the region were reviewed including:

- ❒ Existing vegetation mapping, as well as other available GIS data;
- ❒ Atlas of NSW Wildlife (OEH);
- ❒ EPBC Protected Matters Search Tool (DSEWPAC);
- ❒ Threatened Species Profiles Database (OEH);
- ❒ Biometric Vegetation Types Database (OEH, May 2012 updated version);
- ❒ Biometric Vegetation Types Benchmarks Database; and
- ❒ Correspondence from Mr John Seidel, OEH BioBanking Team, regarding updated Hunter CMA Plant Community Types (PCTs) and their relationship to revised Biometric Vegetation Types (BVTs).

2.3 Field survey

2.3.1 Vegetation Mapping – Ecosystem Credits

Base vegetation maps utilising information from previous studies and reports and aerial photography were utilised in the field for classifying the vegetation communities on the site.

Vegetation had been at least partially mapped for previous assessments of the Assessment Area and at a coarser resolution by GTCC. A comparison of the Niche (2010) mapping with these mapping products is provided in Appendix C.

For this assessment, which utilises the *Biodiversity Certification Assessment Methodology*, conversion of the previously utilised revised Biometric Vegetation Types (BVTs), to the new Plant Community Types (PCTs) for the Hunter CMA was required. This was done under advisement from Mr John Seidel of the Office of Environment and Heritage (OEH) BioBanking Team. Some shortcomings of the new PCTs for the Hunter CMA were discovered when operating the Calculator. As a consequence of these shortcomings ideal PCTs were replaced, in some cases, by those of the same red flag status and vegetation formation and class. The alignment of Niche mapping with previously used BVTs, the ideal PCT and the actual PCT used is provided in Appendix A. Appendix B aligns the vegetation types to TECs, red flag vegetation greater than 70 per cent cleared and vegetation formations and classes (Keith 2004).

Vegetation zone mapping

The Methodology requires the mapping of vegetation zones within the Assessment Area and defines a vegetation zone as a relatively homogenous area that is of the same vegetation type and broad condition state. Condition was determined to be in three different categories throughout the site:

- Intact or relatively mature forest and woodland where the original structure and composition exists;
- Regrowth forest and woodland where one or more layers of the vegetation have been modified or lost but the zone retains good capacity for regeneration (i.e., resilience); and
- Future replanting zones that are currently cleared land.

A description of each of the vegetation zones within the Assessment Area is provided in Section 3.2.

Vegetation Plots

As required by the Methodology, 50 x 20 metre BioBanking plots were conducted at select locations within each PCT to collect the required ten site attributes for Ecosystem Credit calculations. This fieldwork was conducted over three separate survey periods in June, July and August 2010.

An array of equidistant survey locations was defined using GIS and a rapid assessment of structure, with the composition of the vegetation being assessed at as many of these

locations as possible. Full floristic plots, Braun-Blanquet cover-abundance scores and dissimilarity analyses were viewed as unnecessary for the purposes of this assessment.

Flora survey effort is shown in Figure 4.

2.3.2 Threatened flora surveys – Species Credits

Threatened flora random meanders

Random meander surveys were carried out to locate and record threatened plant species. Where threatened plant species were detected, population estimates were made using a suitably robust and scientific method.

Random meander surveys were conducted in November and December 2003, November 2009 and June, July and August 2010, either by Niche or other parties.

***Eucalyptus seeana* population estimates**

A population estimate was made for *Eucalyptus seeana* using the following methodology.

E. seeana density was mapped as points in the northwest and southwest corners of the Brimbin site (Figure 5). Points were attributed with stems/hectare counts (zero for sites without *E. seeana*). Eighty-seven locations were sampled over an area of approximately 250 hectares. An additional 14 locations were added, where *E. seeana* individuals were previously mapped, but where stem density estimates were not undertaken. For these locations, stem density was estimated as the average density of non-zero sites with outliers removed (i.e., the maximum and minimum stems/hectare values were excluded from averaging).

Density surfaces for each plot area were interpolated in ESRI Spatial Analyst using Ordinary Kriging with a spherical semivariogram model. Prior to interpolation, potential outliers (minimum and maximum values for each area) were removed. Outliers were removed because after initial processing, spot high values produced strongly skewed and unrealistic surfaces. Kriging produced surfaces with density ranges from zero to 84 stems per hectare, compared to original point values up to 340 stems per hectare.

The continuous density surface was then classified in to 10 stems per hectare intervals, then spatially intersected with vegetation mapping for the same area. Area-weighted stems per hectare averages were then calculated for each vegetation type. The results of this survey and analysis are provided in Section 3.3.1.

2.3.3 Threatened fauna surveys – Species Credits

Fauna surveys were conducted from 21 June to 1 July 2010 by two zoologists, Rhidian Harrington and Matt Swan. Surveys were conducted across all habitat types within the study area. All survey locations and data were recorded with the use of a Trimble Nomad GPS (accuracy 2-5 metres).

Survey methodology is described below and survey effort is summarised in Table 2. Survey locations are displayed in Figure 5.

Table 2. Fauna survey techniques and survey effort

Survey Technique	Number of Sites	Survey Effort per Site	Survey Dates	Total Survey Effort
Diurnal Birds	24	20 minute 2 hectare census	22/06/10 – 1/07/10	8.3 Person Hours
Call Playback - Owls	4	5 minute playback and listening for each species	24/06/10 – 1/07/10	11.2 Person Hours
Call Playback - Mammals	3	5 minute playback and listening for each species	27/06/10 – 30/06/10	3 Person Hours
Terrestrial Camera Traps	9 (11 separate camera traps)	1 or 2 cameras per site	22/06/10 – 1/07/10	96 Trap Nights
Arboreal Elliot Trapping	5	8 Elliot A and 7 Elliot B Traps at each site	21/06/10 – 1/07/10	630 Trap Nights
Hair Tubes (Ground)	7	7 50 mm and 7 110x70 mm hair tubes	21/06/10 – 1/07/10	798 Trap Nights
Hair Tube Arboreal	1	7 50 mm and 7 110x70 mm hair tubes	23/06/10 – 30/06/10	98 Trap nights
Harp Trapping	3 (2 harp traps)	1 harp trap	23/06/10 – 1/07/10	15 Trap Nights
Anabat Detection	7 (2 Anabat units)	1, 2 or 3 nights per site	22/06/10 – 30/06/10	15 Recording Nights
Spotlight Search	11 Separate sites	At least 0.5 hours of spotlighting	23/06/10 – 1/07/10	11 Person Hours

Elliot Traps – Arboreal

Type A and B arboreal Elliot trapping was undertaken at five sites for either eight or ten consecutive nights. Eight type A and seven type B traps were set up at each of the five trapping sites. Pairs of traps were spaced at 20 m intervals along a transect to make seven separate trapping stations at each site, with the last station having three traps (two Elliot A, one Elliott B). Traps were placed on platforms and mounted on trees approximately 2.0-2.5 metres off the ground. Traps were baited with a mixture of peanut butter, rolled oats, honey and truffle oil. The base of the trees was sprayed with a mixture of honey and water.

Traps were checked each morning and any captured animals were identified and released at the site of capture.

Hair Tubes – Ground

Two sizes of hair tubes (50 mm and 110 x 70 mm) were placed at each of the five trapping sites and at two additional sites. At the trapping sites seven pairs of the hair tubes were placed at the trapping stations close the arboreal Elliott traps. At the two additional hair tube sites, the hair tubes were placed at 20 metre intervals in a transect. Of the additional hair tube sites, Hair Tube Site 1 had eight pairs of hair tubes and Hair tube Site 2 had seven pairs. Hair tubes were in place for either seven, eight or ten nights.

The hair tubes were baited with either dog food, chicken wings or a mixture of peanut butter, rolled oats, honey and truffle oil. Double-sided tape was only adhered to the upper and lateral inner surface of the tubes so as to limit the incidence of 'by catch'. Hair samples were sent to Barbara Triggs of "Dead Finish" for analysis.

Hair Tubes – Arboreal

At Hair Tube Site 2 seven pairs of hair tubes were placed in trees using water resistant electrical tape. Arboreal hair tubes were placed in pairs alongside ground hair tubes. The hair tubes were baited with a mixture of peanut butter, rolled oats, honey and truffle oil. Hair samples were sent to Barbara Triggs of "Dead Finish" for analysis.

Camera Traps

'Reconyx' motion sensing camera traps were placed at ground level. Two camera traps were placed at four of the five trapping sites. One camera was placed at a hair tube sites, and another camera trap was placed at the remaining trapping site. On the 28th of June, six camera traps were moved from the trapping sites and placed in three separate transects consisting of two camera traps for the remaining three nights.

The cameras were set to take three pictures upon sensing motion and placed in front of baited hair tubes. The ground in front of the camera traps was sprayed with a mixture of truffle oil and water. Upon recovery, the pictures were individually analysed and animals were identified to the lowest possible taxonomic level.

Nocturnal Call Playback - Owls

Four call playback sites were established at strategic positions in the landscape so calls would broadcast down in to valleys and achieve maximum coverage.

After an initial listening period of five minutes, calls of the Barking Owl, Grass Owl, Masked Owl, Sooty Owl and Powerful Owl were broadcast through a 10 watt megaphone for five minutes followed by a five minute listening period and a two minute period of spotlighting. Calls of the Grass Owl were only broadcast at two of the sites which were deemed to be in the vicinity of potential habitat.

No call playback was performed on the 21st, 22nd or 23rd of June 2010 due to rainfall impeding the ability to broadcast.

Nocturnal Call Playback – Mammals

Calls of the Squirrel Glider and Koala were broadcast at three of the owl call playback sites. The calls were broadcast on the 28th, 29th and 30th of June 2010. Calls were broadcast for five minutes followed by a five minute listening period.

Diurnal Bird Surveys

Birds were surveyed at stationary points by one zoologist for at least twenty minutes. Birds were identified with the use of 10 X 42 binoculars or from their calls. Where possible surveys were conducted as close as possible to dawn or dusk when bird activity is greatest.

Twenty-four separate bird surveys were undertaken across the study area for a total survey effort of 8.3 person hours. Two dawn water bird surveys were conducted in the large dam in the paddock to the north of the site. Incidental observations of birds were recorded throughout the course of other surveys.

Harp Trapping

Harp traps targeting microchiropteran bats were deployed at three sites within the study area. Traps were set up in potential flyways and checked the following morning.

Anabat Detection

Two ultrasonic recording devices (Anabats) were deployed at seven separate sites across the study area. The devices were left in place for a minimum of two nights and recorded from dusk until dawn.

Spotlighting

Spotlighting took place either on foot or from a slow moving vehicle using one or two handheld 50-watt spotlights. The speed of survey was approximately 1 kilometre per hour on foot or 5 kilometre per hour in the vehicle.

Spotlighting and active listening for frogs was conducted in the sedgeland complex, however the time of year surveys were undertaken limited the ability to detect frogs.

Stag Watching

Stag watches involved observing hollows for fauna occupancy. Stag watches were conducted from 30 minutes before dusk to 30 minutes after dusk on two trees within the study area on the 29th of June. A total survey effort of 2 person hours was conducted.

Habitat Assessment

Habitat assessments were carried out at various locations throughout the course of surveys of the study area and involved an assessment of the type and condition of fauna habitat as well as potential for threatened species to occur. The habitat assessment was guided by plant community structure and the occurrence of important features such as tree hollows, canopy feeding resources, leaf litter, fallen timber, water bodies and specific feeding resources such as koala feed trees.

2.4 Determination of threatened species requiring survey – Species Credits

Upon a review of the available threatened species data from previous and current surveys, the seasons that surveys have been carried out and the answers given to the Geographic Habitat questions in the Calculator, the Calculator has determined that further survey is required for two threatened species; Eastern Pygmy-possum (an arboreal mammal) and *Diuris flavescens* (Pale Yellow Doubletail, a terrestrial orchid). In the case of Eastern Pygmy-possum, the nomination of this species as requiring additional survey effort is entirely a result of no single month of the year being identified in the Calculator as appropriate for survey for the species. Clearly this is an error in the Calculator. Previous and current survey effort described in Section 3 is deemed adequate for the species.

Threatened flora surveys have not been conducted in September-October, thus excluding the peak survey period of *Diuris flavescens*. Whilst it is considered unlikely that *D. flavescens* would inhabit the relatively degraded habitats of the Development Area, surveys

will be conducted for this Critically Endangered species in September or October. These additional surveys will be carried out at the same time as the reference population south of Wingham is flowering. Niche would coordinate this with the relevant Council and OEH officers, or other relevant experts, if required.

2.5 Limitations of this assessment

Field surveys were carried out over a single sampling period. Some species are cryptic, and are only likely to occur or be detected seasonally, or use the site periodically. For example, some frogs and bats are more difficult to detect in the winter months.

Inclement weather was experienced for the first three days of the survey period, which affected some surveys such as call playback. This also limited vehicular travel within the study area and accessing some sections of the site. For example, more time was needed in the field for vegetation mapping and validation as large parts of the study area had to be accessed on foot. Furthermore, a lack of vehicle access to more remote areas made the checking of traps difficult and time-costly. Remote techniques (camera traps and hair tubes) were utilised in these sections so that they did not need to be revisited on a daily basis.

Despite these limitations, it is considered that the survey effort and data now at hand, through either the Niche surveys or previous surveys, is sufficient to support robust conclusions in relation to the biodiversity of the site.

Substantial limitations were found to exist in the Calculator, including a lack of suitable PCTs that are selectable and threatened flora that were not selectable (*Eucalyptus seeana*). Niche has worked around these limitations of the Calculator in consultation with the OEH BioBanking team, but within what would be considered appropriate for the Methodology. The final credit calculations provided in this document should be viewed with these limitations in mind.

3 RESULTS

3.1 Vegetation zones

The 31 vegetation zones as defined by the GIS queries (clip) run by Niche are provided in Table 3 and are further divided up between the Development Area and the Conservation Area. These 31 vegetation zones have been stratified on the basis of whether the vegetation within the zone represents mature or relatively intact native vegetation, regrowth native vegetation or are areas that will be replanted (Figure 6).

Another vegetation type exists within the retained lands, 73 hectares of native Herbfield. However, this does not form an assessable vegetation zone as it is within a retained area. Furthermore, substantial areas of cleared land exist within the Development Area (1,352.5 hectares) and a smaller amount in the Conservation Area (28 hectares), however, as these areas are cleared they are not assessable and cannot therefore form vegetation zones as per the Methodology (unless a part of the 40.8 hectares of cleared land that will be replanted in the Conservation Area).

Vegetation mapping for the study area is presented in Figure 6, with the Plant Community Types mapped in Figure 7.

Table 3. Vegetation zones within the Brimbin study area

Niche Veg Code	Niche Veg Type	Vegetation zone (PCT code used)	Area of veg zone certified	Area of veg zone offset	Vegetation zone area
BT	Blackbutt Tallowwood Tall Open Forest	HU511_Moderate/Good_BT	-	126	126
BT Reg	Blackbutt Tallowwood Regrowth	HU511_Moderate/Good_BT Reg	5	0.1	5.1
BT Reg_E2	Blackbutt Tallowwood Regrowth	HU511_Moderate/Good_BT Reg_E2	-	1.2	1.2
FR Reg	Forest Redgum Regrowth	HU808_Moderate/Good_FR Reg	-	1.9	1.9
FG	Flooded Gum Brush Box Tall Forest	HU783_Moderate/Good_FG	1.4	-	1.4
GB	Grey Box Red Gum Grey Ironbark Woodland	HU549_Moderate/Good_GB	10	1.7	11.7
GB Reg	Grey Box Red Gum Grey Ironbark Regrowth	HU549_Moderate/Good_GB Reg	2.6	0.5	3.1
TG	Grey Gum Stringybark Tallowwood Tall Open Forest	HU646_Moderate/Good_TG	29.7	147.5	177.2
TG_E2	Grey Gum Stringybark Tallowwood Tall Open Forest	HU646_Moderate/Good_TG_E2	-	2.1	2.1
TG Reg	Grey Gum Stringybark Tallowwood Regrowth	HU646_Moderate/Good_TG Reg	-	14.3	14.3
TG Reg_E2	Grey Gum Stringybark Tallowwood Regrowth	HU646_Moderate/Good_TG Reg_E2	-	10.1	10.1
SI	Spotted Gum Ironbark Forest	HU763_Moderate/Good_SI	25.7	216	241.7
SI_E2	Spotted Gum Ironbark Forest	HU763_Moderate/Good_SI_E2	-	11.3	11.3
SI Reg	Spotted Gum Ironbark Regrowth	HU763_Moderate/Good_SI Reg	91.5	0.5	92

Niche Veg Code	Niche Veg Type	Vegetation zone (PCT code used)	Area of veg zone certified	Area of veg zone offset	Vegetation zone area
SI Reg_E2	Spotted Gum Ironbark Regrowth	HU763_Moderate/Good_SI Reg_E2	-	8.6	8.6
RGIB Mel	Red Gum Grey Ironbark Paperbark Forest (non TEC)	HU703_Moderate/Good_RGIB Mel	42.5	215.3	257.8
RGIB Mel (TEC)	Red Gum Grey Ironbark Paperbark Forest (TEC component)	HU703_Moderate/Good_RGIB Mel (TEC)	0.4	5.1	5.5
RG Reg	Red Gum Grey Ironbark Paperbark Regrowth	HU703_Moderate/Good_RG Reg	49.3	10.7	60
RGIB	Narrow-leaved Red Gum Ironbark Woodland	HU703_Moderate/Good_RGIB	5.1	27.7	32.8
RG Ang	Red Gum Angophora Mahogany Woodland	HU703_Moderate/Good_RGAng	1.1	-	1.1
DP (TEC)	Derived Swamp Paperbark Thicket (TEC)	HU591_Moderate/Good_DP (TEC)	4.7	2.7	7.4
PT (TEC)	Swamp Paperbark Thicket (TEC)	HU591_Moderate/Good_PT (TEC)	-	5.6	5.6
SM (TEC)	Swamp Mahogany Forest (TEC)	HU633_Moderate/Good_SM (TEC)	-	55.4	55.4
SO (TEC)	Swamp Oak Forest (TEC)	HU635_Moderate/Good_SO (TEC)	2.4	44.1	46.5
SO Reg (TEC)	Swamp Oak Forest Regrowth (TEC)	HU635_Moderate/Good_SO Reg (TEC)	3.1	-	3.1
Replanting Vegetation Zones					
SO Rep	Swamp Oak Replanting	HU635_Low_SO Rep	-	4.2	4.2
TG Rep	Grey Gum Stringybark Tallowwood Replanting	HU646_Low_TG Rep	-	5.8	5.8
TG Rep_E2	Grey Gum Stringybark Tallowwood Replanting	HU646_Low_TG Rep_E2	-	6.8	6.8
SI Rep	Spotted Gum Ironbark Replanting	HU763_Low_SI Rep	-	3	3
SI Rep_E2	Spotted Gum Ironbark Replanting	HU763_Low_SI Rep_E2	-	17.6	17.6
FR Rep	Forest Redgum Replanting	HU808_Low_FR Rep	-	3.4	3.4
		Total	**274.5**	**949.20**	**1,223.7**

3.1.1 Threatened Ecological Communities

Six vegetation zones equate to three distinct Threatened Ecological Communities (TECs). These TECs are listed in Table 4 and mapped in Figure 8. No more than 10.20 hectares of TEC will be impacted within the Development Area, while 112.90 hectares of TEC fall within the Conservation Area. It should be noted that the 73 hectares of Herbfield in the retained lands also constitutes a TEC, namely Freshwater Wetlands on Coastal Floodplain.

