INDEPENDENT PEER REVIEW OF OFFSETS FOR THE MAULES CREEK MINE PROJECT - EPBC 2010/5566

Prepared for
Whitehaven Coal Pty Ltd
by

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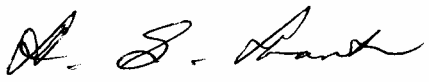
Signed:	
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Table Of Contents

Table Of Contents

Table Of Contents

Table Of Contents

Table Of Appendices

List of Tables

List of Figures

List of Photographs

Executive Summary

BACKGROUND AND PURPOSE

Alison Martin, Director of Greenloaning Biostudies, was commissioned by Whitehaven Coal Limited (Whitehaven) in June 2013 to undertake an independent review of the condition and quantity of proposed biodiversity offsets for the Maules Creek Mine Project (the Project) near Boggabri, NSW. The review is required as part of the Commonwealth Approval Conditions for the Project under s 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). Condition 10 states that:

> *'The person taking the action must verify through **independent review** the quantity and **condition class** of White Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and the quantity and quality of habitat for the regent honeyeater, swift parrot and greater long-eared bat within all proposed **offset areas** including those proposed in the **Environmental Assessment**, as defined in Attachment C of these conditions, and any additional offsets as required at condition 9….'*

Condition 10 also requires that the offsets must meet the requirements prescribed in Conditions 9, 12 and 12b of the Approval. Condition 9 dictates the total amount of Critically Endangered Ecological Community (CEEC) and habitats that must be provided, either separately or combined if appropriate, viz:

> *'a. 9,334 ha of an equivalent or better quality of habitat for the regent honeyeater, swift parrot and greater-long-eared bat; and*
>
> *b. 5,532 ha of an equivalent or better quality of the White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Grassland ecological Community.'*

Condition 12 prescribes the necessity for the offset areas to be of equivalent or better quality overall than the areas to be cleared, meaning that:

- *for White Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, **offset areas** must meet the definition of the ecological community described in the listing, and must be of an overall equivalent or better condition class than the areas being cleared, based on the proportion of each condition class represented and the other relevant ecological attributes;*
- *for the threatened species, the quality of the habitat for the species, taking account of its ecological requirements, must be equivalent to or better than the areas being cleared.'*

It is also noted that under Condition 11, if this review finds that the current offset areas do not meet fully the requirements of the above conditions, additional offset areas must be provided to the extent necessary to ensure compliance.

The purpose of this report is to provide a comprehensive assessment of the attributes identified within the offset properties and the extent to which these attributes may, or may not, conform to the offset requirements as stipulated in the Approval Conditions. The review and associated assessments have been prepared in this context and do not reflect either support for, or opposition to the Maules Creek project, or a specific view on the value or concept of offsets per se.

The Project entails the development and operation of an open cut coal mine over a period of at least 21 years and the development of supporting surface infrastructure. The Project Site encompasses a substantial portion of the western sector of Leard State Forest, as well as a sector of private land adjoining the forest to the west and north. There is a range of forest and woodland vegetation types occurring within the Project Site, with some grazing and agricultural lands also occurring in the western sector. A number of communities have been determined from the EIA process to conform to the CEEC *Box-Gum Woodland and Derived Grasslands* community. The Leard State Forest also was confirmed during the recent EIA studies as known habitat for the South-eastern Long-eared Bat (formerly known as the Greater Long-eared Bat) and as potential habitat for the Swift Parrot and Regent Honeyeater.

Development of the project will require staged clearing of 1,665.85 ha of forest/woodland vegetation and habitats and 512.59 ha of Derived Native Grassland and other grasslands.

Offsets

The offsets that are the subject of this peer review are intended to compensate for the residual biodiversity impacts from the Project and comprise a set of land packages referred to as the 'Northern,' 'Eastern' and 'Western' Offsets. The Eastern and Western Offset properties are either adjacent to Leard State Forest and/or Leard State Conservation Area, or are in immediate proximity. The Northern Offsets are located approximately 15 km to the north/northeast of Leard State Forest and 12 km from the Eastern Offsets. The combined offsets support an array of forest/woodland vegetation, grasslands and agricultural land. All offset properties have been utilised over a period of many decades for agricultural-based activities, primarily sheep and cattle grazing, cropping and timber harvesting.

One property included in the offset package for the Maules Creek Project is under shared ownership with Boggabri Coal and is referred to as the 'Shared Offsets.' Since the commencement of the peer review process, some additional properties also have been added to the offset package. These properties comprise:

1. Roseglass;
2. Oakleigh/Onavale; and
3. Bimbooria.

The Roseglass property is located immediately to the west of Vickery State Forest, approximately 15 km to the south-east of Leard State Forest. The combined offset properties of Oakleigh and Ona vale are located immediately adjacent to Leard State Forest on the north-eastern extremity of the forest. The Bimbooria Offset is located immediately to the north-east of, and adjoining the Roseglass Offset. All additional offsets support varying amounts of forest /woodland habitats, some of which represent the *Box-Gum Woodland and Derived Grasslands* and/or potential foraging habitat for one or more of the subject threatened fauna species.

Review Methodology

The focus of the required review was very specific as determined by the Approval Conditions and the range of procedures employed during the review process reflects this focus. The methods utilised encompassed desktop reviews of existing data on the Project Site and offsets, site inspections and surveys, reviews of relevant key definitions and criteria for the *Box-Gum Woodland* CEEC and threatened fauna species requirements, GIS mapping, data collation and analysis and preliminary and final assessments of results. A key objective of the procedures was to develop a robust basis for the offset assessment process.

The review procedures encompassed a strong focus on reviewing the key definitions for the *Box-Gum Woodland and Derived Grasslands* CEEC and determining the appropriate field data collection procedures for both the CEEC review and evaluation of fauna species habitats. Additionally, it was a requirement of the review process to consider the quantity and quality of the subject threatened fauna species habitat in accordance with the definitions and guidance provided in section 2C of the document 'How to use the Offsets Assessment Guide.'

The main limitation to the field assessment process was associated with the seasonal conditions, with the timing of the review period coinciding with a prolonged period of drought in both the Project Site and Offset areas. The situation was similar however for both the Project Site and the offset properties and some allowance for the seasonally poor conditions was therefore incorporated into the assessment process.

Key Peer Review Outcomes

Box-Gum Woodland and Derived Grasslands

Desktop comparisons of the Ecological Impact Assessment (EIA) plot data with both mapped vegetation community units and conformance to the CEEC criteria (where applicable) found the majority of plot data to correspond with the mapped units. EIA plot data for areas mapped as good condition CEEC also conformed to the criteria for the community. General observations by the author of this review suggested that there has been extensive understorey regeneration throughout much of the Leard State Forest since the 1970s, particularly of cypress pine. Continuation of this type of regeneration is likely to reduce the value of the CEEC over time.

The majority of areas inspected conformed to the definition of the CEEC, with some sectors of non-conformance. The CEEC was most represented by White Box communities in the Eastern/Western offsets and in the southern portion of the Northern Offset properties and by Yellow Box-Blakely's Red Gum communities in the northern sector of the Northern Offset. Areas that did not conform to the CEEC definition were excluded from the CEEC and the total area of the community recalculated for the offset properties. The final extent of good condition *Box-Gum Woodland* provided by the offsets, including the additional offsets of Roseglass, Oakleigh/Onavale and Bimbooria, is 3,827.7 ha and low to moderate condition *Box-Gum Woodland* totals 1,874.2 ha. The full extent of the CEEC provided by the total proposed offset package is approximately 5,703 ha.

Threatened Fauna

Swift Parrot

Surveys for the EIA yielded no records of the Swift Parrot from the Project site, nor from offset areas. The Project Site however, was recognised during the EIA process as providing potential stepping stone habitat for the species between larger expanses of vegetation to the west and north. Potential foraging habitat identified for the Swift Parrot within the Project Site encompassed all forest and woodland types occurring within the general box–ironbark habitat.

The majority of woodland/forest habitat occurring on the offset properties was considered to represent suitable foraging habitat for the Swift Parrot equivalent to, or better quality than the the habitats represented within the Project Site. Additional large areas of open woodland, small habitat patches and vegetated drainage lines within the offset properties also represent low to moderate condition habitat for the species equivalent or better in habitat value than the low to moderate condition habitat occurring within the Project site. In general, a number of attributes of the offsets were considered to render the habitats of equivalent or better quality than the Project Site habitats as potential forage habitat for the Swift Parrot, including: more extensive representation of drainage line habitat, more extensive occurrence of Yellow Box, including sectors supporting large mature trees in both the Eastern and Northern Offsets; and potential occurrence of the favoured food tree species, the Mugga Ironbark, in the south-eastern sector of the Northern Offsets.

Regent Honeyeater

The EIA surveys yielded no records of the Regent Honeyeater from either the Project site or the offset areas and no other surveys recently conducted in the area, encompassing the Shared Offset and the Roseglass, Bimbooria and Oakdale additional offset properties, have detected the species. The Project Site, Eastern, Western and Shared Offsets and additional offset properties however, are within the historical range of the species and the Northern Offsets are within the vicinity of one of the four key known breeding areas for the species – the Barraba–Bundarra area. Potential foraging habitat was identified for the Regent Honeyeater within the Project Site and encompassed all forest and woodland types within the general box–ironbark habitat.

The majority of woodland/forest habitat occurring on the offset properties was considered to represent suitable foraging habitat for the Regent Honeyeater of equivalent to, or better quality than the habitats represented within the Project Site. The suspected occurrence of one of the forage tree species favoured by the Regent Honeyeater, the Mugga Ironbark, adds value to the Northern Offsets as potential habitat for the honeyeater. Additionally, the offsets provide the habitat value of more extensive representation of drainage lines, including sheltered watercourses encompassed by the favoured box–ironbark habitat.

South-eastern Long-eared Bat

Records of the South-eastern Long-eared Bat were detected from within Leard State Forest during the EIA surveys and the removal of 1665 ha of woodland/forest habitat for the Project was recognised as likely to have a significant impact on the local occurrence of the species. Other records for the species closest to either the Project Site or offsets are from the Mount Kaputar National Park, in habitat immediately adjacent to the south-eastern extremity of the Northern Offset.

Suitable foraging habitat for the South-eastern Long-eared Bat was observed on the Project Site and large portions of the woodland/forest habitat occurring on the offset properties are considered to represent suitable foraging habitat for the species. The offset habitats generally are considered to be of equivalent to, or better quality overall, than the habitats represented within the Project Site. This assessment takes into account all habitat features assessed. Favourable attributes represented on the offset sites, particularly on the Northern Offset properties, include; the occurrence of large habitat patches; connectivity with very large areas of high quality known habitat (Mount Kaputar National Park); prevalence of dense/complex shrubby habitat; and occurrence of high quality drainage line habitat.

The potential for habitat value to be affected adversely in the long term by dense cypress pine regeneration applies to the Project Site and offset properties alike.

Conclusions

The results from the combined desktop assessments, field inspections, surveys and data analysis has led to the conclusion that the proposed offset package complies with Conditions 9, 10 and 12, providing that the additional offset properties of Roseglass, Oakleigh/Onavale and Bimbooria are included as offsets. Reviews of the quantity and condition class of the *White Box–Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC determined that most areas of offset vegetation conformed to the CEEC definition but some adjustments were required to the offset calculations. It was therefore recommended that additional offsets supporting areas of the CEEC were required to fulfil the Approval Conditions. With the addition of the Roseglass, Oakleigh/Onavale and Bimbooria properties, providing a further 728 ha of CEEC, the requirement for the Maules Creek offsets to provide a total of 5532 ha of the *CEEC* is fulfilled.