Table 4. TECs within the Assessment Area

Niche Veg Code	Niche Veg Type	TEC	Area of veg zone certified	Area of veg zone offset	Vegetation zone area
DP (TEC)	Derived Swamp Paperbark Thicket (TEC)	Swamp Sclerophyll Forest	4.7	2.7	7.4
PT (TEC)	Swamp Paperbark Thicket (TEC)	Swamp Sclerophyll Forest	0	5.6	5.6
SM (TEC)	Swamp Mahogany Forest (TEC)	Swamp Sclerophyll Forest	0	55.4	55.4
SO (TEC)	Swamp Oak Forest (TEC)	Swamp Oak Floodplain Forest	2.4	44.1	46.5
SO Reg (TEC)	Swamp Oak Forest Regrowth (TEC)	Swamp Oak Floodplain Forest	3.1	0	3.1
RGIB Mel (TEC)	Red Gum Grey Ironbark Paperbark Forest (Component below 1:100 year flood level)	Subtropical Coastal Floodplain Forest	0	5.1	5.1
		Total	**10.20**	**112.90**	**123.50**

3.2 Vegetation Community Descriptions

Blackbutt – Tallowwood Tall Open Forest

132.3 hectares of Blackbutt – Tallowwood Tall Open Forest and associated regrowth is located in the Assessment Area of which five hectares falls within the Development Area. In general this unit was considered to have good resilience throughout the Assessment Area.

The unit is dominated by an open canopy of *Eucalyptus pilularis* (blackbutt) and *Eucalyptus microcorys* (tallowwood) with less common occurrences of *Eucalyptus eugenioides* (thin-leaved stringybark) and *Eucalyptus siderophloia* (grey ironbark). The mid-storey is a sparse combination of medium-sized trees such as *Callistemon salignus*, *Alphitonia excelsa*, *Melaleuca styphelioides* and *Glochidion ferdinandi*. The shrub layer is more-or-less absent except for the occasional *Breynia oblongifolia* and sub-shrubs such as *Hibbertia aspera*. The ground-cover is dominated by grasses such as *Imperata cylindrica*, *Poa labillardieri*, *Echinopogon* spp. and *Entolasia* spp., while the herbs *Pteridium esculentum*, *Lomandra longifolia*, *Dichondra repens*, *Pseuderanthemum variabile* and *Pratia purpurascens* are also common.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU511 Blackbutt – Tallowwood dry grassy open forest of the southern North Coast, and is not considered to constitute any component of a TEC.

Forest Red Gum regrowth

1.9 hectares of Forest Red Gum regrowth is located within the Assessment Area, none of which falls within the Development Area. This unit displayed poor resilience, although it would regenerate with moderate management input and removal of grazing pressure.

The unit is dominated by *E. tereticornis* with a largely absent mid-storey and shrub layer. The ground cover was dominated by grasses and herbs such as *Carex appressa*, *Echinopogon* spp., *Entolasia* spp., *Oplismenus imbecillus* and *Dichondra repens*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU808 Cabbage Gum – Rough-barked Apple grassy woodland. The type does not equate to any TEC.

Flooded Gum Brush Box Tall Forest

1.4 hectares of Flooded Gum Brush Box Tall Forest is located within the Assessment Area, all of which falls within the Development Area. This unit displayed good resilience and was largely intact remnant vegetation.

The unit is dominated by a tall (+30 metre) open canopy of *Eucalyptus grandis* (flooded gum) and *E. microcorys* (tallowwood) with *Lophostemon confertus* (brush box) and *Syncarpia glomulifera* (turpentine) forming a dense, tall mid-storey. A shrub and small tree layer was dominated by *Acmena smithii*, *Neolitsea dealbata* and *Cryptocarya microneura*. Common ground covers included *Oplismenus imbecillus*, *Dichondra repens* and *Gymnstachys anceps*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU783 Flooded Gum – Brush Box – Tallowwood mesic tall open forest, and is not considered to constitute any component of a TEC.

Grey Box Red Gum Grey Ironbark Woodland

14.8 hectares of Grey Box Red Gum Grey Ironbark Woodland and associated regrowth is located within the Assessment Area, of which 12.6 hectares falls within the Development Area. In general, this unit displayed good resilience, including the regrowth vegetation.

The unit is dominated by an open canopy of *Eucalyptus moluccana* (grey box), *E. tereticornis* (forest red gum) and *E. siderophloia* (grey ironbark). *E. seeana* (narrow-leaved red gum) is also common. The mid-storey is sparse while the shrub layer is more-or-less absent except for the occasional *Leucopogon juniperinus*. Ground covers are those typical for the area and include grasses and herbs such as *Echinopogon* spp., *Entolasia* spp., *Oplismenus imbecillus* and *Dichondra repens*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU549 Grey Box – Forest Red Gum – Grey Ironbark open forest, and is not considered to constitute any component of a TEC. It should be noted that HU549 was not selectable in the Calculator and therefore HU910 was selected instead. Benchmarks would have been altered to match those of HU549 in the BVTs Benchmarks Database but this was not necessary as the benchmark values for each of the ten site attributes was the same for the two PCTs.

Grey Gum Stringybark Tallowwood Tall Open Forest

203.7 hectares of Grey Gum Stringybark Tallowwood Tall Open Forest and associated regrowth is located within the Assessment Area, of which 29.7 hectares falls within the Development Area. In general, this unit displayed good resilience and would regenerate to a remnant state with a reduction in grazing pressure and fire frequency.

The unit is dominated by an open canopy of *Eucalyptus microcorys* (tallowwood) and *Eucalyptus propinqua* (small-fruited grey gum) with less common occurrences of *Eucalyptus eugenioides* (thin-leaved stringybark) and *Eucalyptus siderophloia* (grey ironbark). The mid-storey is sparse and typically features *Allocasuarina littoralis*. The shrub layer is more-or-less absent except for the occasional *Leucopogon juniperinus* and the ground cover is dominated by grasses and herbs such as *Echinopogon* spp., *Entolasia* spp., *Oplismenus imbecillus* and *Dichondra repens*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU646 Tallowwood open forest, and is not considered to constitute any component of a TEC.

Spotted Gum - Grey Ironbark Open Forest

353.6 hectares of Spotted Gum – Grey Ironbark Open Forest and associated regrowth is located within the Assessment Area, of which 117.2 hectares falls within the Development Area. In general this unit displayed good resilience and would regenerate to a remnant state with a reduction in grazing pressure and fire frequency.

The unit is dominated by an open canopy of *Corymbia maculata* (spotted gum) and *Eucalyptus siderophloia* (grey ironbark) with less common occurrences of *Eucalyptus microcorys* (tallowwood). The mid-storey is sparse and typically features *Allocasuarina littoralis*, *Acacia maidenii* and immature eucalypts. The shrub layer is largely non-existent and the ground-cover is dominated by grasses and herbs such as *Echinopogon* spp., *Entolasia* spp., *Microlaena stipoides*, *Eragrostis brownii*, *Schoenus paludosus* and *Lomandra multiflora*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU763 Tallowwood – Spotted Gum – Grey Gum tall open forest, and is not considered to constitute any component of a TEC.

Eucalyptus seeana (Narrow-leaved Red Gum) is common in this vegetation type (though not dominant) and therefore this type is considered known habitat for the *Eucalyptus seeana* Endangered Population.

Sporadic occurrences of the threatened *Eucalyptus glaucina* (Slaty Red Gum) were also found in this vegetation type.

Narrow-leaved Red Gum - Grey Ironbark - Paperbark Forest

323.3 hectares of Narrow-leaved Red Gum – Grey Ironbark – Paperbark Forest and associated regrowth is located within the Assessment Area, of which 92.2 hectares falls within the Development Area. In general this unit displayed good resilience and would regenerate to a remnant state with a reduction in grazing pressure.

The unit is primarily dominated by *Eucalyptus seeana* (narrow-leaved red gum) and *E. siderophloia* (grey ironbark), but included a mixed eucalypt canopy of *E. tereticornis*, *E. amplifolia*, *E. resinifera* and *E. propinqua*. The mid-storey is a dense layer of trees with dominant species including *Melaleuca nodosa*, *Callistemon salignus*, *Melaleuca styphelioides*, *Casuarina glauca* and *Melaleuca linariifolia*, typically featuring *Allocasuarina littoralis*. The shrub layer is largely absent except for occasional *Leucopogon juniperinus*

and juvenile over-storey species. The ground cover is dominated by grasses and herbs such as *Echinopogon* spp., *Entolasia* spp., *Oplismenus imbecillus* and *Dichondra repens*.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU703 Narrow-leaved Red Gum woodlands of the lowlands of the North Coast. It should be noted that HU703 was not selectable in the Calculator and therefore HU906 was selected instead. Benchmarks were altered to match those of HU703 in the BVTs Benchmarks Database. The component of this vegetation type below the 1:100 year flood level constitutes the Subtropical Coastal Floodplain Forest TEC.

Eucalyptus seeana (narrow-leaved red gum) is a dominant in this vegetation type and therefore this type is considered known habitat for the *Eucalyptus seeana* Endangered Population. It is suspected that the prevalence of *Eucalyptus seeana*, particularly throughout the western side of the Assessment Area, had not previously been detected due to its similarity with *Eucalyptus propinqua* and, and to a lesser degree, *E. tereticornis*.

Narrow-leaved Red Gum Grey Ironbark Woodland

32.8 hectares of Narrow-leaved Red Gum Grey Ironbark Woodland is located within the Assessment Area, of which 5.1 hectares falls within the Development Area. This unit generally displayed good resilience.

The unit is primarily dominated by *Eucalyptus seeana* (narrow-leaved red gum) and *E. siderophloia* (grey ironbark), associated with *E. propinqua*. The mid-storey is a sparse layer of trees including *Melaleuca nodosa* and *Allocasuarina littoralis*. The shrub layer is largely absent except for occasional *Leucopogon juniperinus* and juvenile over-storey species. The ground cover is dominated by grasses and herbs such as *Echinopogon* spp., *Entolasia* spp., *Oplismenus imbecillus* and *Dichondra repens*.

This unit differs from Narrow-leaved Red Gum - Grey Ironbark - Paperbark Forest and Red Gum Angophora Mahogany Woodland in that it is located in drier substrates away from the main drainage lines. It is therefore more open and lacks the dense mid-storey of the other similar types. On this basis, it is not considered to constitute a part of the Subtropical Coastal Floodplain Forest TEC. This vegetation type is, however, considered a part of the PCT, HU703 Narrow-leaved Red Gum woodlands of the lowlands of the North Coast.

Eucalyptus seeana (narrow-leaved red gum) is a dominant in this vegetation type and therefore this type is considered known habitat for the *Eucalyptus seeana* Endangered Population. It is suspected that the prevalence of *Eucalyptus seeana*, particularly throughout the western side of the Assessment Area, had not been previously detected due to its similarity with *Eucalyptus propinqua* and *E. tereticornis*.

Red Gum Angophora Mahogany Woodland

1.1 hectares of Narrow-leaved Red Gum Angophora Mahogany Woodland is located within the Assessment Area, all of which falls within the Development Area.

The unit is primarily dominated by *Eucalyptus seeana* (narrow-leaved red gum), *Angophora subvelutina* (broad-leaved apple) and *Eucalyptus carnea* (broad-leaved mahogany). The mid-storey is an open layer of trees with dominant species including *Melaleuca nodosa*, *Callistemon salignus*, *Melaleuca styphelioides*, *Casuarina glauca* and *Melaleuca linariifolia*.

Common ground covers included *Echinopogon* spp., *Microlaena stipoides, Imperata cylindrica* and *Entolasia* spp.

For the purposes of this report, this vegetation type has been aligned to the PCT, HU703 Narrow-leaved Red Gum woodlands of the lowlands of the North Coast.

Eucalyptus seeana (narrow-leaved red gum) is a dominant in this vegetation type and therefore this type is considered known habitat for the *Eucalyptus seeana* Endangered Population.

Swamp Oak Forest

49.6 hectares of Swamp Oak Forest and associated regrowth is located within the Assessment Area, of which 5.5 hectares falls within the Development Area. The condition of this unit varies from intact mature forest to regrowth with moderate levels of weed infestation. Overall the type exhibits a high level of resilience.

The unit is dominated by a moderately dense canopy of *Casuarina glauca* (swamp oak) with scattered *Melaleuca* spp. Eucalypts are largely absent from this unit except the occasional *Eucalyptus amplifolia* (cabbage gum), *E. resinifera* (red mahogany) and *E. propinqua* (small-fruited grey gum). A mid-storey and shrub layer is largely absent except for immature *C. glauca* and patches of *Parsonsia straminea*. The ground cover is dominated by a mix of moisture loving grasses and herbs such as *Oplismenus* spp., *Carex appressa*, *Dichondra repens*, *Gahnia clarkei* and *Christella dentata*.

This vegetation type has been aligned to the PCT, HU635 Swamp Oak Swamp Forest fringing estuaries, Sydney Basin and South East Corner, as a best fit (given that the site doesn't actually exist within either of these bioregions). The type is also aligned with the Swamp Oak Floodplain Forest TEC.

Swamp Paperbark Thicket and derived type

Swamp Paperbark Thicket was largely a derived community resulting from intensive ploughing of the lowland areas (non-assessable retained lands) in the eastern portion of the Draft Structure Plan. A total of 13 hectares of this community is found within the Assessment Area, of which 4.7 hectares of the derived regrowth type only, falls within the Development Area. No intact thicket occurs in the Development Area, however 5.6 hectares of intect thicket and 2.7 hectares of regrowth occurs in the Conservation Area.

This is a simplified type comprised of a dominant shrub-layer of *Melaleuca ericifolia* (swamp paperbark) at varying stages of maturity, depending on when it had last been ploughed. This shrub layer typically had a projective foliage cover of more than 80 per cent and was up to 2.5 metres high at its tallest. Small patches of this community appeared to resemble a remnant form but there is no obvious justification for this. The type is species poor, typically recording less than ten native species per plot. This is likely due to the dominance of *M. ericifolia*. Immature individuals of *Eucalyptus robusta* and *Casuarina glauca* inhabit this type as sporadic occurrences, suggesting that it was once a swamp forest type with *M. ericifolia* dominant in patches in the mid-storey. At the time of the field survey, this type was inundated to an average of 100 millimetres.

As this type is a derived vegetation unit, it was difficult to align it to a Hunter Central Rivers PCT, however the unit was most likely derived from HU591 Paperbark Swamp Forest of the coastal lowlands of the North Coast and Sydney Basin. Despite the poor structural and floristic integrity of the unit, it is considered a modified form of the Swamp Sclerophyll Forest TEC.

Swamp Mahogany Forest

55.4 hectares of Swamp Mahogany Forest falls entirely within the Conservation Area and none occurs in the Development Area. This unit is largely in good condition within the Assessment Area, having been spared from over-clearing; however it suffers from heavy grazing pressure in places.

The over-storey is primarily dominated by *Eucalyptus robusta* (swamp mahogany), with *E. tereticornis* (forest red gum) and *E. resinifera* (red mahogany) occurring less frequently. The mid-storey is dominated by a dense layer of medium-sized trees with dominant species including *Melaleuca nodosa*, *Callistemon salignus*, *Melaleuca styphelioides*, *Casuarina glauca* and *Melaleuca linariifolia*. The shrub layer is largely absent except for sporadic occurrences of *Breynia oblongifolia*, *Glochidion ferdinandi* and immature over-storey and mid-storey species. The ground cover is dense and generally dominated by *Gahnia clarkei*, *Blechnum indicum* and *Dichondra repens*.

This vegetation type has been aligned to the PCT, HU633 Swamp Mahogany Swamp Forest on coastal lowlands of the North Coast and northern Sydney Basin, and forms part of the Swamp Sclerophyll Forest TEC present on the site.

Replanting

40.8 hectares of cleared land will be strategically revegetated with local provenance tubestock. This will be composed of a variety of vegetation types typical of the adjacent native vegetation. The split of relevant vegetation types is provided in Table 3.

Herbfield

73.5 hectares of Herbfield is located within the eastern part of the Draft Structure Plan and is entirely within an area of non-assessable retained lands. This unit is substantially modified with a moderate cover of weeds, low species richness and low resilience.

Structurally the unit has a high cover of native grasses and herbs no more than 0.2 metres high due to a high level of grazing. Due to the heavy grazing pressure plant identification was difficult, however the unit is dominated by the native grass *Hemarthria uncinata*, with *Chorizandra cymbaria*, *Baumea teretifolia* and *Juncus usitatus* also common. Common weed species included *Paspalum dilatatum* and *Cyperus congestus*. Along with Derived Swamp Paperbark Thicket, this unit is seen as having been heavily impacted by the combination of the alteration of natural flow regimes, heavy ploughing and grazing pressure.

This vegetation type was aligned to the PCT, HU532 Coastal floodplain sedgelands, rushlands and forblands of the North Coast, and is also aligned with the Freshwater Wetland on Coastal Floodplain TEC.

Cleared

1,827.25 hectares of cleared land exists throughout the Assessment Area, of which 1,286.18 hectares is within the Development Area. The remaining area of cleared land exists within retained lands.

The cleared land is a mixture of native and exotic pastures and herbfields with some regenerating patches of eucalypts. Isolated areas might hold moderate resilience but, on the whole, these areas have been degraded through first clearing, then tilling, pasture improvement and grazing, and therefore hold little or no ecological value.

3.3 Flora

171 plant species were recorded during the field survey, of which 16 were exotic species (nine per cent) and 155 were native species (91 per cent). A full list of the flora recorded on-site is provided in Appendix C.

3.3.1 Threatened Flora

Threatened flora (and fauna) recorded during the field surveys are represented in Figure 9 and the distribution of the *Eucalyptus seeana* population is shown in Figure 5.

***Eucalyptus glaucina* (Slaty Red Gum)**

Seven individuals of *Eucalyptus glaucina* (Slaty Red Gum) occurred in the Conservation Area on drier soils along ridge tops, while an additional two specimens were located in retained lands (Riparian). These specimens were confirmed by the presence of buds.

***Corybas dowlingii* (Red Helmet-orchid)**

Corybas dowlingii (Red Helmet-orchid), which is listed as endangered on the TSC Act was recorded within the proposed Conservation Land in the east of the Assessment Area. Previously this species had not been recorded further north than Bulahdelah, approximately 75 kilometres to the south. This is considered a significant record and raises the conservation significance of the Assessment Area. The specimen was confirmed by the National Herbarium of NSW.

***Eucalyptus seeana* (Narrow-leaved Red Gum)**

Previous recordings (Whelans Insites 2009) of *Eucalyptus seeana*, which is listed on the TSC Act as an Endangered Population within the Greater Taree LGA, were confirmed in the Assessment Area by Niche. The species is considered common to dominant in the western portion of the Assessment Area.

Due to the extent and density of the species within the Assessment Area, it was considered necessary to provide a rigorous estimate of the population. This estimate was carried out using the methodology described in Section 2.3.2.

The population estimates (number of stems) for the Conservation Area and for the Development Area is provided in Appendix E. *E. seeana* was known to be present in seven of the vegetation types as mapped by Niche (2011). Table 5 summarises this data for the

Biodiversity Certification Assessment Area and provides a population estimate based on these density counts.

The population estimate found that 19,424 individuals were considered to be present within the whole of the Assessment Area. Of these, 5,329 individuals fall within the Development Area while 14,095 individuals will be reserved in the Conservation Area. These calculations do not account for lands zoned as Steep or Riparian lands, Rural or Large Lot Residential in the Draft Structure Plan (and therefore non-assessable retained lands in this assessment), where substantially more individuals and habitat is known to exist.

Table 5. Summary of *E. seeana* population estimate

Veg Type	*E. seeana* stems/ha	Development Area habitat (ha)	Development Stems	Conservation Area habitat (ha)	Total Reserved Stems
Flooded Gum Brush Box Tall Forest	13.55	1.4	19	0	0
Grey Gum Stringybark Tallowwood Tall Open Forest	18.33	29.7	544	149.6	2,742
Red Gum Angophora Mahogany Woodland	25.63	1.1	28	0	0
Red Gum Grey Ironbark Paperbark Forest	21.67	42.9	930	220.4	4,776
Red Gum Grey Ironbark Paperbark Regrowth	28.05	49.3	1,383	10.7	300
Spotted Gum Ironbark Forest	26.62	25.7	684	229.3	6,104
Spotted Gum Ironbark Regrowth	19.03	91.5	1,741	9.1	173
Totals		241.60	5,329	619.1	14,095

3.3.2 Weeds

Remnant and regrowth forest areas within the Assessment Area were considered to be in a good resilient condition.

Areas that were not in good condition included:

- Derived Swamp Paperbark Thicket;
- Herbfield;
- Paddocks;
- Tracks; and
- Areas adjacent to canal works.

The common weed species within the Assessment Area were largely associated with these disturbances and included; *Andropogon virginicus, Axonopus ficifolius, Chenopodium album, Cinnamomum camphora, Cirsium vulgare, Conyza* sp., *Cyperus congestus, Hypochaeris radicata, Lantana camara, Paspalum dilatatum, Plantago lanceolata, Rubus ulmifolius, Senecio madagascariensis, Setaria parviflora, Solanum mauritianum* and *Verbena bonariensis*. Two of these species, *Lantana camara* (lantana) and *Rubus ulmifolius* (blackberry) are listed as noxious weeds within the Greater Taree Local Government Area.

3.4 Fauna

3.4.1 Trapping Results

Arboreal Elliot Trapping

The trapping effort resulted in 50 captures across the five sites which is equivalent to 8 per cent trapping success. Animals were trapped at all of the trapping sites (Figure 10).

Three ground dwelling mammal species, Brown Antechinus (*Antechinus stuartii*) Bush Rat (*Rattus fuscipes*) and Black Rat (*Rattus rattus*) were trapped during the surveys. Three arboreal mammal species were trapped, Common Brushtail Possum (*Trichosurus vulpecula*), Brush-tailed Phascogale (*Phascogale tapoatafa*) and Sugar Glider (*Petaurus breviceps*).

Camera Traps

The vast majority of pictures taken with the camera traps were of cattle, however, overall there were many photos of small mammals. Where possible animals were identified to species level, although for a number of photos this could not be achieved. For example, many of the pictures of rats and antechinus are assumed to be of Bush Rats (*Rattus fuscipes*) and Brown Antechinus (*Antechinus stuartii*) as these were the most common species observed through trapping, however, without having these animals in hand it is not possible to identify them definitively.

Bandicoots were observed at two of the camera trap sites, one in riparian forest and the other in Spotted Gum Grey Ironbark Open Forest. The Bandicoot recorded in the riparian forest is believed to be a Long-nosed Bandicoot (*Perameles nasuta*) as it clearly has large ears and a long snout. The other Bandicoot was much smaller and is believed to be a juvenile. It was not possible to determine the species of this individual. It is possible that it is a Northern Brown Bandicoot (*Isoodon macrourus*). Neither of these species are listed on the TSC or EPBC Acts, however, the presence of medium sized ground dwelling mammals such as these is indicative of habitat complexity and confirms observations that the site is in moderate to good condition.

Species recorded definitively by the camera traps included Red-necked Wallaby (*Macropus rufogriseus*), Common Brushtail Possum (*Trichosurus vulpecula*), Common Ringtail Possum (*Pseudocheirus peregrinus*), Long-nosed Bandicoot, Domestic Cow and Red Fox (*Vulpes vulpes*).

Hair Tubes

Hair was recovered at all of the sites at which hair tubes were installed. Three mammal species were recorded with definite certainty; the introduced House Mouse (*Mus musculus*), Feral Cat (*Felis catus*) and Brushtail Possum (*Trichosurus sp*). It is not possible to distinguish between the hairs of Common Brushtail Possum (*Trichosurus vulpecula*) and Mountain Brushtail Possum (*Trichosurus caninus*), however, it is considered likely that the hairs were from the Common Brushtail Possum given the number of observations of this species within the Assessment Area. Species recorded with probable certainty included Feathertail Glider (*Acrobates pygmaeus*) and Swamp Rat (*Rattus lutreolus*).

3.4.2 Species Recorded

A total of 107 animal species were recorded during the field surveys, including 84 native birds, 13 native mammals, six introduced mammals and four frog species.

Eleven species listed on either the TSC or EPBC Acts were recorded from within the study area during the current surveys (see Figure 9):

- Varied Sittella (Vulnerable TSC Act);
- Little Lorikeet (Vulnerable TSC Act);
- Scarlet Robin (Vulnerable TSC Act);
- Masked Owl (Vulnerable TSC Act);
- Black-necked Stork (Endangered TSC Act);
- Comb-crested Jacana (Vulnerable TSC Act);
- Brush-tailed Phascogale (Vulnerable TSC Act);
- Koala (Vulnerable TSC Act);
- Grey-headed Flying-fox (Vulnerable TSC and EPBC Acts);
- Cattle Egret (Migratory EPBC Act); and,
- Great Egret (Migratory EPBC Act).

The following species listed on the TSC and/or EPBC Acts have been previously recorded from the study area:

- Glossy Black-cockatoo (Vulnerable TSC Act);
- Square-tailed Kite *Lophoictinia isura* (Vulnerable TSC Act);
- Powerful Owl (Vulnerable TSC Act);
- Squirrel Glider (Vulnerable TSC Act);
- Little Bentwing-bat *Miniopterus australis* (Vulnerable TSC Act);
- Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* (Vulnerable TSC Act);
- Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris* (Vulnerable TSC Act);
- East-coast Freetail Bat *Mormopterus norfolkensis* (possible) (Vulnerable TSC Act);
- Eastern False Pipistrelle *Falsistrellus tasmaniensis* (possible) (Vulnerable TSC Act);
- Greater Broad-nosed Bat *Scoteanax rueppellii* (possible) (Vulnerable TSC Act);
- Large-footed Myotis *Myotis macropus* (possible) (Vulnerable TSC Act);
- Australian Wood Duck (Migratory EPBC Act);
- Pacific Black Duck (Migratory EPBC Act);
- Black-shouldered Kite (Migratory EPBC Act);
- Whistling Kite (Migratory EPBC Act);
- Wedge-tailed Eagle (Migratory EPBC Act);
- Nankeen Kestrel (Migratory EPBC Act); and,
- White-throated Needle-tail (Migratory EPBC Act).

In total, 20 threatened species (TSC and/or EPBC Act) and nine migratory species (EPBC Act) have been recorded from the study area. Of the threatened species, four were microchiropteran bat species that were recorded with only "possible" certainty.

3.4.3 Habitat Descriptions

Open Forest

Tree hollows of various sizes are present within this forest type providing refuge for a wide variety of vertebrates. There are some large trees with hollows (>200 mm) suitable for large forest owls. Eucalypts within the forest canopy provide direct (foliage, nectar) and indirect (invertebrates) foraging for a range of vertebrate species, particularly birds and arboreal mammals.

Although the ground layer has been disturbed by the impacts of grazing in many areas, leaf litter, fallen logs and debris are scattered throughout the open forest of the study area at varying densities. These important microhabitats provide refuge and foraging for a range of small mammals, birds, reptiles and amphibians. In isolated areas such as Trap Site 1, which is adjacent to a creek line, there is a heavy coverage of Lantana in the mid storey and ground cover, however this occurs only in a small area of this habitat.

Angophora subvelutina (broad-leaved apple), *Eucalyptus amplifolia* (cabbage gum), *E. grandis* (flooded gum), *E. microcorys* (Tallowwood), *E. propinqua* (small-fruited grey gum), *E. robusta* (swamp mahogany), *E. seeana* (narrow-leaved red gum), *Eucalyptus tereticornis* (forest red gum) and *Lophostemon confertus* (brush box) are present at varying densities within the open forest of the study area. All of these species are listed as either primary or secondary Koala feed tree species for the north coast bioregion in the Koala Recovery Plan (DECC 2008).

Bird diversity within the large tracts of open forest is good. Invasive native species such as the Noisy Miner (*Manorina melanocephala*) were observed only on the edges of the larger patches and did not appear to be overabundant or occur away from forest edges. Species most commonly recorded within this habitat type included: Yellow-faced Honeyeater (*Lichenostomus chrysops*), Eastern Yellow Robin (*Eopsaltria australis*), Brown Thornbill (*Acanthiza pusilla*), Grey Fantail (*Rhipidura albiscarpa*), Golden Whistler (*Pachycephala pectoralis*) and Laughing Kookaburra (*Dacelo novaeguineae*). Threatened bird species recorded in this habitat type included: Varied Sittella (*Daphoenositta chrysoptera*), Little Lorikeet (*Glossopsitta pusilla*) and Masked Owl (*Tyto novaehollandiae*).

Swamp Sclerophyll Forest

This forest type had relatively fewer large hollow bearing trees than the open forest types, although some *Eucalyptus robusta* had small hollows. The ground layer vegetation has been affected by grazing, although *Gahnia* appeared unaffected, thus the ground cover remains relatively dense providing refuge for a range of vertebrates such as small mammals, birds and reptiles. Important microhabitats such as leaf litter, fallen logs and debris are common throughout this habitat type.

Canopy trees such as *Casuarina* spp., *Melaleuca* spp. and *Eucalyptus* spp. provide direct (foliage, nectar) and indirect (invertebrates) foraging for a range of vertebrate species, particularly birds, bats and arboreal mammals. Numerous Grey-headed Flying-foxes were observed utilising this habitat type. No evidence of a Flying-fox colony was observed throughout the study area. It is likely that individuals are exploiting the abundance of foraging resources (nectar) and travelling from a nearby colony external to the study area.

Bird diversity within this forest type is good, species most commonly recorded in this habitat type included: White-browed Scrubwren (*Sericornis frontalis*), Yellow-faced Honeyeater, Lewin's Honeyeater (*Meliphaga lewinii*), Yellow Thornbill (*Acanthiza nana*), Eastern Yellow Robin, Noisy Friarbird (*Philemon corniculatus*) Grey Fantail and Brown Thornbill.

Derived Swamp Paperbark Thicket

This derived *Melaleuca ericifolia* (swamp paperbark) thicket covers a large portion of the study area. It is very dense and structurally homogenous. Native bird species recorded utilising this habitat type included edge specialists such as Superb Fairy Wrens (*Malurus cyaneus*), Grey Fantails and Australian Magpies (*Gymnorhina tibicen*).

Small linear stands of *Casuarina glauca* are scattered throughout the thicket landscape providing some refuge, for native bird species. Species observed utilising these small patches included Mistletoebird (*Dicaeum hirundinaceum*), Golden Whistler and Yellow-faced Honeyeater. The threatened Scarlet Robin (*Petroica boodang*) was recorded from this habitat type.

There are a number of man-made drainage channels bordering areas of this vegetation type. These provide some limited habitat for common native amphibians and indirect foraging (invertebrates) for bird species.

Sedgeland

This habitat type consists of a wet seepage area with native sedges and exotic pasture grasses. There are pools of stagnant water up to 10-15 cm deep. This area is heavily affected by grazing, although it does provide habitat for native amphibians such as the Common Eastern Froglet (*Crinia signifera*), exotic mammals such as house mice (*Mus musculus*) and birds that specialise in open or edge environments such as raptors and butcherbirds.

Wetland

Two large dams are present within the study area providing foraging and refuge for a number of species of water birds. Species recorded using these dams included: Black Swan (*Cygnus atratus*), Great Egret (*Ardea Alba*), Grey Teal (*Anas Gracilis*), Pacific Black Duck (*Anas superciliosa*), and two species listed as threatened under the NSW TSC Act, the Black-necked Stork (*Ephippiorhynchus australis*) and Comb-crested Jacana (*Irediparra gallinacea*).

3.4.4 Threatened Fauna

The relatively high diversity of animal species within the study area is considered to be a reflection of the quality and heterogeneity of habitat available. There are habitat opportunities for a range of fauna within the study area. Measures to improve the vegetation condition such as removal of grazing would be beneficial to a range of local threatened and non-threatened animal species.

A total of 57 species listed on either the TSC or EPBC Acts as threatened or migratory species or their habitat have been previously recorded from within 10 km of the study area.

This section of the report discusses the local occurrence of these species and the likelihood of occurrence within the study area of species not recorded during the current study.

Bats – Grey-headed Flying Fox, Eastern Bentwing Bat, Little Bentwing Bat, Eastern Freetail Bat, Large-eared Pied Bat Greater Broad-nosed Bat, Golden-tipped Bat

Numerous individual Grey-headed Flying-foxes were recorded from within the study area. No evidence of a Flying-fox colony was observed within the study area. It is likely that individuals are exploiting the abundance of foraging resources on site from a colony located outside the study area.

Only one individual microchiropteran bat was captured during the surveys. The lack of captures is likely to be related to time of year and conditions during the surveys. It is considered highly likely that microchiropteran bat diversity is high in the study area, given the habitat heterogeneity, potential roosting structures (tree hollows) and invertebrate diversity.

The Eastern Bentwing Bat, Large-eared Pied Bat and Little Bentwing Bat are obligate cave dwelling species (Churchill 2008) and if present, would only utilise the site for foraging.

The Eastern Freetail Bat and Greater Broad-nosed Bat were not recorded within the study area, although they are considered likely to occur and could potentially utilise hollows within the study area for roosting.

The Golden-tipped Bat has not been recorded from the study area. This species has a highly specialised diet and roosting requirements, requiring Yellow-throated Scrubwren or Brown Gerygone nests for roosting (Churchill 2008). This species most often roosts in wet forest or rainforest gullies, although it has also been recorded from casuarina dominated riparian forests and coastal melaleuca forest (Churchill 2008). The Swamp Sclerophyll forest types within the study area could provide potential habitat for this species.

Arboreal Mammals – Brush-tailed Phascogale, Squirrel Glider, Koala, Yellow-bellied Glider

One individual Brush-tailed Phascogale was trapped during the surveys in open forest.

No Squirrel Gliders were recorded from within the study area. The closely related sugar glider was recorded calling during a spotlighting survey, and the species was trapped within open forest at Trap Site 3. Squirrel Gliders are much less vocal than Sugar Gliders and are rarely detected by call. Two Individual gliders were observed whilst spotlighting and a glider responded to a Squirrel Glider call during call-playback surveys, but it is not possible to definitively distinguish the two species without having them in hand. Given that Squirrel Gliders have been previously recorded in close proximity to the study area (Whelans Insites 2009), it is considered likely that they also occur within the study area.

No Individual Koalas were recorded from within the study area during the surveys, although evidence of their presence (scats) were observed and previous surveys have detected their presence on site (Whelans Insites 2009). This species has been recorded many times in habitat to the west and southwest of the study area. It is likely that individuals from the local population utilise the study area at least on a transient basis. *State Environmental Planning Policy No. 44 - Koala Habitat Protection* (SEPP 44) is addressed below.

The Yellow-bellied Glider is not considered likely to occur within the study area. This species prefers tall wet sclerophyll forest on high nutrient soils.

Terrestrial Mammals – Spotted-tailed Quoll, Long-nosed Potoroo, Brush-tailed Rock Wallaby, Parma Wallaby

The Spotted-tailed Quoll was not recorded from within the study area, but has been recorded within the locality. The habitat within the study area is considered suitable for this species.

The Long-nosed Potoroo, Parma Wallaby and Brush-tailed Rock Wallaby are not considered likely to occur within the study area.

Woodland Birds – Powerful Owl, Grass Owl, Masked Owl, Sooty Owl, Barking Owl, Bush Stone-curlew, Varied Sittella, Little Lorikeet, Square-tailed Kite, Scarlet Robin, Spotted Harrier, Little Eagle, Hooded Robin, Glossy Black Cockatoo, Black-chinned Honeyeater, Painted Honeyeater, Regent Honeyeater, Swift Parrot

The Little Lorikeet was recorded from within the study area, this species is known to be highly nomadic (NSW Scientific Committee 2009a). It is not known how the individuals are using the site (i.e., roosting, foraging). There are numerous suitable tree hollows which this species could utilise for nesting, and abundant forage.

The Varied Sittella was recorded from two locations within the study area (Figure 9). This species is sedentary in nature (NSW Scientific Committee 2010e) and is likely to be relatively common within the study area.

The Scarlet Robin was recorded in the derived swamp paperbark thicket within the study area. It is unknown if this species breeds within the study area.

Although not detected, the Hooded Robin is considered likely to occur within the study area at least on a transient basis.