A total of 3,827.7 ha of Box-Gum Woodland was assessed as conforming to good condition for the CEEC, with a further 1874.2 ha being of low to moderate condition. The overall

conclusion is that the offsets comply with the requirement for equivalent or better quality CEEC in relation to the Project Site CEEC.

As for the CEEC assessments, the desktop assessments confirmed the vegetation community mapping, relevant to habitat for the Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat, to be reasonably accurate. Some minor adjustments to habitat areas were made and one more significant adjustment was made for the Northern Offsets that resulted in an increase in the total area of suitable habitat within the offset site. In conjunction with the habitat provided by the inclusion of the additional offsets, the total quantity of offset habitat provided is 12,035 ha, complying with the 9334 ha specified in the Approval Conditions.

The review found most areas of forest/woodland habitat inspected or surveyed within the offsets to be in moderate to good condition. The total offset habitat comprises 6,355 ha of good condition habitat suitable for the subject threatened fauna species combined and 5,323 ha of low to moderate condition habitat, representing varying levels of habitat value to these species. The low to moderate condition habitat incorporates woodland/ forest areas with lower quality understorey or ground cover development, small vegetation patches and other vegetation types that would provide some potential as foraging habitat for one or more of the Swift Parrot, Regent Honeyeater and/or South-eastern Long-eared Bat, equivalent to the lower quality habitat of the Project Site.

The conclusion therefore is that the offsets comply overall with the requirement for equivalent or better quality habitats for the three subject threatened fauna species in relation to the Project Site habitats.

Recommendations

On the basis of the peer review assessments and findings, it is recommended that the additional offsets of Roseglass, Oakleigh/Onavale and Bimbooria be included in the offset package for the Project. It is also recommended that, for the purposes of development and ongoing management of the offset properties, the vegetation and habitat mapping be refined and amended to take account of the revisions identified during the peer review process. Verification of the additional offset community boundaries and habitats, taking into account the verification processes employed for the purposes of this peer review, is also strongly recommended.

Chapter

1

Introduction

1.1 BACKGROUND

Alison Martin, Director of Greenloaning Biostudies, was commissioned by Whitehaven Coal Limited (Whitehaven) in June 2013 to undertake an independent review of the condition and quantity of proposed biodiversity offsets for the Maules Creek Mine Project (the Project) near Boggabri, NSW. The Project was approved in February 2013 and the review is required as part of the Commonwealth Conditions of Consent for the Project (Department of Sustainability, Environment, Water, Population and Communities, [DSEWPAC] 2013) under s 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). Condition 10 states that:

> *'The person taking the action must verify through **independent review** the quantity and **condition class** of White Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and the quantity and quality of habitat for the regent honeyeater, swift parrot and greater long-eared bat within all proposed **offset areas** including those proposed in the Environmental Assessment, as defined in Attachment C of these conditions, and any additional offsets as required at condition 9….'*

Condition 10 also requires that the offsets must meet the requirements prescribed in Conditions 9, 12 and 12b of the Approval. Condition 9 dictates the total amount of Critically Endangered Ecological Community (CEEC) and habitats that must be provided, either separately or combined if appropriate, viz:

> *'a. 9,334 ha of an equivalent or better quality of habitat for the regent honeyeater, swift parrot and greater-long-eared bat; and*
>
> *b. 5,532 ha of an equivalent or better quality of the White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Grassland ecological Community.'*

Condition 12 prescribes the necessity for the offset areas to be of equivalent or better quality overall than the areas to be cleared, meaning that:

a. *for White Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, **offset areas** must meet the definition of the ecological community described in the listing, and must be of an overall equivalent or better condition class than the areas being cleared, based on the proportion of each condition class represented and the other relevant ecological attributes;*

b. *for the threatened species, the quality of the habitat for the species, taking account of its ecological requirements, must be equivalent to or better than the areas being cleared.'*

It is also noted that under Condition 11, if this review finds that the current offset areas do not meet fully the requirements of the above conditions, additional offset areas must be provided to the extent necessary to ensure compliance.

On the basis of the above conditions, key aspects of the review process undertaken by Greenloaning Biostudies identified as essential in order to fulfil the peer review requirements and ensure compliance with Conditions 9, 10 and 12 are as follows:

- A comprehensive review of all aspects of the listing advice for the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community* (Box-Gum Woodland) relevant to determining conformity of offset vegetation to the community definition and the defined condition classes;

- Assessing the extent and condition of Box-Gum Woodland and relevant attributes of the area to be cleared within the project area and the corresponding extent and condition within the offset properties

- Gaining a thorough appreciation of the existing condition of areas to be affected by mining to enable comparative assessments with the quality and condition of the proposed offset communities and habitats;

- A review of relevant data, habitat requirements, listing/conservation advice and recovery plans for each of the threatened fauna species, viz; the Regent Honeyeater (*Anthochaera phrygia)*, Swift Parrot (*Lathamus discolor*) and the Greater Long-eared Bat, now known as the South-eastern Long-eared Bat (*Nyctophilus corbeni*);[1]

- Identifying the key habitat features present within the project area, relevant to each of the subject threatened fauna species; and

- Assessing the extent and quality of these habitat features within the area to be cleared in the Project Site and the corresponding extent and quality within the offset properties.

It was also required through correspondence to Whitehaven from the Commonwealth(dated 17th July 2013) that consideration of the ecological requirements of the subject threatened species 'be in accordance with the definitions and guidance provided in section 2C of the document How to use the offsets assessments guide.''

[1] The subject species referred to in Condition 10 of the Approval was formerly considered as part of the Greater-Long-eared Bat [*Nyctophilus timoriensis*] species complex but has been determined to be a separate species. The more recent taxonomic status of the species – the South-eastern Long-eared Bat (*Nyctophilus corbeni*) – is adopted for the purposes of this report, see Schulz and Lumsden (2010); Department of Environment (2013).

Details on the procedures employed for the review process and the understanding of the relevant definitions is provided in Chapter 2 of this peer review document.

1.2 PURPOSE OF REPORT AND APPROACH TO THE REVIEW PROCESS

The purpose of this report is to provide a comprehensive assessment of the attributes identified within the offset properties and the extent to which these attributes may, or may not, conform to the offset requirements as stipulated in Conditions 9, 10 and 12 for the Project Approval. The review and associated assessments have not been prepared within a framework of either support for, or opposition to the Maules Creek project, or the concept of offsets per se. The two key tasks of the review focus on the requirements of the Approval Conditions: firstly to review the level of compliance of the proposed offsets as presented in Attachment A of the conditions; and secondly to provide advice to Aston Coal (Whitehaven) regarding matters in which the offsets may not be compliant such that additional offsets may be provided, as per Condition 11.

The review process takes into account the most recent ecological studies and assessments undertaken for the Maules Creek Project which are relevant to the offsets package. A summary of the key aspects of the Project and offset provisions are presented in **Section 1.3.** The various procedures implemented to carry out the review are then detailed, with a focus on the key attributes examined and the understanding of definitions forming the basis for the offset assessments. Limitations to the review process are also discussed. Each of the subject components of the review are then considered individually, with each chapter encompassing a summary and discussion of the results from the review assessment process, discussion of other relevant matters, such as specific issues raised by various stakeholders and an assessment of the final outcomes. The final section of the report provides an overall assessment of the peer review outcomes, the level of compliance with Conditions 9, 10 and 12 of the Project Approval and relevant recommendations regarding the offset package.

1.3 PROJECT DESCRIPTION AND OFFSET PACKAGE

The following information has been drawn from the Ecological Impact Assessment (EIA) (Cumberland Ecology 2011) and the Biodiversity Management Plan (BMP) (Cumberland Ecology 2013) for the Project.

The Project entails the development and operation of an open cut coal mine over a period of at least 21 years and the development of supporting surface infrastructure. Contemporary mining methods and practices are to be implemented. Key aspects of the mining operation causing impacts on vegetation include:

- Extraction of up to 13 Million tonnes per annum (Mtpa) Run of Mine (ROM) coal from the Templemore Seam;
- Construction and operation of a Coal Handling and Preparation Plant;

- Construction and operation of a Tailings Drying Area;
- Construction and operation of a rail spur, rail loop, associated load out facility and connection to the Werris Creek to Mungindi Railway Line (WCMR);
- Construction and operation of a Mine Access Road, administration, workshop and related facilities;
- Construction and operation of water management infrastructure including a water pipeline, pumping station and associated infrastructure for access to water from the Namoi River;
- Installation of supporting power and communications infrastructure; and
- Construction and operation of explosive magazines and explosives storage areas.

The offsets that are the subject of this peer review are intended to compensate for the residual biodiversity impacts from the Project and comprise a set of land packages referred to as the 'Northern,' 'Eastern' and 'Western' Offsets. The Eastern and Western and Offset properties are either adjacent to Leard State Forest and/or Leard State Conservation Area or are in immediate proximity and support a mixture of forest/woodland vegetation, grasslands and agricultural land. The Northern Offsets are located approximately 15 km to the north/northeast of Leard State Forest and 12 km from the Eastern Offsets. The south-western sector of the Northern Offsets abuts Mount Kaputar National Park, whilst the north-eastern sector is contiguous with native forest/woodland connecting to Horton Falls National Park to the east. The Northern Offset properties support a combination of native forests/woodlands and grasslands, in varying stages of regeneration and/or condition. All offset properties have been utilised over a period of many decades for agricultural-based activities, primarily sheep and cattle grazing, cropping and timber harvesting.

1.4 KEY ATTRIBUTES OF PROJECT SITE AND OFFSETS

1.4.1 Project Site

The Project Site encompasses a substantial portion of the western sector of Leard State Forest, as well as a sector of private land adjoining the forest to the west and north. The topography within the Project Site varies from low-lying and almost flat or gently undulating to moderately steep, with a series of gullies and rocky knolls a key feature of the area. The latter are most evident in the western sector of the forest, whilst the more gentle topography occurs primarily in the northern sector of the Project Site. The forest supports a range of forest and woodland vegetation types, whilst the private land to the west and north supports some forest/woodland communities as well as grazing (grasslands) and agricultural (cultivated) lands.

The forest and woodland units have been described and mapped as part of a number of studies, including early ecological studies conducted by the author of this review (James B Croft and Associates 1979). The following descriptions and community definitions are drawn directly from the EIA and BMP (Cumberland Ecology, 2011, 2013), for which forest, woodland and derived grasslands have been distinguished. A full list of the communities identified for the Project Site and the area of each community as mapped by Cumberland Ecology, is provided in **Appendix A**.

The most extensive vegetation communities occurring within the Project Site have been identified as *Narrow-leaved Ironbark - White Cypress Pine Shrubby Open Forest* and *White Box - Narrow-leaved Ironbark - White Cypress Pine Grassy Open Forest*. A range of other communities have also been identified and mapped, but tend to cover only comparatively small areas. A number of communities have been determined from the EIA process to conform to the CEEC Box-Gum Woodland and Derived Grasslands community, the most extensive within the Project Site being the *White Box - Narrow-leaved Ironbark - White Cypress Pine Grassy Open Forest*. Derived native grassland communities have also been identified and distinguished on the basis of supporting either a high diversity in ground cover species or a low diversity. One such grassland community has been determined to conform to the definition of the CEEC, with patches of this community occurring in the northern and western sectors of the Project Site outside Leard State Forest. The main communities identified as occurring within the Project Site comprise:

Communities Determined as Conforming to CEEC Criteria

- *White Box-Narrow-leaved Ironbark-White Cypress Pine Grassy Open Forest*; and
- *Derived Native Grassland (High Diversity-White Box Woodland).*

Other Communities

- *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*;
- *White Box-Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest;*
- *Silver-leaved Ironbark Heathy Woodland;*
- *Dwyer's Red Gum-Ironbark woodland;*
- *Derived Native Grassland (Low Diversity-White Box Woodland); and*
- *Derived Native Grassland (Low Diversity with scattered Poplar Box trees)*

Small patches of other communities also occur and areas of cultivated lands occur in the western sector of the Project Site. The extent and distribution of all communities identified within the Project Site, as mapped for the EIA, is shown in **Appendix B**, **Figure B1**.