The Masked Owl was recorded in open forest from three separate parts of the study area. Given that this species has average territory size of 500 – 1000 hectares (Kavanagh and Murray 1996) it is considered likely that the study area comprises only one pair's territory. These individuals were not recorded within or adjacent to the Development Area.

The Grass Owl is not considered likely to occur within the study area given the lack of preferred habitat (long grass) as a result of grazing impacts. The removal of grazing from the study area would improve habitat availability for the Grass Owl.

The Powerful Owl has been previously recorded in the western section of the study area. The Sooty Owl and Barking Owl could potentially occur within the study area as suitable habitat exists.

Foraging habitat for the Little Eagle, Spotted Harrier and Square-tailed Kite is considered to be present within the study area, and these species are considered likely to occur, although they were not detected.

The Glossy Black-cockatoo is considered likely to occur within the study area as there was abundant suitable foraging habitat in the form of Allocasuarina and many suitable tree hollows for breeding.

The Regent Honeyeater, Painted Honeyeater and Swift Parrot are highly nomadic species and could potentially utilise foraging resources within the study area on a seasonal basis.

Migratory Birds – Great Egret, Cattle Egret, White-bellied Sea-eagle, Satin Flycatcher, Black-faced Monarch, Rufous Fantail, Rainbow Bee-eater, Spectacled Monarch, Fork-tailed Swift, Latham's Snipe, Australian Painted Snipe

Both the Cattle Egret and Great Egret were recorded from the study area, and are likely to be relatively common in suitable habitat such as dams, seepage and wet paddocks in and around the study area. The remaining migratory species are considered to potentially occur within the study area at least on a transient basis.

Wetland Birds – Comb Crested Jacana, Black-necked Stork, Magpie Goose

Both the Comb-crested Jacana and the Black-necked Stork were recorded from a dam/wetland within the study area. It is unknown if either species breeds within the study area. The Magpie Goose may utilise wetland habitats within the study area on a transient basis.

Habitat for the Comb-crested Jacana and the Black-necked Stork is restricted to the two large dams within the study area and the open areas subject to periodic inundation (cleared riparian areas, and Herbfield and Derived Swamp Paperbark Thicket). All these areas fall with Retained lands within the study area.

Amphibians – Wallum Froglet, Green-thighed Frog, Giant Barred Frog, Stuttering Frog, Green and Golden Bell Frog

No threatened frog species were recorded from within the study area.

The Wallum Froglet occurs in coastal acid paperback swamps (DEC 2005). The study area is considered to contain marginal potential habitat in sections of swamp sclerophyll forest.

Habitat for the Green-thighed Frog includes ephemeral streams within open forest. The habitat within the study area is not considered likely to sustain a population of this species given the lack of preferred habitat.

It is considered unlikely that the Giant Barred Frog or the Stuttering Frog would occur within the study area given the lack of preferred breeding habitat in the form of permanent streams.

The Green and Golden Bell Frog is not considered likely to occur within the study area given that existing populations are predominantly coastal.

Reptiles – Stephen's Banded Snake

Stephen's Banded Snake was not recorded from within the study area, although this species is highly cryptic and difficult to detect. Spotlighting is the only survey that was undertaken for this species. The open forest habitat within the study area is considered to be suitable for this species.

3.4.5 SEPP 44

State Environmental Planning Policy No. 44 – Koala Habitat Protection aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline:

a) By requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat; and
b) By encouraging the identification of areas of core Koala habitat; and
c) By encouraging the inclusion of areas of core Koala habitat in environment protection zones.

A number of criteria in the SEPP are to be considered during an assessment of potential Koala habitat. These criteria are set out and assessed below.

1. Does the policy apply? Does the subject land occur in a Local Government Area (LGA) identified in Schedule 1?

The subject site occurs in the Greater Taree LGA, which is listed under Schedule 1 of the SEPP.

2. Is the landholding to which the DA applies greater than 1 hectare in area?

Yes.

3. Is the land potential Koala habitat? Does the site contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?

The subject site contains forest red gum *Eucalyptus tereticornis*, grey gum *Eucalyptus punctata* and swamp mahogany *Eucalyptus robusta* which are listed as Koala feed tree species on Schedule 2 of the SEPP. Within the subject site each of these species are dominant in their relevant vegetation types and would represent at least 15% or more of the total number of trees in the upper or lower strata.

4. Is the land core Koala habitat?

Under the SEPP ***core Koala habitat*** means an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Whilst it is clear that the Greater Taree LGA supports a healthy and viable population of Koala, three recent fauna surveys have not detected the species within the subject site. However, Koala have been recorded within the Conservation Area and immediately adjacent to the study area (current study and Whelans Insites 2009). Therefore, despite the dominance of Koala feed tree species within the study area, it is considered unlikely that the subject site represents core Koala habitat as defined in SEPP 44.

Conclusion

The Development Area does not contain core habitat for Koalas as defined by SEPP 44, although the adjacent Conservation Area does. A plan of management for this species is not considered necessary.

3.4.6 Corridor Values

The Assessment Area contains a regional and sub-regional corridor as mapped by OEH. Regional corridors are primary landscape corridors which provide potential residential and dispersal habitat for many species (Scotts 2003). Preserving these corridors is important for regional conservation planning and helping to reverse historical species declines. Almost all of the regional corridor that occurs within the Brimbin property will be protected within the Conservation Area, which adds significance to the importance of the offset package.

The Lower Manning Valley regional wildlife corridor runs through the southern part of the site and connects extensive areas of vegetation east and west of the Assessment Area. There is a gap in this corridor at Lansdowne Road in the southern-central part of the property which would limit the value of the corridor for some native species such as small and medium ground-dwelling mammals. However, this gap would be replanted as part of the offset package, significantly improving the east-west connectivity within the locality. The broader corridor is considered to be highly valuable for biodiversity within the region given the links between important habitats and the suite of rare or threatened species that are known to occur, and this will be improved further by the replanting.

The Lower Manning Valley sub-regional wildlife connects vegetation in the south of the Assessment Area to vegetation outside of the Assessment Area and over the Dawson River to west.

All riparian areas within the Draft Structure Plan are only local biodiversity links, as defined in the second to last point above, and have been buffered by 50 metres to form potential additions to the Conservation Area that are currently being excluded from this assessment as retained lands.

4 RED FLAGS

Under Biodiversity Certification, red flags are areas that cannot simply be offset by the retirement of biodiversity credits in order to achieve an Improve or Maintain outcome for biodiversity. Red flags include:

- Highly cleared vegetation types (70% or greater);
- Endangered or critically endangered ecological communities as listed on the TSC or EPBC Acts;
- Threatened species (TSC Act only) that are classed as not being able to withstand further loss in the CMA;
- Land that is mapped or defined as a state or regional biodiversity link in accordance with section 3.7.2 of the *Methodology*;
- A riparian buffer 40 m either side of a major river on the coast and tablelands or 100 m either side of a major river on the western slopes and plains;
- A riparian buffer 30 m either side of a minor river or major creek on the coast and tablelands or 60 m either side of a minor river or major creek on the western slopes and plains;
- A riparian buffer 20 m either side of a minor creek on the coast and tablelands or 40 m either side of a minor creek on the western slopes and plains; and
- Areas listed as a SEPP 14 wetland.

All local biodiversity links, as defined in the second to last point above, have been buffered by 50 metres to form potential additions to the Conservation Area, however they are currently being excluded from this assessment as retained lands. No SEPP 14 land is present in the Assessment Area and none of the vegetation types within the Development Area are highly cleared vegetation types as defined in the Biometric Vegetation Types database. Two red flag issues fall within the Development Area of this assessment:

1. Two TECs, Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest; and
2. The *Eucalyptus seeana* Endangered Population.

A red flag variation will be provided in the Strategy. The process that must be followed for a red flag variation, as prescribed in the Methodology, is outlined below in relation to *Eucalyptus seeana*.

Eucalyptus seeana is identified in the Biobanking Threatened Species Profiles Database as a threatened species that cannot withstand further loss within the Hunter/Central Rivers CMA and is therefore a red flag species. Furthermore, the number of individuals considered a negligible loss for the species is set to five in the database (i.e., if more than five individuals are removed a red flag will be raised).

Table 6 outlines the process that must be followed (the "improve or maintain test") in order to demonstrate that the development of the site achieves an "improve or maintain" outcome for biodiversity values in relation to its potential impact on *Eucalyptus seeana* under the rules contained in the Methodology.

In order to answer yes to Criteria 1b), and therefore achieve an 'improve or maintain' outcome for *Eucalyptus seeana*, the criteria for red flags variations must be addressed.

These criteria are provided in Section 2.4 of the *Methodology* and will be fully addressed in the Strategy.

Table 6. Improve or maintain test using the Methodology

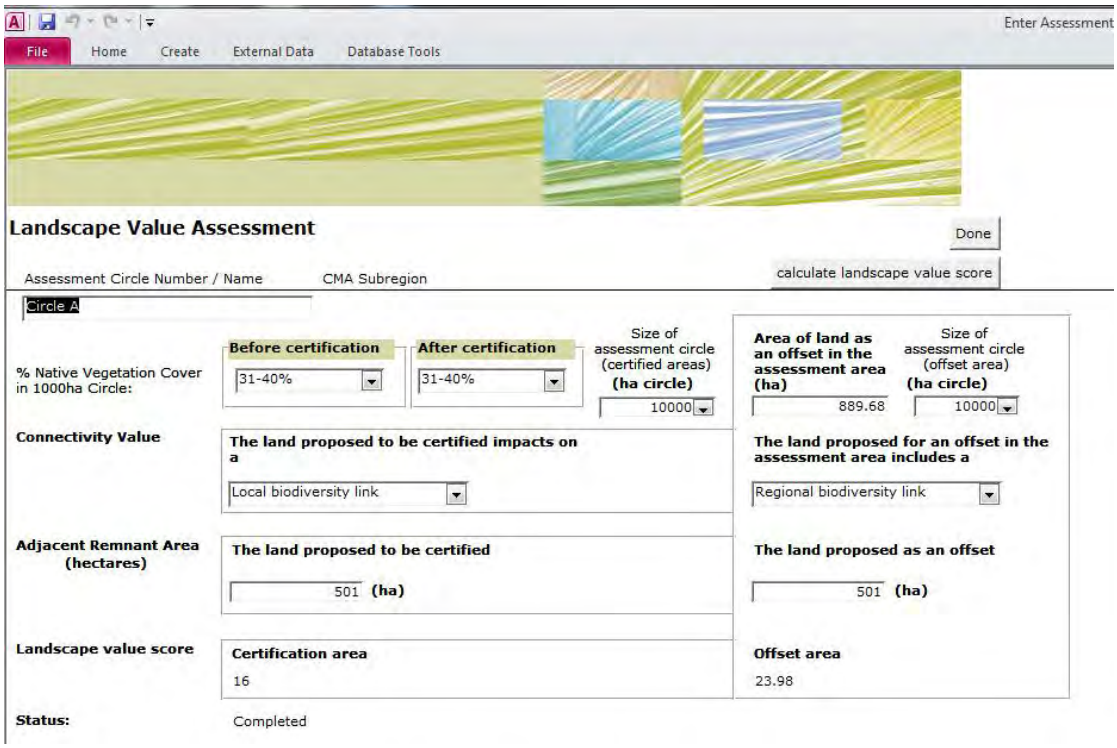
Improve or maintain criteria (must answer YES to all three criteria)	YES	NO	Comment
1a) The development does not impact on *Eucalyptus seeana*, ***or*** 1b) The Director General has made a determination that the development does not impact on *Eucalyptus seeana* as per Section 2.4 of the *Methodology*	Possible		1a) is not satisfied and, therefore, to address 1b) an argument must be presented to OEH using the criteria in Section 2.4 of the Methodology that the development will not impact on *Eucalyptus seeana*
2. The direct impacts on *Eucalyptus seeana* are offset in accordance with the rules of Section 10 of the *Methodology*	Possible		Credit calculations required
3. The indirect impacts on *Eucalyptus seeana* are appropriately minimised in accordance with Section 6 of the Methodology	Possible		Roche and Niche will need to consider and calculate the indirect impacts in the Strategy (such as edge effects)

5 BIODIVERSITY CERTIFICATION CREDIT CALCULATIONS

5.1 Landscape value assessment

The following cropped screen-shot shows the landscape value scores from the Calculator given the values used for native vegetation cover, connectivity and the Adjacent Remnant Area. The landscape score calculations were conducted within a 10,000 hectare circle (the maximum) and whilst the Development Area impacts on a local biodiversity link, the Conservation Area will preserve a regional biodiversity link as per the guidelines in the Methodology. Native vegetation cover will reduce by 274 hectares, however within a 10,000 hectare circle this represents only 2.74 per cent of the cover which falls within the 31-40 percentile both before and after certification. The native vegetation of the Assessment Area is well-connected to more than 501 hectares of moderate-good condition vegetation and this is the same in both the Development Area (i.e., the land to be certified) and the Conservation Area (i.e., the land to be offset).

The result of the landscape assessment was a value of 16 for the Development Area and 23.98 for the Conservation Area.



5.2 Vegetation Zone Assessment

The vegetation zones as listed in Table 3 were the inputs at the second stage of the Calculator. For this, the vegetation formation and class were required to be known and this is why Appendix B has been included.

One of the complications of moving from the *BioBanking Assessment Methodology* (BBAM) to the BCAM has been the alignment of revised Biometric Vegetation Types (BVTs) as used in the BBAM with the new Plant Community Types (PCTs) as used in the BCAM. Some BVTs as previously utilised had no matching PCT in the Calculator. Further, at least two ideal PCTs were not selectable in the Calculator. In both cases, a PCT of the same red flag status and the same vegetation formation and class (Keith 2004) as the BVT previously used in the BioBanking Assessment, was utilised in this assessment. The benchmarks were then altered within the Calculator to match the relevant BVT from the OEH Biometric Vegetation Types Database. This is most relevant to the Narrow-leaved Red Gum forests and woodlands within the Assessment Area.

An alignment of the vegetation types with previously used BVTs, ideal PCT and those PCTs that were eventually utilised is provided in Appendix A. Appendix B includes an alignment of the same vegetation types with TECs, red flag vegetation greater than 70 per cent cleared and vegetation formations and classes (Keith 2004).

5.3 Threatened Species Assessment

An assessment was completed for species requiring survey under the Methodology. Appendix F is a list of the threatened fauna predicted to occur in the PCTs at the site. These species are offset by the Ecosystem Credits generated within the Conservation Area.

Threatened species requiring survey as determined by the Calculator are discussed in Section 2.4. This discussion concludes that additional threatened flora surveys are, according to the Calculator, required for a single species *Diuris flavescens* (Pale Yellow Double-tail), a critically endangered orchid species, whose core population is in similar habitat to the Assessment Area, approximately 8 kilometres to the south. Surveys for this species may be required prior to finalising this assessment and will be completed in September or October 2013.

Threatened species recorded within the Assessment Area that also generate Species Credits include the following:

- ;
- Brush-tailed Phascogale and Koala – 118 hectares of habitat in the Development Area and 839 hectares of habitat in the Conservation Area;
- *Corybas dowlingii* (Red Helmet-orchid) – a single record in the Conservation Area;
- *Eucalyptus glaucina* (Slaty Red Gum) – seven records from the Conservation Area, as well as two records from the retained lands (conservation riparian); and
- *Eucalyptus seeana* (Narrow-leaved Red Gum) – an estimated 5,329 individuals in the Development Area and 14,095 individuals in the Conservation Area. As stated previously in Section 3.3.1, this calculation does not account for lands zoned as

Steep or Riparian lands, Rural or Large Lot Residential in the Draft Structure Plan, where substantially more individuals and habitats are known to exist. These areas are retained lands for the purposes of this assessment.

Although the Black-necked Stork and Comb-crested Jacana were recorded from the study area, their habitat only occurs within the retained lands so species credits are not considered further for these two species.

The information as presented above is used in the third stage of the Calculator to determine the Species Credits required and those generated. Areas of habitat were determined by an examination of the appropriate vegetation types within the Assessment Area, including low-lying cleared areas for Black-necked Stork and Comb-crested Jacana.

The area of habitat within the Development Area and Conservation Area for each of the two threatened fauna species was calculated as per Table 7 (Koala and Brush-tailed Phascogale). More habitat exists for each of these species within the non-assessable retained lands.

Table 7. Area of assessable habitat for Koala and Brush-tailed Phascogale (arboreal mammals)

Niche Veg Code	Niche Veg Type	Development Area (ha)	Conservation Area (ha)
BT	Blackbutt Tallowwood Tall Open Forest	-	125.99
FG	Flooded Gum Brush Box Tall Forest	1.38	-
GB	Grey Box Red Gum Grey Ironbark Woodland	9.81	1.88
TG	Grey Gum Stringybark Tallowwood Tall Open Forest	29.67	147.62
RGIB	Narrow-leaved Red Gum Ironbark Woodland	5.06	27.71
RG Ang	Red Gum Angophora Mahogany Woodland	1.09	-
RGIB Mel	Red Gum Grey Ironbark Paperbark Forest	42.48	215.32
RGIB Mel (TEC)	Red Gum Grey Ironbark Paperbark Forest (TEC)	0.41	5.10
SI	Spotted Gum Ironbark Forest	25.67	216.07
SM (TEC)	Swamp Mahogany Forest (TEC)	-	55.40
SO (TEC)	Swamp Oak Forest (TEC)	2.40	44.13
	Total	**117.97**	**839.22**

5.4 Assessment Summary

The following section summarises the credits required from the Development Area and the credits generated from the Conservation Area. Tables 9, 10 and 11 should be referred to in relation to this section.

5.4.1 Summary of Ecosystem Credit status (i.e., balance) – PCT level

Table 9 is a summary of the credit status assuming retirement of credits for a conversion to National Park estate (E1 conservation measures) and other areas as Council land (E2

conservation measures). Under the Methodology only 90 per cent of the full credit value can be generated on the E2 lands. The 90 per cent credit value is represented for the E2 conservation lands in Tables 9, 10 and 11.

A deficit in credits exists for two PCTs; HU549 – Grey Box - Forest Red Gum - Grey Ironbark open forest (a deficit of 356 credits) and HU783 – Flooded Gum - Brush Box - Tallowwood mesic tall open forest (a deficit of 54 credits). The other seven PCTs can be fully offset on a like-for-like basis. The proposal has an overall surplus of 3,412 Ecosystem Credits.

As there is a shortage of Ecosystem Credits for two PCTs, the offset variation rules as prescribed in the Methodology can be applied in order to achieve an offset. Further, 10.2 hectares of TEC (see Table 4) will require a red flag variation within the Strategy.

5.4.2 Application of offset variation rules to Ecosystem Credits

Step 1. IBRA bioregion

The entirety of the Assessment Area and the conservation measures proposed are in the same IBRA bioregion (NSW North Coast).

Step 2. Ecosystem Credit status at vegetation class level

At vegetation class level (Table 9), the surplus of 46 Ecosystem Credits for HU703 Narrow-leaved Red Gum woodlands (HU906 used in the Calculator) can be retired against the 356 credit deficit for HU549 Grey Box - Forest Red Gum - Grey Ironbark open forest, as both of these vegetation types fall within the Coastal Valley Grassy Woodlands vegetation class. The deficit of credits for HU549 is then reduced to 310 credits (356 less 46).

The deficit of 54 Ecosystem Credits for HU783 Flooded Gum - Brush Box - Tallowwood mesic tall open forest cannot be reduced through credit trading at vegetation class level as it is the only PCT in the Conservation Area that is in the North Coast Wet Sclerophyll Forests vegetation class.

Step 3. Ecosystem Credit status at vegetation formation level

At vegetation formation level (Table 10), the deficit of 54 Ecosystem Credits for HU783 Flooded Gum - Brush Box - Tallowwood mesic tall open forest is absorbed through the retirement of credits within the same formation, in this case from the 1,296 credit surplus for HU511 Blackbutt - Tallowwood dry grassy open forest. HU783 can therefore be offset by the proposal.

A deficit of 310 Ecosystem Credits still exists for HU549 Grey Box - Forest Red Gum - Grey Ironbark open forest, as no other PCT with a surplus of credits exists within the same vegetation formation. Therefore an application for a minor variation to the offsetting rules is required.

Therefore all PCTs, except HU549 can be offset through the retirement of credits at either PCT, vegetation class or vegetation formation level.

Minor variation to offsetting rules

Given a deficit of 310 Ecosystem Credits still exists for HU549 Grey Box - Forest Red Gum - Grey Ironbark open forest, a minor variation to the offsetting rules is sought by utilising a portion of the Ecosystem Credits that are aligned to TECs and, therefore, a higher conservation priority. A total of 1,075 Ecosystem Credits align to three TECs within the Assessment Area, an area of 112 hectares.

At the very least, the minimum of 310 Ecosystem Credits out of the 1,075 TEC credits will be retired and these credits will be entirely sourced from either the HU635 Swamp Oak swamp forest (320 credits available) or HU633 Swamp Mahogany swamp forest (737 credits available), or a mix of these.

In terms of the extent of land required, the offset ratio for HU549 is 2.2 (30.6 credits required per hectare, divided by 13.6 credits created per hectare). Based on this ratio, 27.7 hectares (2.2 x 12.6 hectares impacted) of HU549 is required to achieve an appropriate offset. Given that 2.2 hectares of HU549 exists in the Conservation Area, then an additional 25.5 hectares (27.7 less 2.2) of HU549 must be established as an offset. Should the available TECs within the Conservation Area be utilised for this additional 25.5 hectares, either Swamp Oak swamp forest (42.8 hectares available) or Swamp Mahogany swamp forest (55.4 hectares available) could be used.

It is considered that this would constitute an entirely appropriate variation to the offsetting rules and lead to an improved conservation outcome for biodiversity within the Assessment Area. It is clearly justified on the basis that HU549 is not aligned to a TEC and that only 12.37 hectares of this PCT would be impacted (of which three hectares is regrowth). The on-site conservation of the Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest TECs would also result in an improvement in connectivity throughout the landscape, most significantly between two sub-catchments of the Manning (from the Dawson River to the Lansdowne River). The net result of this trading of credits would be the local conservation of up to three TECs for the loss of a relatively minor amount of non-TEC vegetation.

Table 8. Ecosystem Credit status (balance) – PCT level

Code	PCT name abbreviated	Class	Formation	Certified Area (ha)	Credits required	E2 Offset Area	E2 Credits (90%)	E1 Offset Area (ha)	E1 Credits (100%)	PCT Credit Status (Total)
HU635	Swamp Oak swamp forest	Coastal Floodplain Wetlands	Forested Wetlands	5.5	161	-	-	48.3	481	320
HU808	Cabbage Gum-Rough-barked Apple grassy woodland	Coastal Floodplain Wetlands	Forested Wetlands	0	0	-	-	5.3	55	55
HU591	Paperbark swamp forest	Coastal Swamp Forests	Forested Wetlands	4.7	75	-	-	8.3	93	18
HU633	Swamp Mahogany swamp forest	Coastal Swamp Forests	Forested Wetlands	0	0	-	-	55.4	737	737
HU703 (HU906)	Narrow-leaved Red Gum woodlands (Bull Oak grassy woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	98.4	2980	-	-	258.8	3026	46
HU549 (HU910)	Grey Box - Forest Red Gum - Grey Ironbark open forest (Blakely's Red Gum - Rough-barked Apple shrubby woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	12.6	386	-	-	2.2	30	-356
HU783	Flooded Gum - Brush Box - Tallowwood mesic tall open forest	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests	1.4	54	-	-	0	0	-54
HU511	Blackbutt - Tallowwood dry grassy open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	5.0	87	1.2	11	126.1	1372	1296
HU646	Tallowwood open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	29.7	1047	19.0	172	167.6	1958	1083
HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	117.2	2949	37.5	546	219.5	2670	267
	Totals			**274.50**	**7,739**	**57.7**	**729**	**891.50**	**10,422**	**3412**

Note: PCTs in brackets are the codes and names of those for which the "ideal PCT" could not be selected in the Calculator.

Table 9. Ecosystem Credit status (balance) – vegetation class level

Code	PCT name abbreviated	Class	Formation	Certified Area (ha)	Credits required	E2 Offset Area (ha)	E2 Credits (90%)	E1 Offset Area (ha)	E1 Credits (100%)	PCT Credit Status (Total)	Credit Status after class level retirement
HU635	Swamp Oak swamp forest	Coastal Floodplain Wetlands	Forested Wetlands	5.5	161	-	-	48.3	481	320	320
HU808	Cabbage Gum-Rough-barked Apple grassy woodland	Coastal Floodplain Wetlands	Forested Wetlands	0	0	-	-	5.3	55	55	55
HU591	Paperbark swamp forest	Coastal Swamp Forests	Forested Wetlands	4.7	75	-	-	8.3	93	18	18
HU633	Swamp Mahogany swamp forest	Coastal Swamp Forests	Forested Wetlands	0	0	-	-	55.4	737	737	737
HU703 (HU906)	Narrow-leaved Red Gum woodlands (Bull Oak grassy woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	98.4	2980	-	-	258.8	3026	46	0
HU549 (HU910)	Grey Box - Forest Red Gum - Grey Ironbark open forest (Blakely's Red Gum - Rough-barked Apple shrubby woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	12.6	386	-	-	2.2	30	-356	-310
HU783	Flooded Gum - Brush Box - Tallowwood mesic tall open forest	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests	1.4	54	-	-	0	0	-54	-54
HU511	Blackbutt - Tallowwood dry grassy open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	5.0	87	1.2	11	126.1	1372	1296	1296
HU646	Tallowwood open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	29.7	1047	19.0	172	167.6	1958	1083	1083
HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	117.2	2949	37.5	546	219.5	2670	267	267
	Totals			**274.50**	**7,739**	**57.7**	**729**	**891.50**	**10,422**	**3,412**	**3,412**

Note: PCTs in brackets are the codes and names of those for which the "ideal PCT" could not be selected in the Calculator.

Table 10. Ecosystem Credit status (balance) – vegetation formation level

Code	PCT name abbreviated	Class	Formation	Certified Area (ha)	Credits required	E2 Offset Area (ha)	E2 Credits (90%)	E1 Offset Area (ha)	E1 Credits (100%)	PCT Credit Status after class level retirement	PCT Credit Status after formation level retirement
HU635	Swamp Oak swamp forest	Coastal Floodplain Wetlands	Forested Wetlands	5.5	161	-	-	48.3	481	320	320
HU808	Cabbage Gum-Rough-barked Apple grassy woodland	Coastal Floodplain Wetlands	Forested Wetlands	0	0	-	-	5.3	55	55	55
HU591	Paperbark swamp forest	Coastal Swamp Forests	Forested Wetlands	4.7	75	-	-	8.3	93	18	18
HU633	Swamp Mahogany swamp forest	Coastal Swamp Forests	Forested Wetlands	0	0	-	-	55.4	737	737	737
HU703 (HU906)	Narrow-leaved Red Gum woodlands (Bull Oak grassy woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	98.4	2980	-	-	258.8	3026	0	0
HU549 (HU910)	Grey Box - Forest Red Gum - Grey Ironbark open forest (Blakely's Red Gum - Rough-barked Apple shrubby woodland)	Coastal Valley Grassy Woodlands	Grassy Woodlands	12.6	386	-	-	2.2	30	-310	-310
HU783	Flooded Gum - Brush Box - Tallowwood mesic tall open forest	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests	1.4	54	-	-	0	0	-54	0
HU511	Blackbutt - Tallowwood dry grassy open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	5.0	87	1.2	11	126.1	1372	1296	1242
HU646	Tallowwood open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	29.7	1047	19.0	172	167.6	1958	1083	1083
HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests	117.2	2949	37.5	546	219.5	2670	267	267
	Totals			**274.50**	**7,739**	**57.7**	**729**	**891.50**	**10,422**		

Note: PCTs in brackets are the codes and names of those for which the "ideal PCT" could not be selected in the Calculator.

5.4.3 Summary of Species Credits - threatened flora

In relation to the calculation of the threatened flora Species Credit requirements, *Eucalyptus seeana*, which was present on site as the Greater Taree LGA endangered population, was not selectable in the Calculator (Table 11). The credit requirement and credits generated for *Eucalyptus seeana* have been determined based on the algorithms outlined in the Methodology (Sections 7.4 and 8.2). The analysis in Table 11 shows that, subject to approval of a red flag variation (to be provided in the Strategy), *Eucalyptus seeana* can be more than adequately offset through the retirement of Species Credits. Neither *Corybas dowlingii* nor *Eucalyptus glaucina* are impacted by the proposed development and therefore no offsetting of these species is required.

Table 11. Species Credit status (balance) – threatened flora

Species	Listing status (NSW)	No on land to be certified	Number of credits required for certification	Red flagged	No on land under offset	Number of credits created for offset	Status of Species Credits (Flora)
Eucalyptus glaucina Slaty Red Gum	V	0	0	No	7	42	42
Eucalyptus seeana Narrow-leaved Red Gum	EP (Taree LGA)	5,329	76,129	Yes	14,095	84,570	8,441
Corybas dowlingii Red Helmet Orchid	E	0	0	No	1	6	6

5.4.4 Summary of Species Credits - threatened fauna

Two threatened fauna recorded within the assessment area are not predicted in Ecosystem Credits on the site and therefore retirement of Species Credits is required for each of these species. These species are; Brush-tailed Phascogale and Koala. The assessable area of habitat (calculated in Section 5.3) is used to calculate the Species Credits required and created for threatened fauna.

As is evident from Table 12, an excess of Species Credits is generated for both the Brush-tailed Phascogale and Koala.

Table 12. Species Credit status (balance) – threatened fauna

Species	Listing status (NSW)	Certified area of habitat (ha)	Number of credits required for certification	Red flagged	Conservation area of habitat (ha)	Number of credits created for offset	Status of Species Credits (Fauna)
Phascogale tapoatafa Brush-tailed Phascogale	V	118	2,360	No	839	5,034	2,674
Phascolarctos cinereus Koala	V	118	3,105	No	839	5,034	1,929

6 CONCLUSION

This report has described the natural environment of the Assessment Area and how the developments within it will achieve an 'improve or maintain' outcome for biodiversity outcomes as required by the *Biodiversity Certification Assessment Methodology* (DECCW 2011).

Ecosystem and Species Credit calculations using the Biodiversity Certification Credit Calculator have shown that, through the retirement of Ecosystem and Species Credits, with approval of minor variations to the offsetting rules as permitted under the Methodology, an improved outcome for biodiversity will be achieved through the certification of the proposed Brimbin New Town.

Approval of a red fag variation will also be required for impacts on:

- 10.2 hectares of TEC (Swamp Sclerophyll Forest and Swamp Oak Forest); and
- The threatened population of *Eucalyptus seeana*.

A *Biodiversity Certification Strategy* has been prepared to describe the conservation measures proposed and also provide a justification in relation to impacts on red flags through an address of the red flag criteria.

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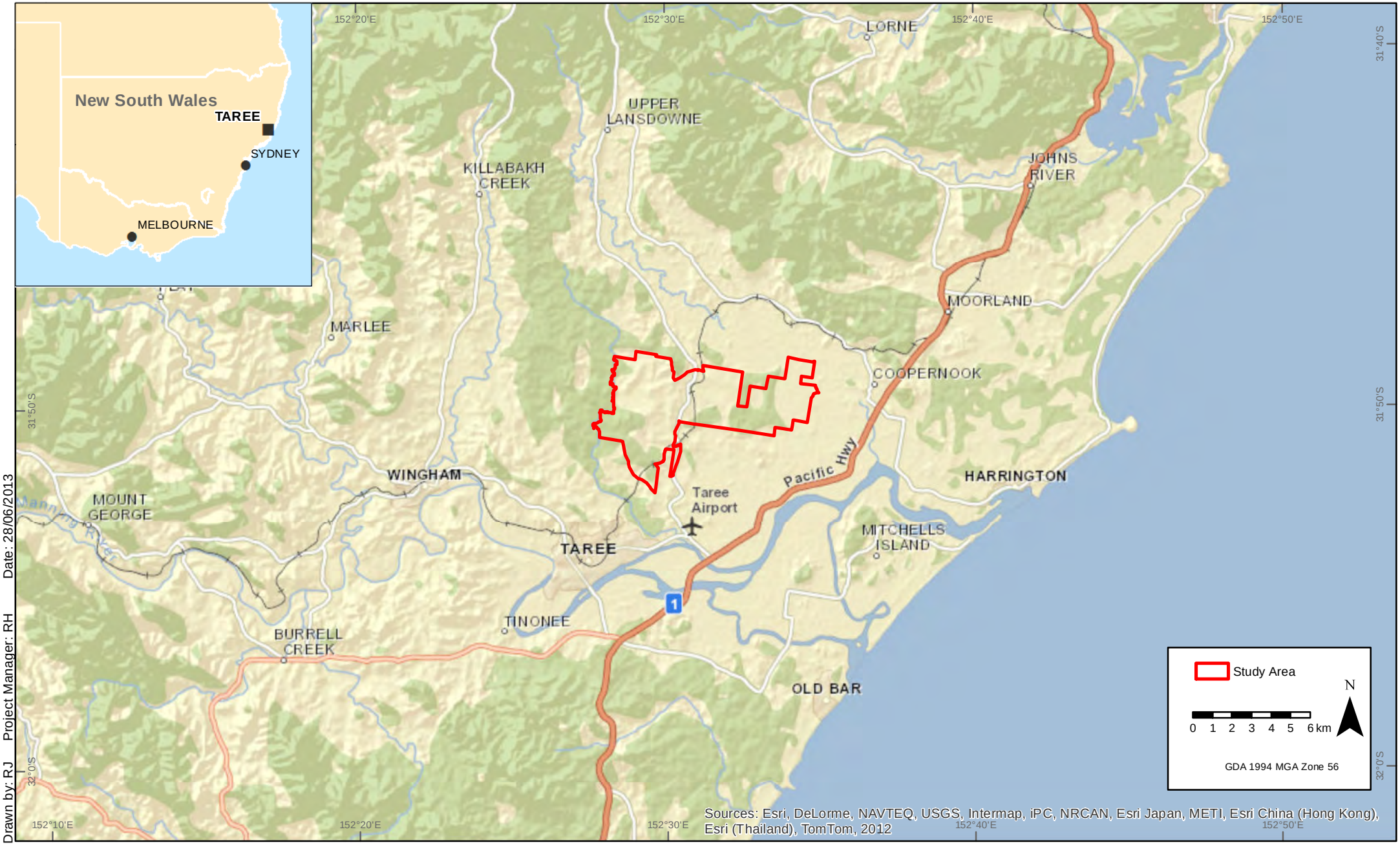
FIGURES



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1554 Brimbin BioCertification

Study area in a regional context

FIGURE 1

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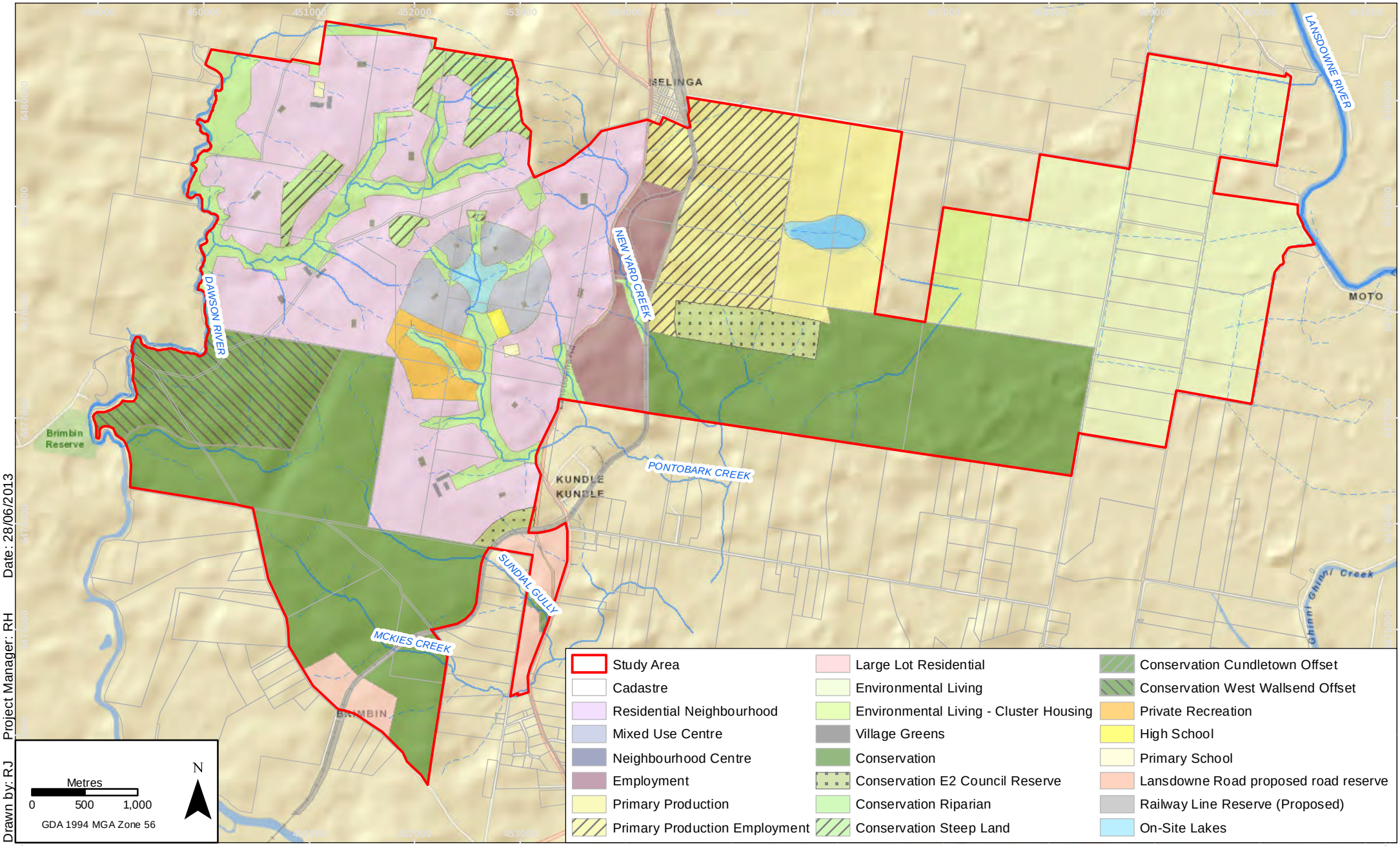