The Leard State Forest also was confirmed during the recent EIA studies as known habitat for the South-eastern Long-eared Bat, with the species captured within the forest during

the EIA surveys. The subject microbat species was previously recorded within Leard State Forest in the 1970s by Fred van Gessel and the author of this review. .The EIA studies also identified Leard State Forest as potential habitat for the Swift Parrot and Regent Honeyeater. Habitat condition as determined for threatened fauna species is also summarised in **Appendix A, Table A2**.

1.4.2 Offsets

i. Eastern and Western Offsets

The Eastern and Western Offsets occur within the same landscape as the Project Site and thus could be expected to support, to varying extents, much of the same vegetation types as occur within the Project Site. The vegetation studies and associated mapping undertaken (Cumberland Ecology 2011, 2013) indicate that this is particularly the case with the Western Offset, with the main communities identified in this area comprising:

Communities Determined by EIA as Conforming to CEEC Criteria

- *White Box-Narrow-leaved Ironbark-White Cypress Pine Grassy Open Forest;*
- *White Box-Wilga-Belah woodland;*
- *White Box-White Cypress Pine Grassy Woodland;*
- *White Box-Blakely's Red Gum-Melaleuca Riparian Forest; and*
- *Derived Native Grassland (White Box Woodland).*

Other Communities

- *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest;*
- *White Box-Narrow-leaved Ironbark-White Cypress Pine shrubby open forest; and*
- *Dwyer's Red Gum-Ironbark woodland; and*
- *Derived Native Grassland (Low Diversity-White Box Woodland).*

Small patches of other communities also occur and the Eastern and Western Offsets encompass large areas of cultivated lands. A full list of the communities identified for the Eastern/Western Offset properties and the area of each community as mapped by Cumberland Ecology, is provided in **Appendix A**. The extent and distribution of these communities, as mapped for the EIA, is shown in **Appendix B**, **Figure B1**.

A number of the communities occurring within the Eastern/Western Offsets have been identified as potential habitat for the Swift Parrot and Regent Honeyeater, whilst the *White Box - Narrow-leaved Ironbark - White Cypress Pine Shrubby and Grassy Open Forests* and the

Dwyer's Red Gum - Ironbark woodland have been identified as potential habitat for the Greater Long-eared Bat.

ii. Northern Offsets

The Northern Offsets occur at higher elevations (approximately 587m in the south-east of the Wirradale property to 1077m in the far north of the Mt Lindesay property) and support some communities representative of the western slopes and some more representative of tableland vegetation. Leard State Forest itself is clearly visible from the south-western sector of the Wirradale property. The vegetation studies and associated mapping undertaken for the EIA (Cumberland Ecology 2011, 2013) indicate that the main communities identified for the Northern Offset properties comprise:

Communities Determined by EA as Conforming to CEEC Criteria

- *White Box - Stringybark- Grassy Woodland;*
- *Stringybark- Blakely's Red Gum Grassy Open Forest;*
- *Manna Gum-Yellow Box- Blakely's Red Gum Grassy Open Forest; and*
- *Derived Native Grassland (Box-Gum Woodland).*

Other Communities

- *White Box - Stringybark- Shrubby Woodland;*
- *Stringybark- Blakely's Red Gum Shrubby Open Forest; and*
- *Narrow-leaved Ironbark - White Cypress Pine Shrubby Open Forest.*

Smaller patches of other forest or shrubland communities also occur, as well as substantial areas identified as *Derived Native Grassland (Low Diversity - Box -Gum Woodland)* and a small area of cultivated land in the far south. . A full list of the communities identified for the Northern Offset properties and the area of each community as mapped by Cumberland Ecology, is provided in **Appendix A**. The extent and distribution of the communities listed above, as mapped for the EIA, is shown in **Appendix B**, **Figure B2**.

A number of the communities occurring within the Northern Offsets have been identified as potential habitat for the Swift Parrot and Regent Honeyeater, whilst the *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest, Stringybark-Blakely's Red Gum Shrubby Open Forest* and the *Manna Gum-Yellow Box-Blakely's Red Gum Grassy Open Forest* have been identified as potential habitat for the South-eastern Long-eared Bat.

iii. Shared Offsets

One property included in the offset package for the Mauls Creek Project is under shared ownership with Boggabri Coal and is referred to as the 'Shared Offsets.' As for the

Eastern and Western Offsets, the Shared Offset property occurs within some proximity to the Project site, but is not immediately adjacent, being located approximately six km to the south-west of the main area of the Project Site. The rail corridor for the Project runs through the centre of the Shared Offset property, dividing the two main vegetation units.

The shared Offset is located on primarily relatively rugged terrain, at elevations of approximately 250m to 400m. The vegetation studies and associated mapping undertaken in this area (Parsons Brinckerhoff Australia Pty Ltd, 2010) indicate that the main communities identified in this area comprise:

Communities Determined as Conforming to CEEC Criteria

- *White Box - White Cypress Pine Grassy Woodland (poor condition).*

Other Communities

- *White Box - Narrow-leaved Ironbark - White Cypress Pine Shrubby Open Forest;*
- *Dwyer's Red Gum – Woodland; and*
- *Silver-leaved Ironbark Heathy Woodland*

Small patches of White Cypress Pine regrowth also occur.

The extent of the communities listed above, as mapped for the EIA, is shown in **Appendix B**, **Figure B3**.

iv. Additional Offsets

Since the commencement of the peer review process, some additional properties have been added to the offset package. These properties comprise:

4. Roseglass;
5. Oakleigh/Onavale;
6. Bimbooria.

A brief overview of the attributes of these properties is provided below.

a Roseglass

The Roseglass property is located immediately to the west of Vickery State Forest, approximately15 km to the south-east of Leard State Forest. A report on the Roseglass property was prepared by Niche Environment and Heritage (2012) as part of the Vickery Coal Project. The report encompassed preliminary vegetation mapping, threatened fauna habitat assessments and target threatened species surveys for both flora and fauna. A total of 11 main vegetation types were identified on the property, subdivided into 20

condition states. Key vegetation communities, including those most represented on the property comprised:

Communities Determined as Conforming to CEEC Criteria

- *White Box- Grassy Woodland – semi-cleared; and*
- *White Box-Wilga-Quinine – semi-cleared; and*
- *White Box-Wilga-Quinine Derived Native Pasture.*

Other Communities

- *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest;*
- *Narrow-leaved Ironbark-White Cypress Pine Shrubby/Grassy Open Forest – semi-cleared*
- *Narrow-leaved Ironbark-White Cypress Pine Shrubby/Grassy Open Forest – Derived Native Pasture*
- *White Box-White Cypress Pine Shrubby Derived Shrubland;*
- *Bracteata Honey-myrtle Riparian Forest – semi-cleared; Semi-evergreen Vine Thicket;*
- *Belah-Wilga-Rosewood Exotic pasture;*
- *Metasediment Rock Outcrop Shrubland;*
- *Narrow-leaved Ironbark-Tumbledown Gum - cleared; and*
- *White Box--Tumbledown Gum on Creek Lines.*

Small patches of other communities also were identified, including small areas of derived pasture (grasslands). The extent of the communities listed above, as mapped for the EIA, is shown in **Appendix B**, **Figure B4**. The site habitats were recognised in terms of representing potential habitat for both the Regent honeyeater and the South-eastern Long–eared Bat.

b Oakleigh/Onavale

These combined offset properties are located immediately adjacent to Leard State Forest on the north-eastern extremity of the forest. The offsets have been subject to recent broad reconnaissance surveys by Cumberland Ecology and the property descriptions have been drawn from the report on the survey results (Cumberland Ecology, 2013a). The property has been cleared extensively for agricultural purposes but retains some vegetation patches, primarily comprising:

Communities Determined as Conforming to CEEC Criteria

- *White Box-Narrow-leaved Ironbark-White Cypress Pine Grassy Woodland.*

Small patches of other communities not confirming to the CEEC also occur. The distribution of all communities on the site as determined by the recent surveys is shown in **Appendix B**, **Figure B5**. The Oakleigh/Onavale Offset is located on relatively flat terrain with moderately fertile soils. The location of the offset in immediate proximity to Leard State Forest has been described as providing long term biodiversity benefits, with potential to link Leard State Forest, Boggabri and the Nandewar Ranges.

c Bimbooria

The Bimbooria Offset is located immediately to the north-east of, and adjoining the Roseglass Offset. This offset also has been subject to recent broad reconnaissance surveys by Cumberland Ecology and the property descriptions have been drawn from the report on the survey results (Cumberland Ecology, 2013b). The property has been partially cleared for agricultural purposes but also retains a large vegetation remnant, comprising the following communities:

Communities Determined as Conforming to CEEC Criteria

- *White Box-Narrow-leaved Ironbark-White Cypress Pine Grassy Woodland;*
- *White Box - White Cypress Pine Grassy Woodland;*
- *Red Gum/Ironbark Forests; and*
- *Derived Nati*ve Grasslands (Box-Gum Woodland);

Other Communities

- *White Box - Narrow-leaved Ironbark - White Cypress Pine Shrubby Open Forest;*
- *White Cypress Pine shrubby open forest;*
- *Dwyer's Red Gum - Ironbark woodland;*
- *Silver-leaved Ironbark heathy woodland; and*
- *Derived Native Grasslands.*

The distribution of all communities on the site, as determined by the recent surveys, is shown in **Appendix B**, **Figure B6**. The Bimbooria Offset is located on relatively rugged terrain along a central ridgeline, partially encompassed by more gentle terrain with moderately fertile soils. The more fertile areas have tended to be utilised for agricultural purposes. The vegetated remnant of the offset links to Boonala State Conservation Area to the south and also adjoins another approved offsets for to the south west.

Chapter

2

Methodology

2.1 BACKGROUND TO REVIEW PROCEDURES

As indicated in Chapter 1 of this document, the focus of the required review is very specific and the range of procedures employed during the review process reflects this focus. The methods utilised thus took into account the key tasks as identified in **Section 1.1** and encompassed the following primary procedures:

- Preliminary desktop reviews of available information and sourcing of additional information;
- Initial site inspections.
- Follow-up reviews of relevant documentation, including:
  - Key definitions and criteria for the Box-Gum Woodland CEEC; and
  - Criteria for threatened fauna species' habitat.
- Field data collection and assessments;
- GIS Mapping;
- Data Collation and Analysis; and
- Preliminary and final assessments of results;
- Review of results and recalculations of areas; and
- Provision of advice to Whitehaven and preparation of final draft report.

A key objective of the procedures was to develop a robust basis for the offset assessment process.

Further details on each of the above procedures are provided in the following sections under the relevant headings.

2.2 PRELIMINARY DESKTOP REVIEW AND INITIAL SITE INSPECTIONS

A preliminary review of available information on the offset areas, assessment processes and relevant mapping was undertaken in July 2013 to gain an understanding of the extent and key characteristics of the proposed offsets. Preliminary reviews of the relevant plans, Commonwealth listing advice and fact sheets were also undertaken. Following the initial desktop assessment process, a reconnaissance survey was undertaken to gain an overview of the characteristics of each site and relevant access details. Areas proposed for mining were inspected and key features of the CEEC and habitats present on the Project Site and to be offset were observed. These observations were also made in the context of noting changes to these features since the reviewer visited the site in the late 1970's.

The offset areas were subsequently inspected to view the specific attributes of each area, some of the identified key vegetation boundaries and general condition and to gain some site and access familiarity.

2.3 FOLLOW-UP REVIEWS

Following the initial site inspections, further desktop reviews were conducted of Project documents obtained from Whitehaven Coal and Cumberland Ecology and relevant documents from other sources. These documents comprised:

- Ecological Assessment (Cumberland Ecology 2011);
- Biodiversity Management Plan (Cumberland Ecology 2013);
- Draft Recovery Plan for the Regent Honeyeater (Ingwersen et al 2013);
- Vegetation plot data for the Project Site and offset properties;
- Updated vegetation mapping for the Project Site and offset properties;
- Mapped locations of vegetation plots and plot coordinates; and
- Topographical maps (1:25000) of the offset areas.

Additional documents subject to reviews included the available recovery plans for the CEEC and the Swift Parrot, Listing/Conservation Advice documents for the CEEC, the EPBC Policy Statement for assessing the Box-Gum Woodland and Derived Grasslands and threatened fauna species and species/community profiles and/or fact sheets. Some difficulty was encountered with obtaining the draft recovery plan for the South-eastern Long-eared Bat but an early draft version was obtained from the Department of Environment in December 2013. Other reference material referred to during the course of the studies is listed under 'References and Bibliography'. This material included, inter alia, various reports and appendices providing specialists' advice and comments as prepared by, or on behalf of, the Northern Inland Council for the Environment (NICE). Matters contained within these documents and relating to the Maules Creek offsets will be

discussed under the individual assessments for the subject CEEC and threatened species (refer to **Chapters 3-**6) as may be relevant. Reference was also made to the report compiled in the late 1979s by the author of this review document (James B Croft and Associates, 1979) as it provided a valuable historical context for much of the Project Site.

The desktop assessment process also incorporated a review of Cumberland plot data and verification of whether recorded attributes conformed to the definitions and criteria described in the following section. This process involved summarising all vegetation plot data for the Project Site and offset areas and each plot summary checked against both the key CEEC attributes (refer to **Section 2.3.1**) and the location of the plot in relation to the vegetation community mapping prepared for the Project (refer to **Appendix B)**.

As the underlying basis for the CEEC assessment process is the Listing Advice for the community, and the definitions and criteria contained therein, the manner in which the Listing Advice definitions were interpreted and followed for the purposes of the review process are explained below.

2.3.1 Key Definitions and Criteria

i. Box-Gum Woodland and Derived Grasslands

a. Key Characteristics and Habitat Requirements

The key characteristics of the Box-Gum Woodland and Derived Grasslands, as listed and defined under the EPBC Act comprise:

- The dominance, **or** prior dominance of White Box (*Eucalyptus albens*), Yellow Box *(E. melliodora*) **or** Blakely's Red Gum (*E. blakelyi*);
- The presence of a species-rich understorey of native tussock grasses and herbs; and
- Scattered shrubs (Threatened Species Scientific Committee, 2006).

For the purposes of this review, it is important to note that, in the absence of the original tree cover, but the continuing presence of the characteristic understorey, the community is deemed still to be present, although representing a lower condition class (Condition B in the BMP) of the community. If the understorey is not dominated by native tussock grasses and herbs, then the community cannot be considered as representing the CEEC, whether the characteristic tree species are present or not.

Thus, the first step to consider for field assessments was the occurrence of one of the three diagnostic tree species as a dominant or co–dominant species, in combination with a grassy understorey. A number of other factors however, also needed to be considered. With regard to tree species dominance, it is of importance to note that the listing advice states the potential for a number of other tree species to be associated, or occasionally co-dominant with the three Box-Gum Woodland species, such species, including, inter alia,

Apple Box (*E. bridgesiana*), Red Stringybark (*E. macroryncha*), White Cypress Pine *(Callitris glaucophylla*) and Kurrajong (*Brachychiton populneus)*. These species have been specifically mentioned here as all have been recorded as occurring on the offset properties (Cumberland Ecology, 2011, 2013). However, by definition, a 'patch' of the CEEC is considered to be 'a continuous area containing the ecological community' and excludes other woodland vegetation of a different type. A patch must also comprise at least five trees, separated by no greater distance than 75 m, or be dominated by a predominantly native understory, with the patch taken to be whichever of these two scenarios represents the larger area.

Additionally, it is also noted that the Grassy White Box Woodland was originally listed as Endangered under the EPBC Act. On consideration by the Commonwealth Threatened Species Scientific Committee and advice from experts, it was subsequently determined that both the Grassy White Box Woodland and the Yellow Box-Red Gum Grassy Woodland were 'sufficiently similar and intermixed to merit listing as a single entity.' This indicates that: 1) the CEEC is likely to exhibit an intermixing of the dominant species; and 2) the two woodland types are considered to be interchangeable as part of the CEEC. The Listing Advice also indicates that the occurrence of the subject CEEC can be from altitudes of 170-1299 metres, within areas experiencing 400-1200 mm per annum and on the moderate to high fertility soils.

Taking the above factors into account, it is apparent that there is allowance for a wide variation in distribution and habitat features for the CEEC. Within the defined parameters, any occurrence of the three diagnostic species as a dominant or co-dominant, in combination with a native grassy understorey and sparse or patchy shrub cover, thus was potentially considered potentially representative of the Box-Gum Woodland CEEC.

b. Structural Features

Further to the above characteristics, the overall structure is defined as woodland by the naming of the community. The Listing Advice also states that tree-cover is generally discontinuous, with widely-spaced trees of medium height in which the canopies are clearly separated (Yates & Hobbs 1997). The use of the term 'generally' however, suggests some allowance for variation, as could be expected with any community and some communities listed as representatives of the CEEC within the Listing Advice are listed as forest communities.[2] Additional variation in structure is provided both in the Listing Advice and in the Policy Statement for the community (Department of the Environment and Heritage [DEH] 2006), whereby the community conforms to the CEEC definition if there is 'natural regeneration of the overstorey eucalypts.'[3] On this basis, a reasonably flexible approach has been taken in assessing the occurrence of the CEEC according to overall structure. It is also noted that the Policy Statement defines a mature tree as having a circumference of at least 125 cm at 130 cm above the ground. This has been taken to

[2] Refer to **Table 2** in the Commonwealth Listing Advice

[3] This item forms part of the flowchart to assist landowners in determining the occurrence of the CEEC on their property.

equate to approximately 40cm dbh,[4] a tree diameter being more readily estimated in the field during rapid assessment procedures.

ii. Understorey Features

A critical component of the CEEC definition is the composition of the understorey, both in relation to shrub cover and the ground cover stratum. Key aspects to consider with regard to shrub cover comprise:

- The overall percentage cover of shrubs within a patch of CEEC, with patches supporting over 30 per cent cover deemed not to conform to the community definition;
- The extent of shrub cover can be patchy within a remnant and the remnant still conform to the CEEC definition (TSSC 2006); and
- A patch is defined as a continuous area supporting the CEEC and excludes areas dominated by other species (DEH 2006).

There are also a number of factors to consider with regard to the ground cover species: Firstly, there needs to be a dominance of native tussock grasses, although the extent of cover can be expected to vary with season, as discussed later in this Chapter (see **Section 2.7**). Secondly, there is a requirement for at least 50 per cent of the ground cover to comprise native perennial species and thirdly, at least 12 species of native non-grassy understorey species need to be present to provide sufficiently high diversity to conform to the CEEC. Additionally, at least one of the herb species present should comprise an 'important species' as listed for the CEEC.

All of these factors therefore needed to form an integral part of both the desktop and field assessment processes, as described in **Section 2.4**.

iii. Criteria for Threatened Fauna Species

The criteria for assessing the extent and condition of habitat had a number of similarities for all three subject species, but also some dissimilarities. The feature with greatest commonality for all three species was considered to be the presence of mature tree species (Saunders and Tzaros, 2011 .Ingwersen et al, 2013, Schulz and Lumsden, 2010). These would have the potential to provide adequate nectar resources for the Swift Parrot and Regent Honeyeater and potential roost sites and sources of insect resources for the South-eastern Long-eared Bat. Drainage lines also seem to be favoured by all three species. Other features considered for each species included:

- Swift Parrot

[4] Diameter at breast height.

- occurrence of favoured box-ironbark and grassy woodlands, including White Box woodlands, as foraging resources;
- Large and small forest remnants.

➢ **Regent Honeyeater** – occurrence of box-ironbark communities, with favoured tree species such as the Mugga Ironbark trees (*E. sideroxylon)* and Yellow Box, White Box, Blakely's Red Gum and Broad-leaved Ironbark (*E. fibrosa)* as a foraging resource; and

➢ South-eastern Long-eared Bat

- Presence of shrubby habitat apparently favoured as foraging habitat;
- Presence of tree hollows, exfoliating bark or dense foliage to provided diurnal shelter sites; and
- Larger tree hollows for maternity sites.

2.4 FIELD ASSESSMENTS

To comply with Condition 10, taking into account all of the factors discussed in **Section 2.3.1,** the field data collection process entailed the following key procedures:

➢ Strategic checking of a proportion of vegetation plots or the general vicinity of plots sampled by Cumberland Ecology to obtain independent data on the vegetation community characteristics to confirm such areas conform to the CEEC definitions;

➢ Similar data collection procedures to be undertaken at a small number of other 20m x 50m plots at randomly or strategically selected locations within areas currently mapped as the CEEC;

➢ Checking of mapped vegetation boundaries and identifying any adjustment in mapping of the CEEC (either expansion or contraction of areas) that may be appropriate;

➢ Use of a rapid assessment procedure to check on the condition class of the CEEC; and

➢ Use of rapid assessment pro forma to assess habitat characteristics and quality for the three subject threatened species (Swift Parrot, Regent Honeyeater and Long-eared Bat).

2.4.1 Plot Data Collection

Data collected from 20m x 50m plots initially comprised:

- Tree species present and percentage canopy cover at 5 m intervals along a line transect through the centre of the plot;
- Mid–story species present and percentage cover at 5 m intervals along the same line transect;
- Ground cover species and percentage cover at 1 m intervals along the same line transect;
- Number of hollow–bearing trees;
- Number and length of hollow-bearing logs;
- Number of native species occurring within the 20 x 20 m plot, nested within the 20 x 50 m plot;
- Proportion of canopy species that were regenerating; and
- GPS coordinates of the plot location.

2.4.2 *Rapid Assessments*

i. Vegetation Assessments

As one of the key objectives all the field surveys was to inspect and assess as many field locations as possible, rapid assessment procedures for both the CEEC and fauna habitats were employed. Vegetation data collected generally was limited to a compilation of the dominant species in all strata, confirmation that at least 12 native non-grassy ground cover species were present and estimates of percentage cover for all strata. In some locations, cover estimates were more structured and obtained from 50 m line transects, following the process for the 20 m x 50 m plots. Tree counts/species were also taken at some plot locations or along transects, with counts categorised into the following age groups:

- Saplings (<5cm diameter);
- Young mature;
- Mature;
- Large mature; and
- Old growth.

ii. Fauna Habitat Assessment

Rapid fauna habitat assessments were also conducted using two different assessment pro forma. The first involved collection of data on ten attributes comprising:

1. Size of the habitat area/connectivity (context in the landscape);
2. Degree of disturbance (past and current);
3. Maturity of regeneration;
4. Structural complexity;
5. Occurrence of alternative forage/ roosting habitats adjoining sample area;
6. Extent of occurrence of old growth trees;
7. Extent of occurrence of hollow–bearing-trees;
8. Extent of occurrence of hollow-bearing logs and ground debris; and
9. Special habitat attributes such as presence of drainage lines/watercourses, extent of shrubby habitat or potential roosting habitat.