Date: 28/06/2013
Project Manager: RH
Drawn by: RJ

1554 Brimbin BioCertification

Brimbin New Town draft structure plan

FIGURE 2

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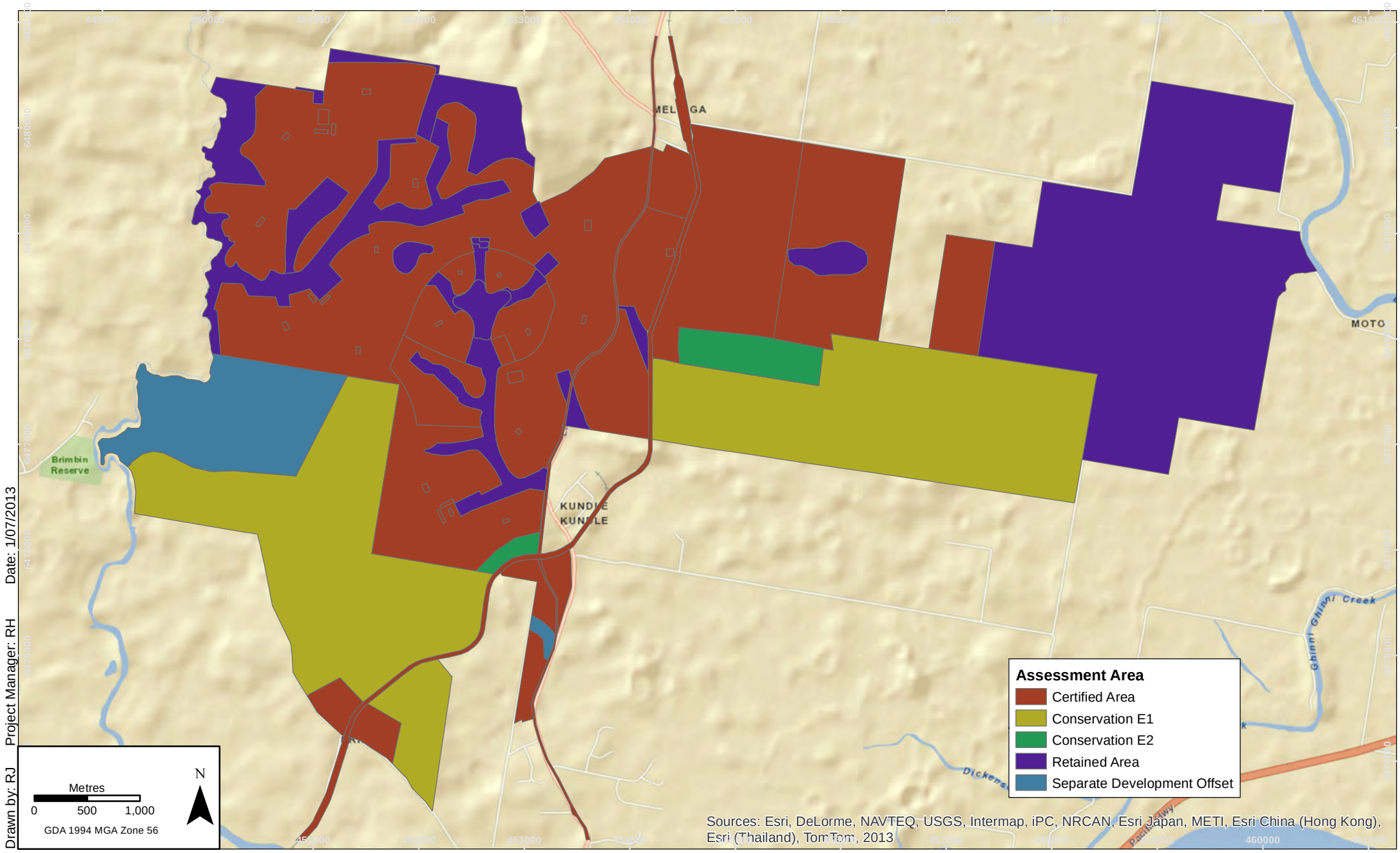

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1554 Brimbin BioCertification

Biodiversity Certification Assessment Area

FIGURE 3

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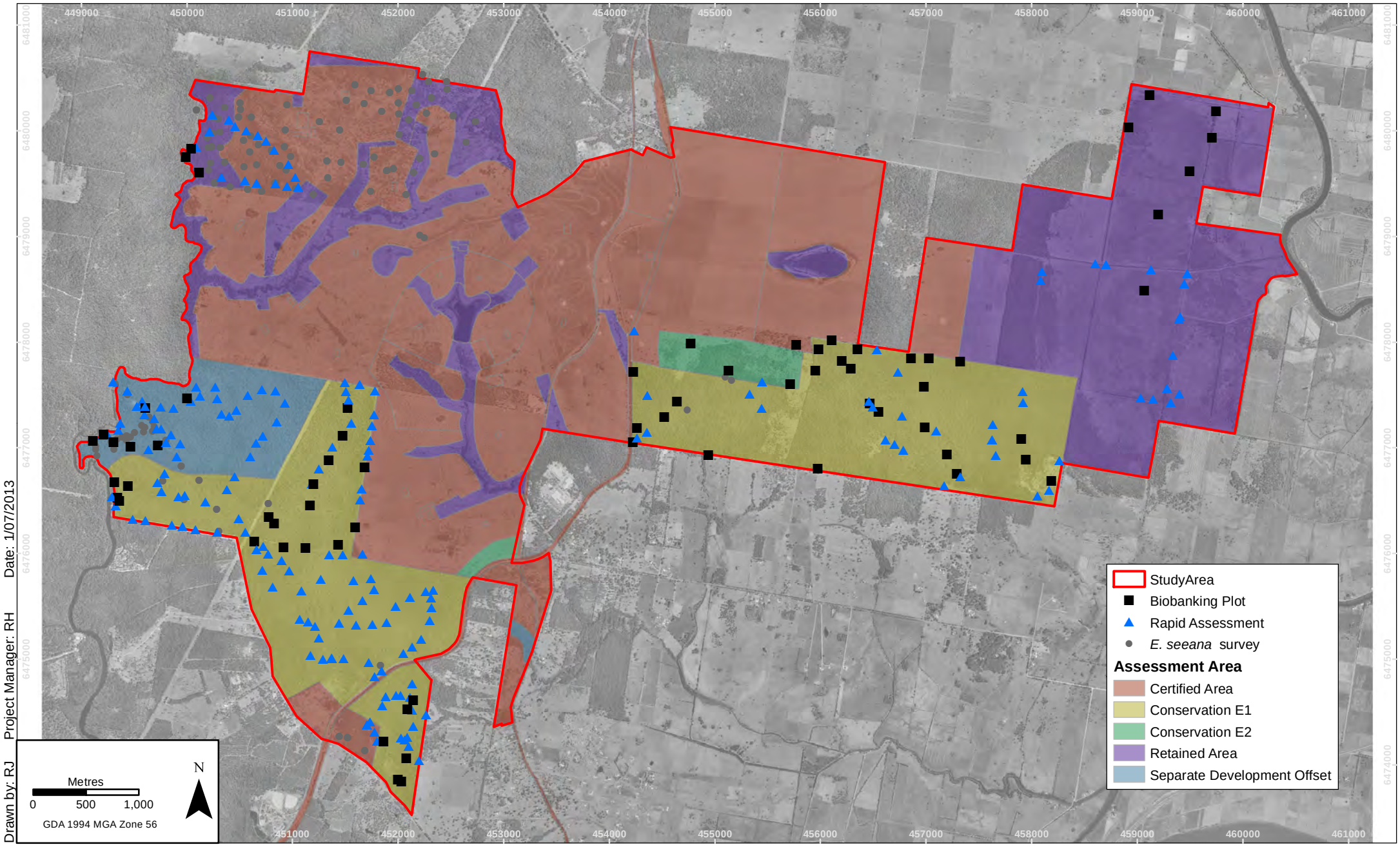

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1554 Brimbin BioCertification

Flora survey effort

FIGURE 4

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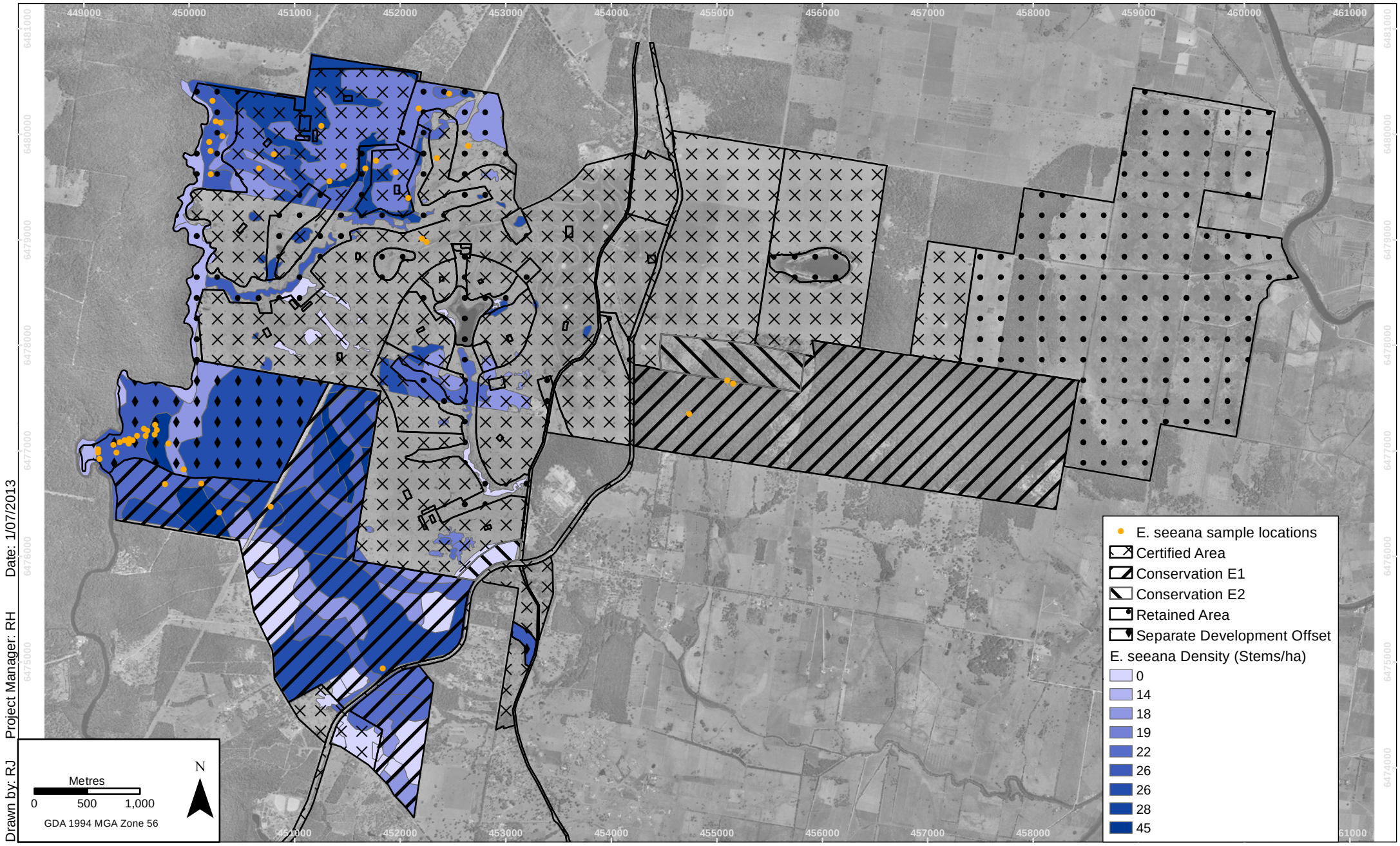

1554 Brimbin BioCertification

Distribution of *Eucalyptus seeana* throughout the assessment area

FIGURE 5

Basemap (c) 2007 LPI

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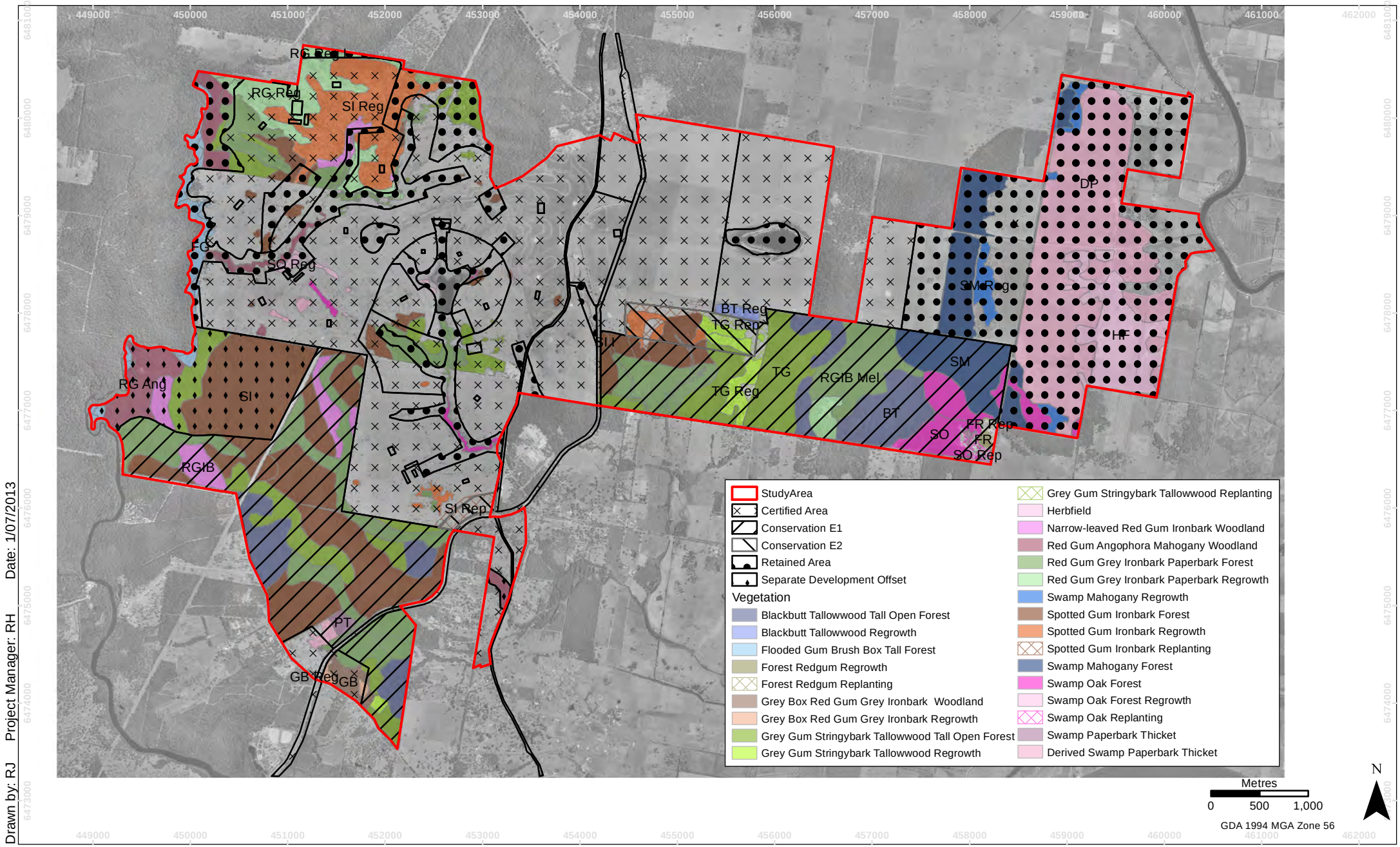

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1554 Brimbin BioCertification