Each attribute was scored from 1 to 6, the scores summed and then averaged to provide a basis for comparison.

The second pro forma more specifically targeted the South-eastern Long–Eared Bat, with the data collected on 4 to 5 attributes as follows:

1. Size of habitat/connectivity;
2. Extent of occurrence of old growth trees;
3. Number of hollows readily observed;
4. Extent of presence of loose or shedding bark/dense foliage; and
5. Extent of shrub cover.

As for the first price pro forma, each attribute was scored from 1 to 6.

On the basis of the above, preliminary field surveys were undertaken to obtain initial datasets and verify that the procedures proposed would yield the required information to enable compliance with the Condition 10 requirements. Plot data collection procedures and rapid habitat assessments were trialled over 1.5 days within the Project Site and the Western Offsets in August 2013, in conjunction with visual inspections of floristic and structural variations in association with observed changes in topography and surface soils. Data was collected by two personnel, with access to some areas facilitated by Whitehaven personnel.

Rapid checks of ground cover species diversity and visual checking of vegetation mapping boundaries and key structural features subsequently were undertaken over 1.5 days within the Northern Offset properties in early September. All locations of data collected were documented using GPS coordinates, marked on field maps and recorded

on GPS units for subsequent mapping purposes. All field data was entered on excel spreadsheets for subsequent analysis. Any unidentified specimens with sufficient material for identification were collected for subsequent taxonomic verification.

Subsequent field assessments were conducted over 4.5 days in October (Northern and Eastern/Western Offsets), 6.5 days in November ((Northern and Eastern/Western Offsets) and over 3 days in early December (Northern Offsets) in order to access as many offset properties and offset vegetation patches as possible. Local information on vegetation occurrences, soils and seasonal conditions was also obtained from offset property owners and neighbours.

2.5 DATA COLLATION AND ANALYSIS

Data from the field reconnaissance and subsequent surveys was collated and analysed following each field session, locations mapped and the results assessed and compared against the offset data and mapping. All data was digitally compiled into excel spreadsheets, sorted and summarised according to the key attributes for each verification process. The subsequent desktop assessments following each survey encompassed a review of offset proposal areas, the extent and range of the CEEC representations and target threatened species habitat in each area and the condition classes/habitat quality as assessed. The review process also included consideration of the corresponding assessments for the areas to be impacted by mining and background documents on the subject CEEC and threatened fauna species. Vegetation mapping was reviewed against the field data and recent aerial photography via Google Earth (2013).

2.6 GIS MAPPING

Vegetation community GIS data prepared by Cumberland Ecology for the EIA and BMP was analysed for any overlap errors that could account for vegetation area discrepancies. Vegetation communities were dissolved using community name (data set a), thereby removing any potential self-overlap. All vegetation communities were also dissolved into one shape (data set b) to determine total vegetation communities mapped, again to remove any overlap. There was no significant discrepancy between the two data sets in terms of area (0.0195% or 2.84 ha over 14534.65 ha) therefore no significant 'double counting' of vegetation was occurring. 'Double counting' results from vegetation communities not being drawn in a topologically rigorous manner. The vegetation units in such cases are not perfectly adjoining polygons, but rather have some slivers of overlap.

The dissolved vegetation communities were then intersected with the property boundaries to generate areas of each community by property for the offset areas. Areas were provided in an excel pivot table for reporting.

2.7 DATA REVIEWS AND OFFSET RECALCULATIONS

Reviews of the fully collated data were undertaken and various checks of the data entries made to verify the validity of each dataset. Summary tables of the data were then compiled. Where any variations in offset areas were considered to be required, area calculations were carried out by a GIS specialist. Positive or negative revisions to offset areas were then entered into an Excel spreadsheet to facilitate final calculations and assessments.

The final assessment of the condition class of the CEEC offset areas relied upon the various field assessment procedures, further reference to the relevant definitions in the Listing/Conservation Advice and consideration of ecological benchmark values for the communities (Namoi Catchment Management Authority, 2013). Final assessments for the quality of the threatened fauna species' habitat relied on the fauna habitat assessments, further informed by the microbat habitat assessment process. Detailed consideration was also given to the definitions and guidance provided in section 2C of the support document for the EP PC Act Environmental Offset Policy (Department of Sustainability, Environment, Water, Populations and Communities [DSEWPaC], 2012). Key aspects of this consideration included the landscape context of the Project Site and the offset habitats and the extent of representation of key habitat attributes for the subject threatened species.

2.8 LIMITATIONS TO THE REVIEW PROCESS

Time and access difficulties are common limitations to most field surveys and the review surveys of the offset properties were no exception, particularly in relation to the Northern Offsets. Most of the tracks on the Northern Offset properties are not well formed and are over rugged terrain, rendering access at times problematic. Directions, assistance and local information provided by property owners facilitated access to some areas and contributed to the knowledge of the offset attributes and such assistance was greatly appreciated. Weather conditions for most of the surveys were favourable but rain and severe storms hindered the data collection process and eventually curtailed the late November surveys.

The main limitation to the field assessment process however, was associated with the seasonal conditions. The timing of the review period coincided with a prolonged period of drought in both the Leard State Forest/Eastern/Western Offsets are and in the Northern Offset area. This severely affected the data collection process, as very little ground cover vegetation was evident in most areas and few species were available for sampling. This also meant that more time had to be spent at each location to record the species present as those that were still evident were often very difficult to recognise from their dried remnants. The situation was similar however for both the Project site and the offset properties, although the seasonal conditions continued to deteriorate over the survey period. Some allowance for the seasonally poor conditions has therefore been incorporated into the assessment process by focussing on the full range of community attributes and minimising the reliance on individual plant species' identification, unless specific identification was essential.

Chapter

3

Results - Box Gum Woodland

3.1 RESULTS FROM DESKTOP ASSESSMENTS

3.1.1 Verification of Project Plot Data and Mapped Vegetation Units

Desktop comparisons of the EIA plot data with both mapped vegetation community units (refer to **Appendix B)** and conformance to the CEEC criteria (where applicable) found the majority of plot data to correspond with the mapped units, with closest correspondence in the vicinity of the plot locations and in areas where greater numbers of plots were sampled, as would be expected. Seven plots were found to exhibit minor discrepancies with the map units, with five of these being close to mapped community boundaries where some overlap of species could be expected. Two plots within the Project Site indicated records of White Box within the mapped areas of *Narrow-leaved Ironbark Shrubby Open Forest* community, but one of these plots also supported Ironbark and some intermingling of species is attributable to natural variation. The second of these plots yielded only White Box, but the plot location, within relatively rugged terrain in the west of the Project Site is an area consistently mapped as shrubby forest, does not suggest that the location represents an additional area of EEC. Review of aerial photographs also supports this assessment. White Box is also listed as an associated species within the *Narrow-leaved Ironbark Shrubby Woodland* biometric vegetation type for the Namoi Catchment Management Area (CMA), with which the mapped community conforms.

EIA plot data for areas mapped as good condition CEEC also conformed to the criteria for diagnostic species' dominance or co-dominance and presence of at least 12 non-grassy native ground cover species, of which at least one represented an important species. Similarly, areas of Derived Grassland (Box-Gum Woodland) generally showed good correspondence with the EIA plot data and conformance to the lower condition CEEC. Another feature evident from examination of the EIA plot data was the general paucity of exotic weed species in most locations, including both the Project Site and the offset properties. The exception to this was in areas that had been subject to very heavy grazing and/or cultivation and such areas conformed to either the derived grassland (low diversity) all of cultivated land categories.

It was noted that the highest number of vegetation plots sampled for the EIA process was within the Project Site, with more scattered plot locations within the offset areas. In general, there was a reasonable spread of data collection points to inform the vegetation mapping process for both the Project Site and offset areas, although there were also some noticeable gaps in coverage in some sectors, particularly in the Eastern and Northern Offsets. It is understood that there were some access and weather constraints that affected

some survey procedures in these areas. A review of the survey methodology indicated that the field surveys for the EIA to determine community floristics, relevant to examining the conformity of vegetation to the CEEC, appear to have been undertaken at appropriate times for seasonal conditions. In fact, it is understood from discussions with the consultants, Whitehaven personnel and local property owners, that the EIA surveys were conducted during very favourable seasonal conditions, as opposed to the drought conditions prevailing at the time of the surveys undertaken for the purposes of this review.

It was also noted that the mapping conducted for the offset properties was described as preliminary (Cumberland Ecology 2013), and this observation, in conjunction with the gaps in plot data collection areas, suggested that some variations in map units could be expected from further ground-truthing exercises. It is understood that a higher level of mapping detail and accuracy was achieved for central sectors of the Project Site from walking transects conducted as part of the EIA/BMP surveys.

3.2 GENERAL FIELD OBSERVATIONS

3.2.1 Vegetation Condition and Regeneration

i. Project Site

Within Leard State Forest, examples of the community defined as White Box-Narrow-leaved Ironbark were evident; however, overall condition of the understorey, in terms of plant vigour, was poor. Low levels of grass cover in most areas as a result of the prevailing drought rendered sampling a reasonable complement of native herbs in the ground cover stratum difficult, as referred to in **Section 2.4.3** (refer to photographs in **Appendix** D). The initial plot data collected within both the project site and the Western offsets (two sample plots within each area) indicated the locations of all four plots to be comparable and to conform to CEEC moderate to good condition definitions, according to the benchmark values for the *White Box Grassy Woodland* (Namoi CMA, 2013). It should be noted that the plots selected within the Project Site in Leard State Forest, were selected subjectively during the initial stage of the review process on the basis of the occurrence of better representations of the CEEC, although grass cover in these plots was observed to be relatively sparse. *White Cypress Pine Grassy Woodland* with a very open structure and dense grassy ground cover was observed in the western sector of the Project Site within the Teston property, in the vicinity of the proposed rail corridor. This woodland conformed to moderate to good condition CEEC, based on: a) plot data from Cumberland Ecology (EIA Plot Q38); b) rapid assessment plot sampling conducted at the same location for the purposes of this review (WOT2A); and c) comparison of both datasets with the ecological benchmark values for this community (Namoi CMA, 2013).

General observations by the author of this review suggested that there has been extensive understorey regeneration throughout much of the Leard State Forest since the 1970s,

including within the Project Site, such that the general appearance of the forest and woodland communities is less open than previously observed. The open nature of the box communities within Leard State Forest in the 1970s is illustrated by Plate 3 in the early ecological report on the forest (James B. Croft and Associates, 1979). It was also noted that the overall structure of Leard State Forest in the 1970s was found to vary from woodland to open forest and much of the community structure, as mapped for the EIA, also indicates a similar variation in structure. This variable structure was observed during the peer review inspections and surveys, with the past land practices conducted in the forest likely to have had a major contributing factor to the existing floristics and community structure. Examples of the current characteristics of some of the communities and variations in vegetation structure and attributes are illustrated in the photographs provided in **Appendix D** to this report.