Vegetation mapping

FIGURE 6

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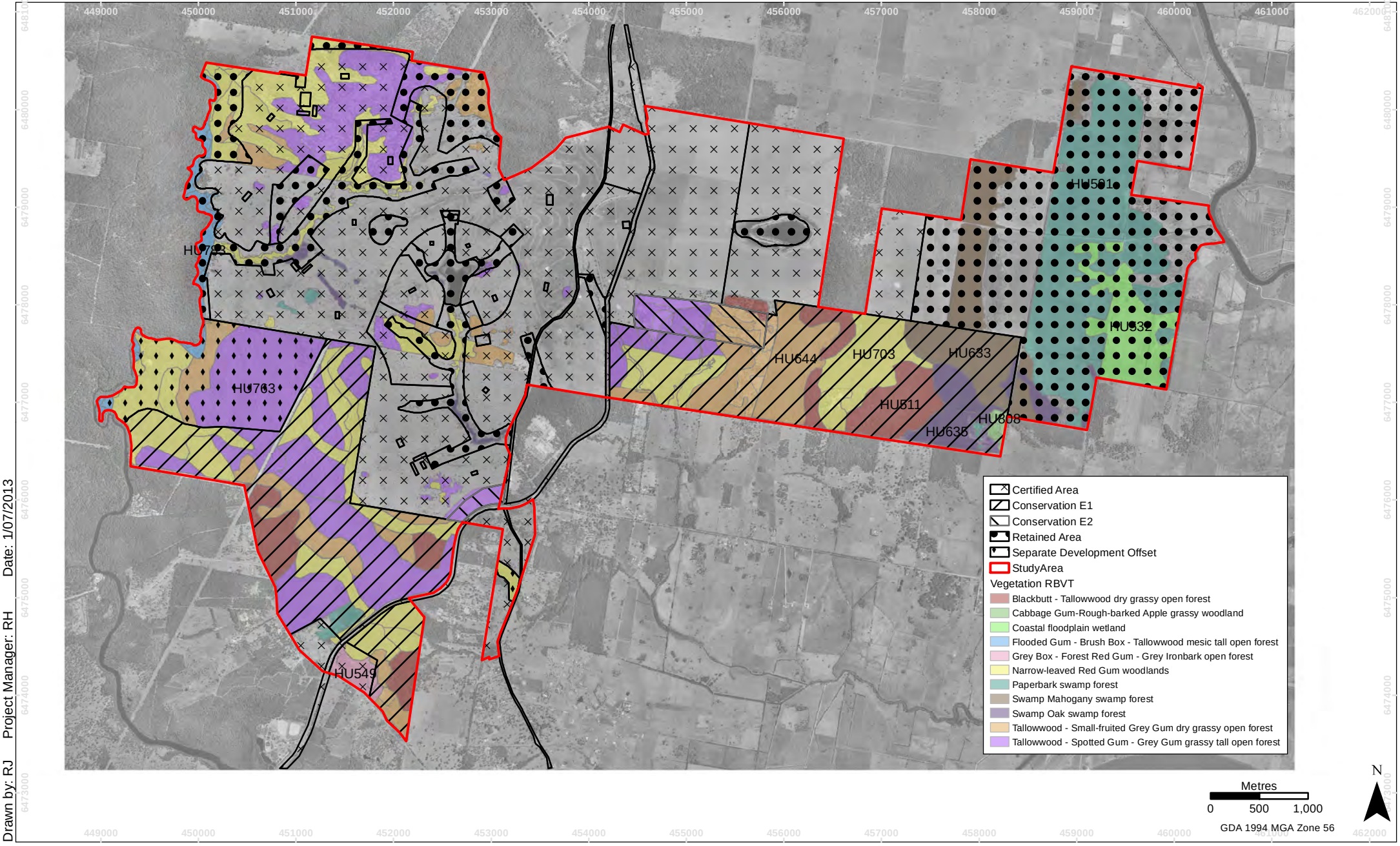

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1554 Brimbin BioCertification

Revised Biometric Vegetation Types (OEH 2013)

FIGURE 7

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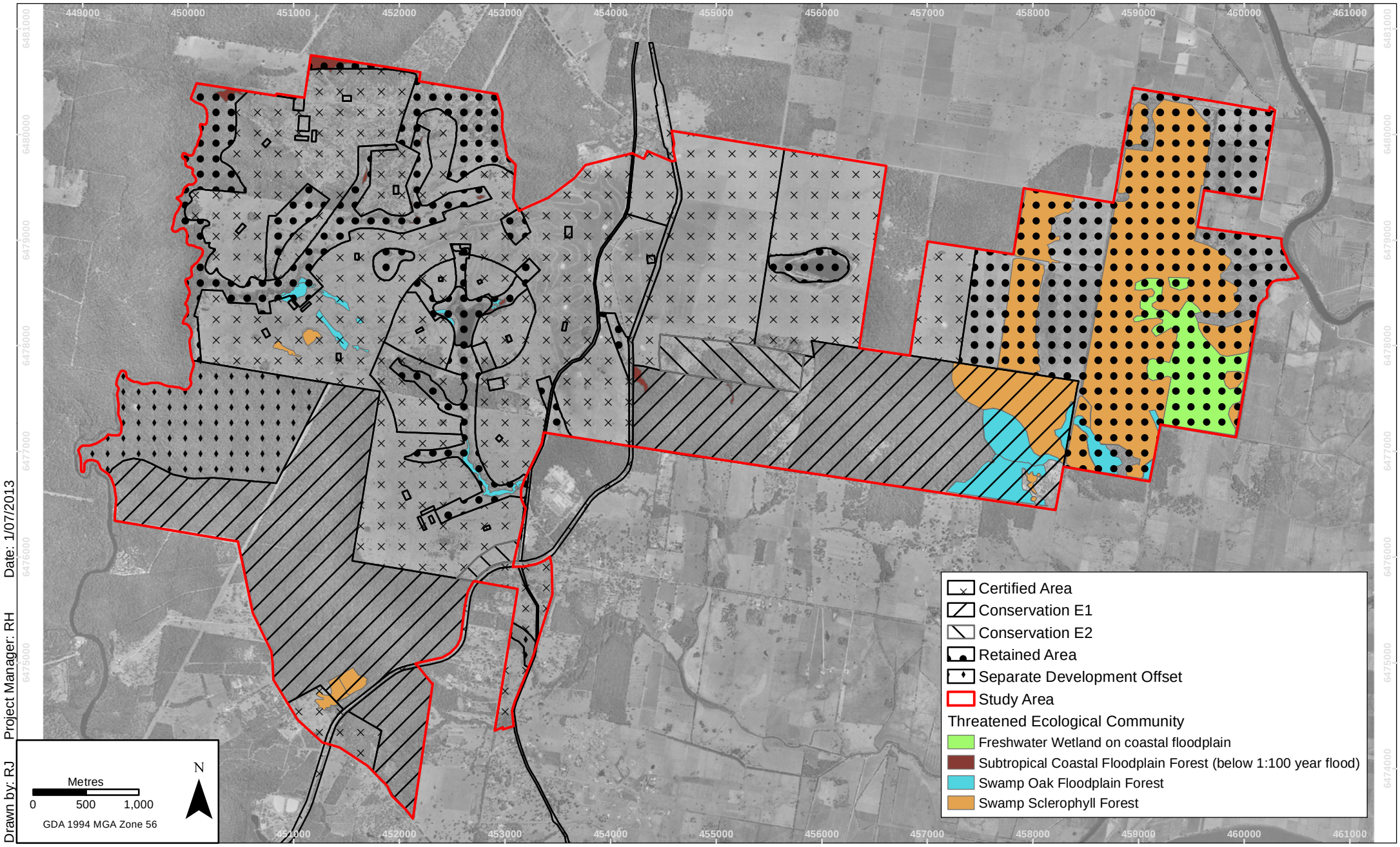

1554 Brimbin BioCertification

Distribution of Threatened Ecological Communities

FIGURE 8

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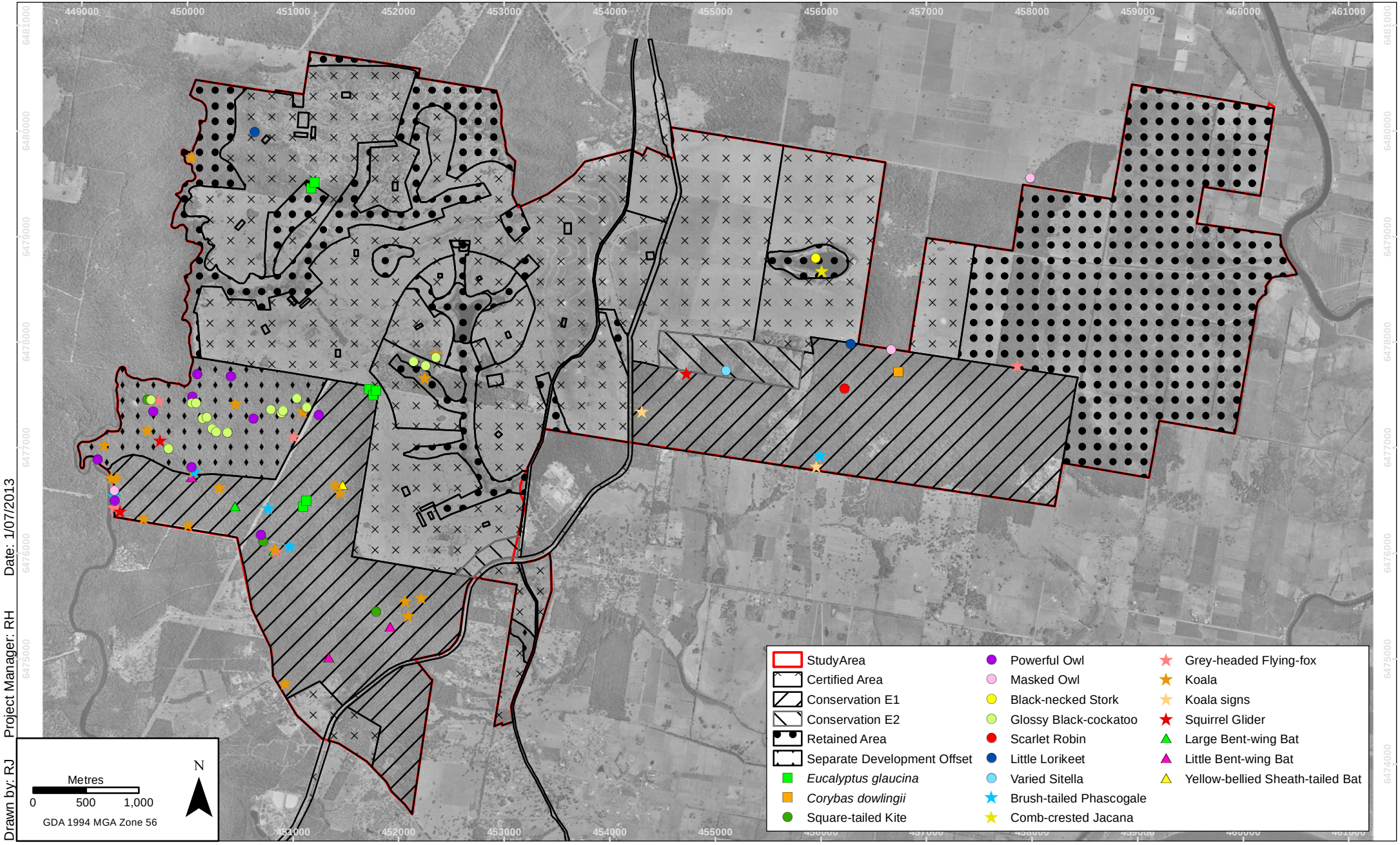

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1554 Brimbin BioCertification

Threatened flora and fauna recorded in the study area

FIGURE 9

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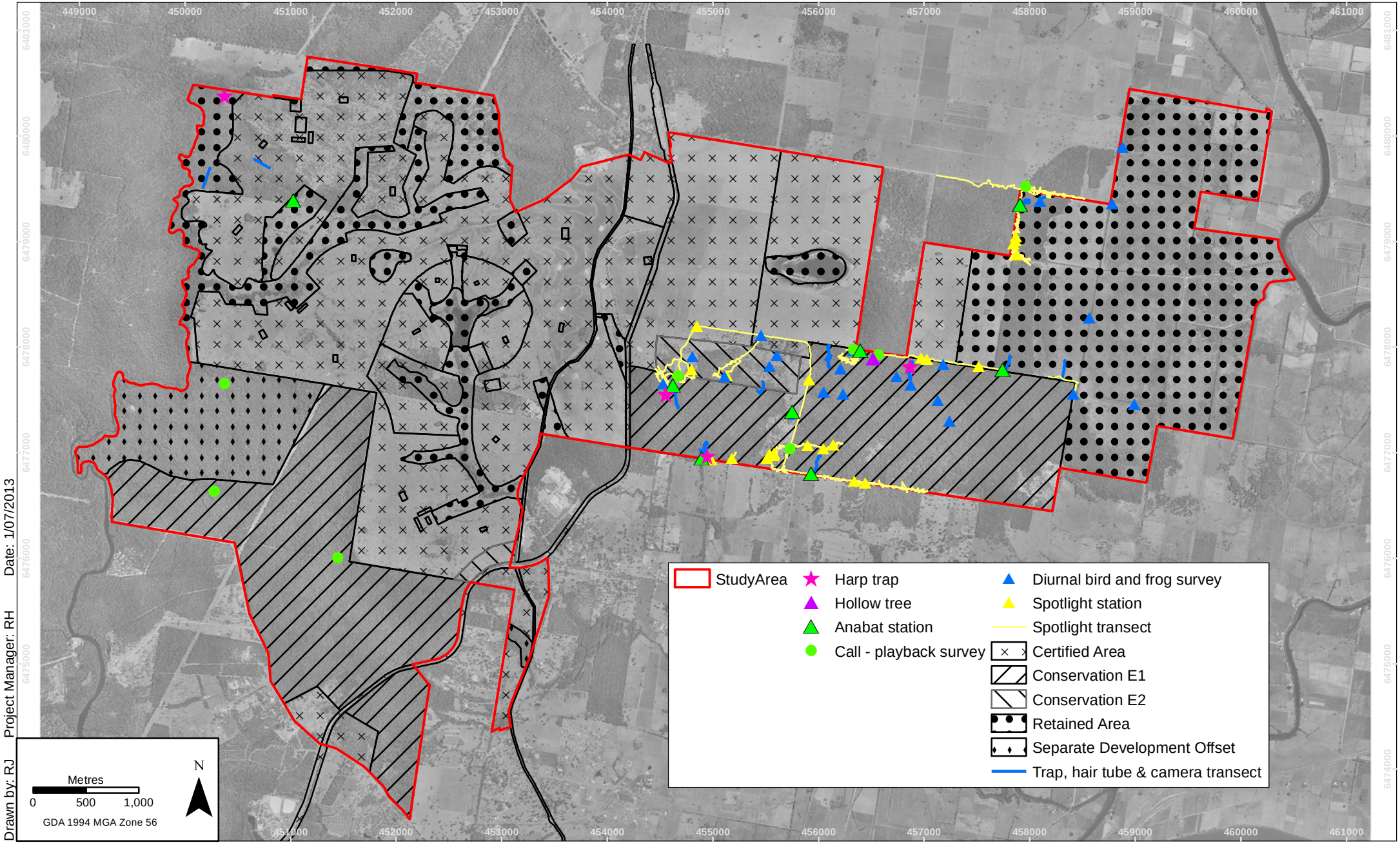

1554 Brimbin BioCertification

Fauna survey effort

FIGURE 5

Basemap (c) 2007 LPI

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APPENDICIES

Appendix A: Vegetation Types Alignment to BVTs and PCTs

Veg Zone	Niche Code	Niche Veg Type	BVT_Code	BVT_short	PCTcode_ideal	PCT_ideal_short	PCTcode_used	PCT_used_short
1	BT Reg	Blackbutt Tallowwood Regrowth	HU511	Blackbutt - Tallowwood dry grassy open forest	No change	No change	No change	No change
2	BT	Blackbutt Tallowwood Tall Open Forest	HU511	Blackbutt - Tallowwood dry grassy open forest	No change	No change	No change	No change
3	PT	Swamp Paperbark Thicket	HU591	Paperbark swamp forest	No change	No change	No change	No change
4	DP	Derived Swamp Paperbark Thicket	HU591	Paperbark swamp forest	No change	No change	No change	No change
5	FG	Flooded Gum Brush Box Tall Forest	HU543	Flooded Gum - Tallowwood - Brush Box moist open forest	HU783	Flooded Gum - Brush Box - Tallowwood mesic tall open forest	PCT ideal	PCT ideal
6	FR Rep	Forest Redgum Replanting	HU526	Cabbage Gum open forest or woodland	HU808	Cabbage Gum-Rough-barked Apple grassy woodland	PCT ideal	PCT ideal
7	FR Reg	Forest Redgum Regrowth	HU526	Cabbage Gum open forest or woodland	HU808	Cabbage Gum-Rough-barked Apple grassy woodland	PCT ideal	PCT ideal
8	GB	Grey Box Red Gum Grey Ironbark Woodland	HU549	Grey Box - Forest Red Gum - Grey Ironbark open forest	HU549	Grey Box - Forest Red Gum - Grey Ironbark open forest	HU910	Blakely's Red Gum - Rough-barked Apple shrubby woodland
9	GB Reg	Grey Box Red Gum Grey Ironbark Regrowth	HU549	Grey Box - Forest Red Gum - Grey Ironbark open forest	HU549	Grey Box - Forest Red Gum - Grey Ironbark open forest	HU910	Blakely's Red Gum - Rough-barked Apple shrubby woodland
10	TG Reg	Grey Gum Stringybark Tallowwood Regrowth	HU644	Tallowwood - Small-fruited Grey Gum dry grassy open forest	As for BVT	As for BVT	HU646	Tallowwood open forest
11	TG Rep	Grey Gum Stringybark Tallowwood Replanting	HU644	Tallowwood - Small-fruited Grey Gum dry grassy open forest	As for BVT	As for BVT	HU646	Tallowwood open forest

Veg Zone	Niche Code	Niche Veg Type	BVT_Code	BVT_short	PCTcode_ideal	PCT_ideal_short	PCTcode_used	PCT_used_short
12	TG	Grey Gum Stringybark Tallowwood Tall Open Forest	HU644	Tallowwood - Small-fruited Grey Gum dry grassy open forest	As for BVT	As for BVT	HU646	Tallowwood open forest
13	RGIB	Narrow-leaved Red Gum Ironbark Woodland	NR197	Narrow-leaved Red Gum woodlands	HU703	Narrow-leaved Red Gum woodlands	HU906	Bull Oak grassy woodland
14	RG Ang	Red Gum Angophora Mahogany Woodland	NR197	Narrow-leaved Red Gum woodlands	HU703	Narrow-leaved Red Gum woodlands	HU906	Bull Oak grassy woodland
15	RGIB Mel	Red Gum Grey Ironbark Paperbark Forest	NR197	Narrow-leaved Red Gum woodlands	HU703	Narrow-leaved Red Gum woodlands	HU906	Bull Oak grassy woodland
16	RG Reg	Red Gum Grey Ironbark Paperbark Regrowth	NR197	Narrow-leaved Red Gum woodlands	HU703	Narrow-leaved Red Gum woodlands	HU906	Bull Oak grassy woodland
17	SI	Spotted Gum Ironbark Forest	HU630	Spotted Gum - Grey Ironbark forest dry open forest	HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	PCT ideal	PCT ideal
18	SI Reg	Spotted Gum Ironbark Regrowth	HU630	Spotted Gum - Grey Ironbark forest dry open forest	HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	PCT ideal	PCT ideal
19	SI Rep	Spotted Gum Ironbark Replanting	HU630	Spotted Gum - Grey Ironbark forest dry open forest	HU763	Tallowwood - Spotted Gum - Grey Gum grassy tall open forest	PCT ideal	PCT ideal
20	SM	Swamp Mahogany Forest	HU633	Swamp Mahogany swamp forest	No change	No change	No change	No change
21	SO	Swamp Oak Forest	HU635	Swamp Oak swamp forest	No change	No change	No change	No change
22	SO Reg	Swamp Oak Forest Regrowth	HU635	Swamp Oak swamp forest	No change	No change	No change	No change
23	SO Rep	Swamp Oak Replanting	HU635	Swamp Oak swamp forest	No change	No change	No change	No change

Appendix B: Alignment of Veg Types to TECs, Red Flags and Keith formations and classes (sorted by Formation and Class)