In some sectors, regeneration comprised primarily juvenile Cypress Pine, suggesting a low fire frequency. It is likely that reduced fire frequency would encourage an increase in understorey growth over time. The observation of increased understorey density does not apply however, to the steeper rocky knolls which have historically often supported dense shrub thickets as observed by the author (James B Croft and Associates 1979).

ii. Eastern/Western Offsets

The Eastern Offsets comprise predominantly grasslands, including some mapped as low diversity Derived Grasslands. There are also some areas of remnant or regenerating woodland vegetation, including some *White Box-Wilga Grassy Woodland,* and patches of *White Box-White Cypress Pine Grassy Woodland,* but the vegetation overall tends to be fragmented. The largest woodland/forest remnant occurs in the far north-east of the Eastern Offsets on the Wallandilly property and was mapped for the EIA as predominantly *Pilliga Box-Poplar Box-White Cypress Pine Grassy Open Woodland*. It is understood that this area was not accessible for the EIA surveys, indicating a lower level of reliability in mapping, and variations to the map units are discussed in **Section 3.4**. Ground cover in the Eastern Offsets, as for Leard State Forest, was exhibiting the effects of the prevailing drought conditions and vegetation condition overall was variable. In the areas determined to conform to the CEEC, which tended to be associated with better quality soils and/or drainage lines of the property, condition class was rated as moderate to good.

Dense regeneration of Cypress Pine was evident in some sectors, again suggesting low frequency fire regimes. These areas were primarily associated with the *Narrow-leaved ironbark Open Forest/Woodland* community on the more steep slopes and/or poorer soil types within the Wallandilly property.

As for the Eastern Offsets, some vegetation in the Western Offsets was fragmented. Other sectors however on the Teston South and Louenville properties, adjoin the Leard Conservation Area to the west and north respectively. Vegetation remnants on the eastern edge of the Velyama property also adjoin a sector of Leard State Forest, external to the Project Site, whilst all of these areas also adjoin the vegetation currently occupying the western sector of the Project Site and connecting with Leard State Forest. Small sectors of

the *White Box-Narrow-leaved Ironbark-White Cypress Pine Woodland* occurring within the Project Site occur along part of the eastern edge of the offsets in this sector, but the community then grades quickly into the shrubby form of forest/woodland upslope and to the west. As referred to earlier, two 20m x 50m plots sampled on the eastern edge of the Western Offset area yielded data highly comparable to plots sampled within the project site and conformed to good condition CEEC. Although vegetation condition was variable to some extent over the Western offsets, within the areas conforming to the CEEC definitions, the condition rating overall was moderate to good, bearing in mind that all areas showed increasing levels of moisture stress as the survey period progressed. Thus the four plots sampled in August 2013 were accessed prior to the onset of extremely hot dry conditions that prevailed prior to the October and November sampling periods.

Regeneration of midstorey tree species, such as Whitewood (*Atalaya hemiglauca*) and Wilga (*Geijera parviflora),* was evident in the eastern sector of the Velyama property adjoining Leard State Forest to the east. Dense regeneration of Cypress Pine was also evident in some sectors, particularly on the Kelso property, both within the edges of the areas mapped as Derived Grasslands and in the woodland/forest areas. As for the Wallandilly property, these areas were typically associated with the more rugged topography, rocky slopes and poorer soil conditions.

iii. Northern Offsets

Vegetation communities in the Northern Offsets were observed to be variable in structure and condition, with large areas of Derived Grasslands in the southern sector and predominantly forest and woodland communities in the remainder, interspersed with smaller patches of Derived Grasslands. The extent of shrub cover was also observed to be very variable, being almost absent in some sectors, patchy in other areas and consistently moderate to dense in locations such as in the steeper lands in the far south-east of the Wirradale property. The dominance of tree species also is highly variable, with mosaics of White Box, Yellow Box, Blakely's Red Gum and Stringybark species occurring. White Box tends to be restricted more to the southern sectors of the offset properties where the elevation is lower, whilst Yellow Box and Blakely's Red Gum are both widespread. The far south-eastern sector of the Wirradale property is substantially different from the rest of the site, and has been mapped as *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*. The majority of this community would therefore not conform to the Box-Gum Woodland community definition, although small sectors of open White Box Woodland occur in the lower sectors (local property owner, pers.com. December 2013).

In general, large sectors of the northern offset properties conformed to the CEEC definitions and also were found to be generally in moderate to good condition. This was evidenced by the more rapid timeframe for confirmation of the occurrence of at least 12 non-grassy native ground cover species.

Overall community structure also was observed to be mosaic in pattern in a number of areas, such that pockets of forest structure would be interspersed with patches of woodland. The structure and species dominance was considered, at least in part, to be indicative of past clearing practices, with many areas supporting even-aged stands of tree

species' regrowth, often in the vicinity of an old growth tree of the same species (refer to photographs in **Appendix D**). Dense regeneration of Cypress Pine was not generally observed over most of the Northern Offsets except in the far south-eastern sector dominated by ironbark forest. Other areas of dense young regeneration were most often observed to comprise stringybark species. Other types of regeneration, such as of Blakely's Red Gum, Manna/Ribbon Gum and Yellow Gum, were estimated as representing approximately 40 to 50 year old regeneration after clearing and this was confirmed by the local property owner.

3.3 RESULTS OF REVIEW PLOT SURVEYS AND RAPID ASSESSMENTS

3.3.1 Project Site

Locations previously mapped as CEEC from which plot data and some rapid assessment data was collected within the Project Site for the purposes of this review, conformed to the definition of the CEEC, if allowance is made for the low level of grass cover and herbs in some areas subject to plot sampling (refer to photographs in **Appendix D** and data summaries provided in **Appendix E**), with grass cover in these plots ranging from 14-68 per cent (native ground cover benchmark value for the *White Box Grassy Woodland* is 50%). As Leard State Forest vegetation also was suffering adverse effects from the prevailing drought conditions, it seemed reasonable to assume that ground cover would normally be more extensive than under less severe seasonal conditions.

The extent of shrub cover was low in the areas sampled, although there was also substantial variation noted in adjacent areas in some sectors, such as at Plot 157. In this location, the plot data indicated only a two per cent shrub cover, whereas the understorey adjacent to the plot had a higher density with patches of over 30 per cent cover observed.

A small number of rapid assessments identified some discrepancies in vegetation boundaries as mapped, but none of these increased the area of the CEEC – rather the reverse. Two main areas noted were: firstly in the far north-eastern sector of the Project Site, where the *Narrow-leaved Ironbark Shrubby Open Forest Community* intruded into the area mapped as *White Box-Narrow-leaved Ironbark-White Cypress Pine Grassy Open Forest*; and secondly, in the far south-west of the Teston property, within the Project Site. In this location, the extent of the CEEC appears to have included an area of *White Box-Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*.

3.3.2 Western Offsets

Locations from which plot data and some rapid assessment data were collected from the Western Offsets conformed to the definition of the CEEC and mapped areas of the CEEC were found to be reasonably accurate. One minor exception was in the north-east of the Louenville property where a stand of Belah Woodland/Open Forest was identified. The better condition CEEC also was identified on this property, likely to be attributable to a number of factors:

- Larger areas of interconnecting CEEC occurring;
- Less sheep grazing pressure; and
- Connectivity with the adjacent Leard Conservation Area.

Only small sectors on the Kelso property had been mapped previously as CEEC and rapid assessments found these areas to coincide with the lower eastern gentle slopes of the main ridgeline through the property. The Derived Grasslands in the Western Offset properties were generally found to be in low condition and not conforming to the CEEC. Rapid assessments of the area mapped as Derived Grassland (Box-Gum Woodland) in the far eastern sector of the property found this area to be in compliance with the criteria for the CEEC (refer to data summaries in **Appendix E).**

3.3.3 Eastern Offsets

Areas inspected within the Eastern Offsets comprised the Wallandilly, Warriahdool and the lower portion of the Teston South properties. A rapid assessment and tree counts on the Warriahdool property confirmed the occurrence of the CEEC and visual observations of the Teston South area confirmed the occurrence of White Box Grassy Woodlands in the area. This observation was supported by rapid assessment data collected from similar vegetation along the boundary of the Teston North area. Within the Wallandilly property, which, it is understood had not been subject previously to on-the-ground assessments for the EIA surveys, a number of rapid assessments and point descriptions found the property to support larger areas of *White Box- -White Cypress Pine Grassy Open Forest* than shown by the map units. An area on the lower flats adjacent to Back Creek, running through the southern portion of the property, was also found to support *Yellow Box Grassy Woodland,* conforming to moderate to good condition CEEC.

A number of other areas within the Wallandilly property and also mapped previously as 'unclassified,' were found to conform to *Derived Grassland (Box-Gum Woodland*). As with all other areas, however, the ground stratum in general was exhibiting obvious signs of severe moisture stress with some ground herbs simply crumbling when touched.

The locations where amendments to the mapping of the CEEC are required are indicated in **Figure D1, Appendix D.**

3.3.4 Northern Offsets

The majority of locations from which detailed plot and rapid assessment data was collected from the Northern Offsets, supplemented by numerous point descriptions, conformed to the mapped units. Most areas identified as the CEEC also conformed to the broad Box-Gum Woodland or *Derived Grassland (Box-Gum Woodland*) definition. The Derived Grasslands in the Northern Offset properties, particularly in the far central eastern sector, appeared to be in good condition at the time of inspection. The Derived Grasslands in the south-western sector of the offsets, whilst conforming to the definition

of the CEEC, showed slightly lower diversity, presumably owing to heavier grazing pressure by sheep.

The data collection process supported the general observation that there was a complexity in the occurrence of dominant tree species in a number of areas, whereby White Box intergraded with Blakely's Red Gum and Yellow Box, with varying occurrences of species such as Apple Box and Red Stringybark. This mosaic of species is not inconsistent with the definition of the CEEC. There were however, some areas that did not conform to the CEEC definition, either through the more consistent occurrence of shrubs at greater than 30 per cent density, or through the concentrations of other species and lack of dominance or co-dominance of the three diagnostic tree species. Thus areas dominated by Silvertop Stringybark or Manna/Ribbon Gum were not considered to conform to the CEEC definition.

Generally, it was these areas that also tended to be more densely vegetated, with a percentage canopy cover ranging from 35 to 60, based on the results from rapid assessments. Other locations from which data on the density of the canopy cover were collected, yielded percentage cover estimates ranging from 15 to 30.5, which was considered to fall within the woodland structural category (Specht et al, 1970, Walker and Hopkins, 1990). It was also noted within these areas that the extent of canopy separation was highly variable, attributable to both natural variation and the influence of past clearing activities affecting the distribution and concentration of species and individual tree specimens. This variation in structure as a result of past impacts is recognised as needing to be taken into account when classifying vegetation types and determining their conservation status (Benson, 2006).

It is noted that in the submission report and associated specialist studies prepared on behalf of NICE (North West Ecological Services [NWES], 2013, undated), the occurrence of the CEEC in the majority of plots sampled in the Northern offsets by the NICE field studies has been refuted. In the opinion of the author of this review, there is validity in the points by NWES relating to the need for excluding stands of Silvertop Stringybark and Manna Gum, from the CEEC category where these species clearly dominate. However, other factors that have also been considered as part of this peer review include:

- The broad definitions of the community;
- The allowance for co-dominance of any one of the diagnostic species with other species;
- The provision for regeneration of diagnostic species to conform to the CEEC definitions;
- Recognition of **prior** occurrence of the diagnostic species as indicative of the CEEC; and
- The conformance of the location of the Northern Offsets to the ecological parameters (bioregion, rainfall, altitude etc) determining the distribution of the CEEC.

Taking all of these factors into account, locations at which the community present was considered to comply with the CEEC definition are indicated in the summary data table provided as **Table E1 in Appendix E**. Thus, although there are clear refinements required to some map units, which in turn reduce to some extent the total area of *Box-Gum Wood land and Derived Grasslands*, the majority of the Northern Offsets previously mapped as representing this community are considered to conform to the CEEC. The areas most affected by the recommended amendments comprise:

- The far northern sector of the Mt Lindesay property;
- The central southern sector of the Mt Lindesay property, to the north of the Mount Lindsay Road; and
- The far central western sector of the Wirradale property.

The locations where amendments to the mapping of the CEEC are required are indicated in **Figure E2, Appendix E.**

In general, making some allowance for the adverse effects on plant vigour and associated impacts on the flowering and fruiting of plant specimens, the condition of most areas of the communities identified as CEEC was found to be good, or moderate to good. This assessment is i indicated in **Table E1** in **Appendix E** and was based on such parameters as general conformance of structural elements, confirmed representation of a minimum of 12 non-grassy native ground cover species, the occurrence of at least one species listed as important under the Listing Advice for the CEEC and at least 50% native ground cover. No areas however, including those within Leard State Forest achieved 100% benchmark status (Namoi Catchment Management Area, 2013).

3.4 OFFSET OUTCOMES FOR BOX-GUM WOODLAND AND DERIVED GRASSLANDS

The final outcomes for the offset areas are presented in **Appendix G, Table G1**. As indicated in **Section 3.3**, some amendments to the offset map units, and thus to the offset areas are recommended, with some additions to the area of CEEC and some losses. Based on the assessments conducted for this review, the final outcome is a reduction in total Box-Gum Woodland and Derived Grassland provided by the combined Eastern, Western, Northern and Shared Offsets of approximately 58 ha. Additional offsets secured by Whitehaven provide an additional 729 ha of Box-Gum Woodland and Derived Grassland. The total area of the CEEC to be provided as offsets for the Project is therefore 5,703 ha, comprising 1,874.2 ha of low to moderate condition CEEC and 3,827.7 ha of good condition CEEC.

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Chapter

4

Results - Threatened Fauna – Swift Parrot (*Lathamus discolor*)

4.1 RESULTS FROM DESKTOP ASSESSMENTS

The desktop assessments for the EIA and BMP for the Project indicated the following procedures were undertaken relevant to determination of Swift Parrot occurrence and habitat suitability:

- Relatively comprehensive fauna surveys within the Project Site, with limitations to the surveys in accordance with what would generally be expected for such surveys (short term seasonal surveys);
- More limited surveys of the Eastern and Western Offsets, but including habitat assessments by specialist ornithologists; and
- General habitat assessments and bird habitat assessments by specialist ornithologists in the Northern Offsets.

The removal of 1665 ha of forest/woodland habitat from the Project Site was identified in the EIA as including potential foraging habitat for the Swift Parrot, a migratory species that over-winters on the Australian mainland and forages on nectar and lerps. The Namoi and Border Rivers–Gwydir CMAs, encompassing the project site and offset areas, support known foraging habitat for the species (Saunders et al, 2010). It was noted that the surveys yielded no records of the Swift Parrot obtained from the Project site, nor from offset areas. The Project Site however, was recognised during the EIA process as providing potential stepping stone habitat for the species (Cumberland Ecology). The most recent checks of the Atlas of NSW for the purposes of this review indicate the records for the species closest to either the Project Site or offsets are from north of Manilla, approximately 35 km east of the Northern Offsets (OEH 2013). However, according to national park records, the Swift Parrot has also been detected within the Mount Kaputar National Park (Department of Conservation [DEC] 2006), which adjoins the Northern Offsets in the south-western and western sectors along the boundaries of the Wirradale property.

Foraging is the key requirement for the species in relation to the offsets, with the species returning to Tasmania to breed in the summer months (Saunders and Tzaro, 2010). It is noted that the potential foraging habitat identified for the Swift Parrot within the Project Site encompassed all forest and woodland types occurring within the general box–ironbark habitat. This encompassed both known forage tree species (White Box and Yellow Box) and species generally occurring within the general box-ironbark habitat type (Narrow-leaved Ironbark [*Eucalyptus crebra*], Blue-leaved Ironbark [*E. nubile*] and Dwyer's

Red Gum [*E. dwyeri*]). Thus, when assessing suitable habitat for the Swift Parrot within the offset properties, it is consistent to consider all patches of forest/woodland habitat within the general box-ironbark habitat type occurring on the offset properties as potential foraging habitat, including patches supporting tree species that are not specifically known to be forage species.

Studies of the species in Victoria found that the occurrence of the Swift Parrot for over-wintering foraging purposes was not necessarily primarily associated with the level of flowering within the favoured box–ironbark habitat. Other factors, such as flowering of wattle species and the occurrence of other aggressive nectivorous species, were found to be highly influential on the spatial distribution of the Swift Parrot (Mcnally and Horrocks, 2000). The use of specific foraging habitat was also found to be highly variable over time with both small and large habitat patches utilised by the species (McNally and Horrocks 2000). Site fidelity has not been found to be important in some areas but is considered important overall for the long term survival of the species (Saunders and Tzaros, 2011). Loss, fragmentation and disturbance of foraging habitat have been identified as key threats to the long-term survival of the swift parrot. Other threats include grazing, increased fire frequency and climate change (Saunders and Tzaros, 2010).

From the information available for the Swift Parrot habitat requirements and the vegetation mapping of the Project Site for the EIA for the Project, the following key attributes have been identified for the purposes of this report:

- Favoured winter foraging habitat of box-ironbark woodlands, including Mugga Ironbark (*Eucalyptus sideroxylon)* and White Box Woodland (for the western slopes of NSW);
- Drainage lines;
- Medium to large forage trees (small and very large trees tend to be excluded from foraging activities) (Kennedy and Tzaros, 2005, Department of Environment 2103); and
- Small and large habitat patches.

Mapping undertaken for the EIA indicated the representation of potentially suitable foraging habitat for the Swift Parrot within the Project Site and the offset areas. This habitat included both White Box Woodland and Ironbark Woodland/Open Forest, but Mugga Ironbark was not identified in either the Project Site or the offset areas. There were however, drainage lines represented to some extent within all areas, as shown on the figures presented in **Appendix B,** with more significant drainage lines occurring in some of the offset properties. Mature trees were identified as occurring within both the Project Site and offset properties. A few potential minor inconsistencies between the EIA mapped units and EIA plot data, as discussed in **Section 3.1** of this peer review report**,** are not considered to affect the potential habitat suitability of the Project Site of offsets for the Swift Parrot.

4.2 GENERAL HABITAT OBSERVATIONS

4.2.1 Project Site

Observations of the Project Site confirm the assessment provided in the EIA that suitable potential foraging habitat for the Swift Parrot is present. This habitat comprises numerous mature White Box trees, representing favoured foraging habitat, with a proportion of these trees occurring on relatively fertile soil. It is noted however, that although the Leard State Forest and the Project Site also support large areas of ironbarks, the favoured foraging tree species, the Mugga Ironbark, does not seem to have been recorded. Based on the experience of the author of this review, another potential factor limiting the value of the Project Site to the Swift Parrot is the density of the Fuscous Honeyeater (*Lichensostomus fuscus*). The latter species has been identified in the studies by McNally and Horrocks (2000) as one of the highly aggressive nectivorous species that may inhibit the use of some foraging resources by the Swift Parrot. In the ecological studies conducted in the Leard State Forest in the 1970s, specialist bird studies by Fred van Gessel found the Fuscous Honeyeater to be the most common bird species within the forest (James B Croft and Associates 1979).

Dense regeneration of cypress pine was also observed in a number of areas of the Project Site, this feature seeming to be more prevalent than during the early studies in Leard State Forest in the 1970s (James B Croft and Associates 1979). In the long-term, continued dense regeneration of cypress pine could be expected to detract from the habitat value of the Project Site and Leard State Forest per se for the Swift Parrot.

4.2.2 Eastern/Western Offsets

Similar habitat as occurs in Leard State Forest, in terms of the requirements of the Swift Parrot, was observed in both the Eastern and Western Offsets, albeit to a more limited extent. Specific suitable habitat attributes observed comprised:

- Mature White Box trees;
- Mature YellowBox trees;
- Mature ironbark trees;
- Medium to large trees in all groups;
- Some areas of the above tree groups on moderately fertile soils, such as on the Louenville and Teston North properties;
- Drainage lines; and
- Connectivity of suitable habitat with large areas of habitat, in particular associated with the Teston South and Louenville properties that adjoin the Leard Conservation Area.

The extent of occurrence of potentially limiting factors to Swift Parrot usage, such as high concentrations of the Fuscous Honeyeater, or other aggressive nectivorous bird species, was not included specifically in the review study methodology. No such concentrations however, were observed during any of the field assessments, although the seasonal conditions also were not conducive to extensive flowering of forage tree species.

4.2.3 Northern Offsets

Similar habitat attributes as were observed with the Project Site and the Eastern/Western Offsets, were observed in the Northern Offsets, although to a much larger extent than in the Eastern/Western offsets. Although there has been substantial clearing on both Northern Offset properties and regeneration of eucalypt species was apparent in many areas, much of this regeneration was quite mature**.** Young regeneration was most often observed to comprise dense stands of Stringybark species (refer to photographs in **Appendix D),** which do not tend to represent favoured forage species for the Swift Parrot.

Additionally, the south-eastern sector of the Wirradale property was observed to support Ironbark-Cypress Pine Woodland/Open Forest, representing favoured foraging habitat for the subject species. Mugga Ironbark, a highly favoured forage tree species, appeared to be represented within this sector of the offsets, although fruiting material was not available for taxonomic confirmation. The occurrence of this species in the area was, however confirmed by the property owner.

4.2.4 Shared Offsets

The Shared Offsets property was not subject to any ground–truthing surveys, but the vegetation community mapping undertaken for the purpose of offsetting indicates that the property supports forms of the box–ironbark woodland favoured by the Swift Parrot (refer to **Figure B3) (**Parsons Brinckerhoff 2010). Based on the assessments conducted by Parsons Brinckerhoff, the most common vegetation community occurring on the Shared Offsets property is *White Box–Narrow–laved Ironbark–White Cypress Pine Shrubby Open Forest*, which could be expected to provide suitable foraging habitat for the subject species. The *Silver–leaved Ironbark Heathy Woodland* and *White Box-White Cypress Pine Grassy Woodland* (low condition) would also represent potential foraging habitat for the Swift Parrot.

4.2.5 Additional Offsets

i. Roseglass

Studies of the Roseglass property have identified only a low potential for the Swift Parrot to occur, based on the lack of records for the species within the area. However, a range of vegetation types falling within the general box-ironbark habitat type, have been identified on the property and would provide suitable potential foraging habitat for the Swift Parrot. The full extent and types of vegetation communities and habitats represented are shown

on **Figure B4** in **Appendix B**. As is evident from examination of this figure, the predominant vegetation community occurring on the property is *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*, with patches of other communities supporting White Box. As the *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest* has been considered as potential foraging habitat for the Swift Parrot within the project site, it is consistent to consider the same habitat type as representing potential foraging habitat within the Roseglass property.