Veg Zone	Niche Code	Niche Veg Type	Keith Formation	Keith Class	RedFlag_nswTEC	RedFlag_Cleared (originally aligned BVT)
6	FR Rep	Forest Redgum Replanting	Forested Wetlands	Coastal Floodplain Wetlands	Not a TEC	n/a
7	FR Reg	Forest Redgum Regrowth	Forested Wetlands	Coastal Floodplain Wetlands	Not a TEC	No (70%)
21	SO	Swamp Oak Forest	Forested Wetlands	Coastal Floodplain Wetlands	Swamp Oak Floodplain Forest	Yes (75%)
22	SO Reg	Swamp Oak Forest Regrowth	Forested Wetlands	Coastal Floodplain Wetlands	Swamp Oak Floodplain Forest	Yes (75%)
23	SO Rep	Swamp Oak Replanting	Forested Wetlands	Coastal Floodplain Wetlands	Not an TEC	n/a
3	PT	Swamp Paperbark Thicket	Forested Wetlands	Coastal Swamp Forests	Swamp Sclerophyll Forest	Yes (75%)
4	DP	Derived Swamp Paperbark Thicket	Forested Wetlands	Coastal Swamp Forests	Swamp Sclerophyll Forest	Yes (75%)
20	SM	Swamp Mahogany Forest	Forested Wetlands	Coastal Swamp Forests	Swamp Sclerophyll Forest	No (60%)
8	GB	Grey Box Red Gum Grey Ironbark Woodland	Grassy Woodlands	Coastal Valley Grassy Woodlands	Not a TEC	No (45%)
9	GB Reg	Grey Box Red Gum Grey Ironbark Regrowth	Grassy Woodlands	Coastal Valley Grassy Woodlands	Not a TEC	No (45%)
13	RGIB	Narrow-leaved Red Gum Ironbark Woodland	Grassy Woodlands	Coastal Valley Grassy Woodlands	Not a TEC	No (40%)
14	RG Ang	Red Gum Angophora Mahogany Woodland	Grassy Woodlands	Coastal Valley Grassy Woodlands	Not a TEC	No (40%)
15	RGIB Mel	Red Gum Grey Ironbark Paperbark Forest	Grassy Woodlands	Coastal Valley Grassy Woodlands	Subtropical Coastal Floodplain Forest (below 1:100 year flood)	No (40%)
16	RG Reg	Red Gum Grey Ironbark Paperbark Regrowth	Grassy Woodlands	Coastal Valley Grassy Woodlands	Subtropical Coastal Floodplain Forest (below 1:100 year flood)	No (40%)
5	FG	Flooded Gum Brush Box Tall Forest	Wet Sclerophyll Forests	North Coast Wet Sclerophyll Forests	Not a TEC	No (55%)
1	BT Reg	Blackbutt Tallowwood Regrowth	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (55%)
2	BT	Blackbutt Tallowwood Tall Open Forest	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (55%)

Veg Zone	Niche Code	Niche Veg Type	Keith Formation	Keith Class	RedFlag_nswTEC	RedFlag_Cleared (originally aligned BVT)
10	TG Reg	Grey Gum Stringybark Tallowwood Regrowth	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (30%)
11	TG Rep	Grey Gum Stringybark Tallowwood Replanting	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	n/a
12	TG	Grey Gum Stringybark Tallowwood Tall Open Forest	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (30%)
17	SI	Spotted Gum Ironbark Forest	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (35%)
18	SI Reg	Spotted Gum Ironbark Regrowth	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	No (35%)
19	SI Rep	Spotted Gum Ironbark Replanting	Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Not a TEC	n/a

Appendix C: Niche vegetation types compared to previous on-site vegetation mapping

Niche Vegetation Type (2011)	Whelans Insites (2009)	Connell Wagner (2004)	Greater Taree City Council Types	Forest Ecosystems (NPWS 1999)
Blackbutt Tallowwood Tall Open Forest	-	Dry Grassy Blackbutt Tallowwood Complex	4	FE 34
Small-fruited Grey Gum Stringybark Tallowwood Tall Open Forest	Grey Gum Tallowwood Forest	Grey Gum Complex	3b, 3c	FE 36
Flooded Gum Brush Box Tall Forest	Flooded Gum Turpentine Forest	Flooded Gum Complex	1a	FE 154
Spotted Gum Ironbark Forest	Spotted Gum Ironbark Forest	Spotted Gum Complex	4b	-
Grey Box Red Gum Grey Ironbark Woodland	-	Grey Box, Red Gum, Grey Ironbark Complex	3h	FE 54
Forest Red Gum Open Woodland	-	-	Loosely 6	FE 36
Narrow-leaved Red Gum Ironbark Woodland	Grey Gum Ironbark Forest	Part of Grey Gum Complex	Loosely 6	-
Narrow-leaved Red Gum Angophora Mahogany Woodland	Grey Gum Ironbark Forest	Redgum – Apple Complex	Loosely 3b	-
Narrow-leaved Red Gum Grey Ironbark Paperbark Forest	Grey Gum Ironbark Forest	-	Loosely 3b	-
Herbfield	-	-	-	FE 141
Swamp Paperbark Thicket and Derived type	-	-	15	FE 112
Swamp Mahogany Forest	-	Swamp Mahogany Complex	14a	FE 142
Swamp Oak Forest	-	Swamp Oak Complex	7	FE 143

Appendix D: Flora Recorded During the Field Survey

Acacia blakei ssp. diphylla
Acacia floribunda
Acacia maidenii
Acacia myrtifolia
Acacia ulicifolia
Acianthus fornicatus
Acmena smithii
Acronychia oblongifolia
Allocasuarina littoralis
Alphitonia excelsa
*Andropogon virginicus**
Angophora subvelutina
Aristida vagans
*Axonopus fissifolius**
Banksia spinulosa var. collina
Baumea articulata
Billardiera scandens
Blechnum indicum
Breynia oblongifolia
Brunoniella australis
Caesia parviflora
Caladenia catenata
Callistemon citrinus
Callistemon salignus
Calochlaena dubia
Carex appressa
Cassine australis
Casuarina glauca
Centella asiatica
Cheilanthes sieberi
*Chenopodium album**
Chorizandra cymbaria
Christella dentata
*Cinnamomum camphora**
*Cirsium vulgare**
Convolvulus erubescens
*Conyza sp.**
Corybas dowlingii
Corymbia intermedia
Corymbia maculata
Cryptocarya microneura
Cryptostylis sp.
Cymbopogon refractus
Cynodon dactylon
*Cyperus congestus**
Cyperus sp.
Daviesia genistifolia
Daviesia ulicifolia
Desmodium gunnii
Desmodium rhytidophyllum
Dianella caerulea var. producta
Dianella revoluta
Dichondra repens
Digitaria parviflora
Echinopogon caespitosus
Entolasia marginata
Entolasia stricta
Eragrostis benthamii
Eragrostis brownii
Eucalyptus amplifolia
Eucalyptus carnea
Eucalyptus eugenioides
Eucalyptus glaucina
Eucalyptus globoidea
Eucalyptus grandis
Eucalyptus microcorys
Eucalyptus pilularis
Eucalyptus propinqua
Eucalyptus resinifera
Eucalyptus robusta
Eucalyptus seeana
Eucalyptus siderophloia
Eucalyptus tereticornis
Euchiton sphaericus
Eustrephus latifolius
Exocarpus cupressiformis
Fimbristylis dichotoma
Gahnia clarkei
Gahnia sieberiana
Galium sp.
Geitonoplesium cymosum
Glochidion ferdinandi var. ferdinandi
Glochidion ferdinandi var. pubens
Glycine clandestina
Glycine microphylla
Glycine tabacina
Gonocarpus teucrioides
Goodenia sp.
Gymnostachys anceps
Hemarthria uncinata
Hibbertia aspera
Hibbertia riparia
Hibbertia scandens
Hybanthus monopetalus
Hydrocotyle peduncularis
Hypericum gramineum
*Hypochaeris radicata**
Hypolepis muelleri
Imperata cylindrica
Jacksonia scoparia
Juncus usitatus
Lagenophora gracilis
Lagenophora stipitata
*Lantana camara**
Leptospermum polygalifolium
Leucopogon juniperinus
Lomandra filiformis spp. filiformis
Lomandra longifolia
Lomandra multiflora ssp. multiflora
Lophostemon confertus
Marsdenia suaveolens
Melaleuca ericifolia
Melaleuca linariifolia
Melaleuca nodosa
Melaleuca quinquenervia
Melaleuca sieberi
Melaleuca styphelioides
Microlaena stipoides
Mitrasacme sp.
Morinda jasminoides
Myrsine howittiana
Myrsine variabilis
Neolitsea dealbata
Notelaea longifolia
Notothixos incanus
Opercularia sp.
Oplismenus aemulus
Oplismenus imbecillus
Oxalis exilis
Oxalis perennans
Ozothamnus diosmifolius
Pandorea pandorana
Panicum simile
Parsonsia straminea
Paspalidium distans
*Paspalum dilatatum**
Persicaria sp.
Persoonia linearis
Philydrum lanuginosum
Pimelea linifolia
Pittosporum revolutum
Pittosporum undulatum
*Plantago lanceolata**
Platycerium bifurcatum
Plectorrhiza tridentata
Poa labillardierei var. labillardierei
Podolobium scandens
Pomaderris sp.
Pratia purpurascens
Pseuderanthemum variabile
Pteridium esculentum
Pterostylis sp.

Pultenaea rosmarinifolia
Ranunculus inundatus
Rubus moluccanus
*Rubus ulmifolius**
Sannantha similis
Schoenus paludosus
*Senecio madagascariensis**
*Setaria parviflora**
Smilax glyciphylla
*Solanum mauritianum**
Stephania japonica
Syncarpia glomulifera
Tricoryne elatior
*Verbena bonariensis**
Vernonia cinerea
Veronica calycina
Viola betonicifolia
Viola hederacea

Appendix E: Fauna Recorded During the Field Survey

Common Name	Scientific Name	Observation Type
Mammals - Native		
Brown Antechinus	*Antechinus stuartii*	T
Bush Rat	*Rattus fuscipes*	T
Swamp Rat*	*Rattus lutreolus*	I
Brush-tailed Phascogale	*Phascogale tapoatafa*	T
Eastern Grey Kangaroo	*Macropus giganteus*	O
Red-necked Wallaby	*Macropus rufogriseus*	O
Feathertail Glider*	*Acrobates pygmaeus*	I
Sugar Glider	*Petaurus breviceps*	IHT
Long-nosed Bandicoot	*Perameles nasuta*	C
Brushtail Possum	*Trichosurus vulpecula*	IOT
Ringtail Possum	*Pseudocheirus peregrinus*	C
Little Forest Bat	*Vespadelus vulturnus*	T
Grey-headed Flying Fox	*Pteropus poliocephalus*	OH
Mammals - Introduced		
Hare	*Lepus europaeus*	O
Rabbit	*Oryctolagus cuniculus*	O
Black Rat	*Rattus rattus*	T
House Mouse	*Mus musculus*	IO
Red Fox	*Vulpes vulpes*	O
Feral Cat	*Felis catus*	I
Frogs		
Common Eastern Froglet	*Crinia signifera*	H
Striped Marsh Frog	*Limnodynastes peronii*	H
Wallum Rocket Frog	*Litoria freycineti*	O
Verreaux's Tree Frog	*Litoria verreauxii*	H
Birds		
Australasian Grebe	*Tachybaptus novaehollandiae*	O
Australasian Shoveller	*Anas rhyncotis*	O
Australian Hobby	*Falco longipennis*	O
Australian Magpie	*Gymnorhina tibicen*	OH
Australian Owlet Nightjar	*Aegotheles cristatus*	H
Australian Raven	*Corvus coronoides*	H
Australian Wood Duck	*Chenonetta jubata*	O

Common Name	Scientific Name	Observation Type
Barn Owl	*Tyto javanica*	OH
Black Duck	*Anas superciliosa*	O
Black Swan	*Cygnus atratus*	O
Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	OH
Black-necked Stork	*Ephippiorhynchus australis*	O
Black-shouldered Kite	*Elanus axillaris*	O
Brown Falcon	*Falco berigora*	O
Brown Gerygone	*Gerygone mouki*	H
Brown Thornbill	*Acanthiza pusilla*	H
Buff-rumped Thornbill	*Acanthiza reguloides*	O
Cattle Egret	*Ardea ibis*	O
Comb-crested Jacana	*Irediparra gallinacea*	O
Eastern Rosella	*Platycercus eximius*	OH
Eastern Spinebill	*Acanthorhynchus superciliosus*	OH
Eastern Whipbird	*Psophodes olivaceus*	H
Eastern Yellow Robin	*Eopsaltria australis*	O
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	H
Galah	*Eolophus roseicapillus*	OH
Golden Whistler	*Pachycephala pectoralis*	OH
Golden-headed Cisticola	*Cisticola exillis*	O
Great Egret	*Ardea alba*	O
Grey Butcherbird	*Cracticus torquatus*	H
Grey Fantail	*Rhipidura albiscapa*	OH
Grey Goshawk	*Accipiter novaehollandiae*	O
Grey Shrike Thrush	*Colluricincla harmonica*	OH
Grey Teal	*Anas Gracilis*	O
Laughing Kookaburra	*Dacelo novaeguineae*	H
Lewins Honeyeater	*Meliphaga lewinii*	H
Little Black Cormorant	*Phalacrocorax sulcirostris*	O
Little Lorikeet	*Glossopsitta pusilla*	OH
Little Wattlebird	*Anthochaera chrysoptera*	H
Magpie Lark	*Grallina cyanoleuca*	OH
Masked Lapwing	*Vanellus miles*	OH
Masked Owl	*Tyto novaehollandiae*	H
Mistletoebird	*Dicaeum hirundinaceum*	H
Musk Lorikeet	*Glossopsitta concinna*	OH
Nankeen Kestrel	*Falco cenchroides*	O

Common Name	Scientific Name	Observation Type
New Holland Honeyeater	*Phylidonyris novaehollandiae*	OH
Noisy Friarbird	*Philemon corniculatus*	H
Noisy Miner	*Manorina melanocephala*	OH
Peregrine falcon	*Falco peregrinus*	O
Pheasant Coucal	*Centropus phasianinus*	O
Pied Butcherbird	*Cracticus nigrogularis*	OH
Pied Cormorant	*Phalacrocorax varius*	O
Purple Swamphen	*Porphyrio porphyrio*	O
Rainbow Lorikeet	*Trichoglossus haematodus*	OH
Red Wattlebird	*Anthochaera carunculata*	OH
Red-browed Finch	*Neochmia temporalis*	OH
Richards Pipit	*Anthus novaeseelandiae*	O
Rose Robin	*Petroica rosea*	H
Royal Spoonbill	*Platalea regia*	O
Rufous Whistler	*Pachycephala rufiventris*	OH
Scarlet Robin	*Petroica boodang*	O
Silvereye	*Zosterops lateralis*	H
Southern Boobook Owl	*Ninox novaeseelandiae*	H
Spangled Drongo	*Dicrurus bracteatus*	O
Spotted Pardolate	*Pardalotus punctatus*	H
Straw-necked Ibis	*Threskiornis spinicollis*	O
Striated Pardalote	*Pardalotus quadragintus*	H
Striated Thornbill	*Acanthiza lineata*	OH
Superb Fairy Wren	*Malurus cyaneus*	H
Superb Lyrebird	*Menura novaehollandiae*	OH
Tawny Frogmouth	*Podargus strigoides*	O
Torresian crow	*Corvus orru*	H
Varied Sittella	*Daphoenositta chrysoptera*	OH
Weebill	*Smicrornis brevirostris*	H
Welcome Swallow	*Hirundo neoxena*	O
White-browed Scrubwren	*Sericornis frontalis*	H
White-cheeked Honeyeater	*Phylidonyris nigra*	OH
White-faced Heron	*Egretta novaehollandiae*	O
White-throated Treecreeper	*Cormobates leucophaeus*	OH
White-winged Chough	*Corcorax melanorhamphos*	O
willie wagtail	*Rhipidura leucophrys*	O
Wonga Pigeon	*Leucosarcia melanoleuca*	OH

Common Name	Scientific Name	Observation Type
Yellow Thornbill	*Acanthiza nana*	O
Yellow-billed Spoonbill	*Platalea flavipes*	O
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OH
Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*	H

Key: O = Observed, H = Heard, T = Trapped, C = Camera Trap I = Indirect Evidence such as scats, hair or feeding signs. * indicates probable identification through hair analysis.

Appendix F: Threatened fauna predicted

Common Name	Scientific Name	Tg value
Barking Owl	*Ninox connivens*	0.33
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	0.75
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	0.5
Bush Stone-curlew	*Burhinus grallarius*	0.38
Common Blossom-bat	*Syconycteris australis*	0.83
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	0.75
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	0.45
Eastern Freetail-bat	*Mormopterus norfolkensis*	0.45
Flame Robin	*Petroica phoenicea*	0.75
Freckled Duck	*Stictonetta naevosa*	0.75
Gang-gang Cockatoo	*Callocephalon fimbriatum*	0.5
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	0.55
Greater Broad-nosed Bat	*Scoteanax rueppellii*	0.45
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	0.75
Grey-headed Flying-fox	*Pteropus poliocephalus*	0.93
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	0.6
Little Bentwing-bat	*Miniopterus australis*	0.75
Little Eagle	*Hieraaetus morphnoides*	0.73
Little Lorikeet	*Glossopsitta pusilla*	0.58
Long-nosed Potoroo	*Potorous tridactylus*	0.75
Masked Owl	*Tyto novaehollandiae*	0.33
Powerful Owl	*Ninox strenua*	0.33
Red-legged Pademelon	*Thylogale stigmatica*	0.38
Regent Honeyeater	*Anthochaera phrygia*	0.38
Rose-crowned Fruit-Dove	*Ptilinopus regina*	0.75
Scarlet Robin	*Petroica boodang*	0.75
Southern Myotis	*Myotis macropus*	0.45
Speckled Warbler	*Chthonicola sagittata*	0.38
Spotted-tailed Quoll	*Dasyurus maculatus*	0.38
Square-tailed Kite	*Lophoictinia isura*	0.73
Squirrel Glider	*Petaurus norfolcensis*	0.45
Superb Fruit-Dove	*Ptilinopus superbus*	0.75
Swift Parrot	*Lathamus discolor*	0.75
Turquoise Parrot	*Neophema pulchella*	0.55
Varied Sittella	*Daphoenositta chrysoptera*	0.75
White-fronted Chat	*Epthianura albifrons*	0.75
Wompoo Fruit-Dove	*Ptilinopus magnificus*	0.75
Yellow-bellied Glider	*Petaurus australis*	0.43
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	0.45