Viewing of this offset on Google Earth Pro™ shows the property generally to be well vegetated and quite rugged, with numerous gullies and drainage lines aligned south-east to north-west. These gullies are shown on **Figure B4** as supporting White Box-Tumbledown Red Gum and represent habitat supporting both a favoured forage tree species (White Box) and favoured drainage line habitat.

ii. Bimbooria

The Bimbooria property adjoins the Roseglass offset along the south-west boundary of Bimbooria. The Bimbooria offset supports large areas of box-gum woodland habitat, as shown on **Figure B5**, in **Appendix B**. Surveys conducted by Cumberland Ecology have found the habitats to comprise a mixture of *Box-Gum Grassy Woodland, Narrow-leaved Ironbark Woodland, Silver-leaved Ironbark Woodland* and *Cypress Pine Woodland*, as well as areas of *Derived Native Grasslands*. A watercourse also runs through the property from the north-west to the south-east and typically supports fringing vegetation of *Box-Gum Grassy Woodland* habitat, which also extends out along associated gullies, as shown on **Figure B5**.

Examination of the Bimbooria property on Google Earth shows the central portion of the site to be well vegetated, with the watercourse vegetation and more open vegetation on the less rugged topography in the north-east readily distinguishable. Although areas mapped as *Cypress Pine Woodland* do not typically represent favoured foraging habitat for the Swift Parrot, following the same procedure as adopted for the assessment of potential habitat for the project site, this habitat is appropriate to be encompassed in the overall category of potential Swift Parrot foraging habitat. This is particularly so given that the areas of *Cypress Pine Woodland* as mapped are primarily surrounded by White Box or ironbark-dominated habitat.

iii. Oakdale

The south-eastern sector of the Oakdale property adjoins Leard State Forest on the north-eastern corner of the forest. The property supports patches of woodland and derived grasslands with the main patch of woodland comprising *White Box Grassy Woodland*. The southern edge of this woodland also adjoins Leard state forest, as indicated in **Figure B6**, **Appendix B**. As the Swift Parrot utilises both large and small remnants of box-gum woodland habitat (McNally and Horrocks, 2000), all woodland patches occurring on the property represent potential habitat for the species, particularly when viewed in the context of the broader landscape and vicinity of Leard State Forest. The headwaters of

Oakey Creek also run through the property and the portions of these drainage lines that are vegetated represent potential foraging habitat for the Swift Parrot.

4.3 FIELD ASSESSMENTS OF HABITAT FEATURES

4.3.1 Project Site

Plot data, rapid assessments and point descriptions conducted within the Project Site for the purposes of this peer review, found the EIA mapping of the vegetation communities generally to be accurate, as discussed in some detail in **Section 3.3** of this report. The peer review plot data supports the observation that the Project Site supports suitable foraging habitat for the Swift Parrot in the form of box-ironbark woodland/open forest. The extent of mature and large mature trees was observed to be variable, but overall, mature trees in particular were well represented. Four plots within Leard State Forest/the Project Site, from which specific data on the maturity of regeneration was recorded, yielded consistent scores of 5 (a score of 6 representing a climax community). Another plot in the western sector of the Project Site, within habitat mapped for the EIA as *White Box- Narrow-leaved Ironbark–White Cypress Pine Grassy Open Forest,* yielded a score of 4, indicating that trees were typically mature, but not large mature old growth. Overall habitat scores for the Project Site areas sampled ranged from 2.3 to 3.8, with an average score of 3.2. Factors such as the level of past and current disturbances and variation in the occurrence of old growth trees and hollow bearing trees limited the total habitat value score. A summary of the fauna habitat assessment data is provided in **Table E2, Appendix E. As sorry of the justice distant**

A number of plots or point descriptions locations were observed to be adjacent to drainage lines, with small drainage lines and intermittent watercourses well represented within the Project Site. Such areas would represent potential favoured foraging habitat for the Swift Parrot. Random checks of ironbark species detected three ironbark species occurring within the Project Site, viz: Narrow-leaved Ironbark (*E. crebra*), Silver-leaved Ironbark (*E. melanophloia*) and Blue-leaved Ironbark (*E. nubila*), corresponding with the species identified for the EIA.

4.3.2 Eastern/Western Offsets

Plot data for the Eastern and Western offsets also confirmed the occurrence of the vegetation communities mapped for the EIA, primarily representing box–ironbark woodland/open forest and thus suitable foraging habitat for the Swift Parrot. The majority of plots in the Western offsets rated a score of 4 for maturity of regeneration, thus indicating that trees present were typically mature. Two locations also yielded a score of 5, comparable with the results for Leard State Forest. Overall habitat scores for the Western Offset areas sampled ranged from 2.6 to 3.8, with an overall average of 3.2. .These results were highly comparable with the scores for the Project Site. Overall habitat scores for the Eastern Offset areas sampled ranged from 2.4 to 3.3, with an overall average of 3.04 and

these scores were also reasonably comparable with the Project site habitat values. The level of past and current disturbances was a substantial factor in limiting the total habitat value score. A summary of the fauna habitat assessment data for the Eastern and Western Offsets is provided in **Table E1, Appendix E.**

As for the Project Site, some sectors of the Eastern/Western Offset supported areas of dense cypress pine regeneration, which could be expected to reduce the value of potential habitat for the Swift Parrot in the long-term. Properties exhibiting this type of regeneration were primarily Kelso, in the south-west of the Western Offsets and the ironbark dominated sectors of Wallandilly in the far north-east of the Eastern Offsets.

Drainage lines were recorded within both the Eastern and Western Offsets but were best developed in the Eastern Offsets. In particular, plot data and point descriptions in the vicinity of Back Creek, on the Wallandilly property, indicated good quality riparian habitat, although the primary box species in this location was Yellow Box. This species however, is also listed as a favoured forage species for the Swift Parrot (Threatened Species Scientific Committee, 2011). White Box also was found to occur in adjacent areas of the property as discussed in **Section 3.3** of this report.

Suitable foraging habitat within the Eastern and Western Offsets is represented as either small fragmented patches or small patches adjoining, and connected with, large vegetation remnants. Both of these types of habitat units conform to the requirements of the Swift Parrot as described by McNally and Horrocks (2000). Scattered trees also are utilised as a foraging resource (Saunders and Heinsohn, 2008), and scattered White Box trees are present in a number of sectors of the eastern offsets with in areas mapped as Derived Native Grassland (Box-Gum Woodland).

4.3.3 Northern Offsets

As described in **Section 3.3** of this report, although there are some areas of the Northern offset properties that do not conform to *Box–Gum Grassy Woodland*, the majority of the areas mapped as representing this community were confirmed. Some of the areas not conforming to the CEEC, still support White Box and/or Yellow Box and thus still represent the favoured habitat of the Swift Parrot of box–ironbark. The area mapped as *Narrow-leaved Ironbark–White Box-White Cypress Pine Shrubby Open Forest* in the far south-east of the Wirradale property was also confirmed from point descriptions and habitat assessments, and sectors on the lower slopes of this area also support White Box Woodland. Thus the Northern Offset habitats conform to the favoured foraging habitat type of box–ironbark woodlands.

Data from 13 habitat assessment plots sampled within the Northern Offsets yielded an average maturity of regeneration score of 4.5, indicating relative maturity of trees. Large mature trees tended to be recorded only occasionally in many of the areas surveyed or inspected. This size category was more common however in the more rugged sectors of the offset properties less subject to heavy logging practices and as scattered paddock trees of White Box or Yellow Box in the southern sectors of the Northern Offsets.

Well developed drainage lines occur within the Northern Offsets, with the Horton River running through part of the central and eastern sector of the Mt Lindesay property. Large mature trees and old growth trees were recorded at various locations along the river, such as near site NOML1 and waypoint 229 (refer to **Figure E1** in **Appendix C**). The far northern sector of the Mt Lindesay property is dissected by Second Water Creek and Maules Creek runs through the Wirradale property from the north-west to the south-east. Numerous other gullies and minor tributaries of the creeks occur in the Northern Offset, as indicated on **Figure B2** in **Appendix B**. All of these areas would represent potential favourable habitat for the Swift Parrot. Overall habitat scores for the Northern Offset areas sampled ranged from 2.8 to 4.1, with an overall average 3.3, which represents a slightly higher overall average than obtained for the Project Site. The high level of connectivity of much of the Northern Offset habitats with the extensive tracts of habitat within Mount Kaputar National Park and other adjoining forested areas contributed to the the total habitat value score. A summary of the fauna habitat assessment data for the Northern Offsets is provided in **Table E1, Appendix E.**

Dense cypress pine regeneration, as was noted for the Project Site and the Eastern Western Offsets, was only recorded as a feature in habitat assessments for the *Narrow-leaved Ironbark Shrubby Open Forest* community occurring in the far south-east of the Wirradale property. As indicated earlier in this report, continuation of cypress pine regeneration could be expected to reduce the value of habitat for the Swift Parrot in the long term.

4.4 OUTCOMES FOR SWIFT PARROT HABITAT

The majority of woodland/forest habitat occurring on the offset properties was considered to represent suitable foraging habitat for the Swift Parrot equivalent to, or better quality than, the habitats represented within the Project Site. Although some sectors of the offset properties potentially support fewer large mature trees/ha than the Project Site, mature trees are well represented in many of the offset habitats. Any potential lower habitat value arising from a lower density representation of large mature trees is considered to be counterbalanced by the following factors provided by the combined offset properties:

- More extensive representation of drainage line habitat, including sheltered watercourses encompassed by the favoured box–ironbark habitat;
- More extensive occurrence of Yellow Box, including sectors supporting large mature trees in both the Eastern and Northern Offsets; and
- Potential occurrence of a favoured food tree species, the Mugga Ironbark, in the south-eastern sector of the Northern Offsets.

Additional large areas of open woodland, small habitat patches and vegetated drainage lines within the offset properties also represent low to moderate condition habitat for the species equivalent or better in habitat value than the low to moderate condition habitat occurring within the Project site.

The potential for habitat value to be affected adversely in the long term by dense cypress pine regeneration applies to the Project Site and offset properties alike.

Areas of offset habitat estimated as providing foraging habitat for the Swift Parrot and other threatened species and equivalent in quality to the Project Site habitats are provided in **Appendix E, Table E1**.

Chapter

5

Results for Threatened Species - Regent Honeyeater (*Anthochaera phrygia*)

5.1 RESULTS FROM DESKTOP ASSESSMENTS

The desktop assessments of the EIA and BMP for the Project and relevant to the determination of Regent Honeyeater occurrence and habitat suitability indicated that the following procedures were employed in relation to the Project Site and the Eastern, Western and Northern offset:

- Relatively comprehensive fauna surveys within the Project Site, with limitations to the surveys in accordance with what would generally be expected for such surveys (short term seasonal surveys);
- More limited surveys of the offset areas, with the focus of surveys in the Eastern and Western Offsets being to confirm the occurrence of habitat suitable for the species detected within Leard State Forest. The studies included bird habitat assessments by specialist ornithologists; and
- Northern Offset surveys focussed on general habitat assessments and bird habitat assessments by specialist ornithologists.

As for the Swift Parrot, the EIA surveys yielded no records of the Regent Honeyeater from either the Project site or the offset areas. No other surveys recently conducted in the area and encompassing the Shared Offset and the Roseglass, Bimbooria and Oakdale additional offset properties, have detected the species (Parsons Brinckerhoff, 2010, Niche Environment and Heritage, 2012 and Cumberland Ecology, 2013). The Project Site, Eastern, Western and Shared Offsets and additional offset properties however, are within the historical range of the species. The Northern Offsets are within the vicinity of one of the four key known breeding areas for the species – the Barraba–Bundarra area (Ingwerson et al 2013).

In general the Regent Honeyeater appears to favour box-ironbark communities with a particular preference for wetter, more fertile sites such as creek flats and lower slopes. The combination of key forage species and drainage lines is considered likely to be of particular significance to the honeyeater population (Ingwerson et al 2013). The Project Site was recognised during the EIA process as providing potential stepping stone habitat for the species, representing a substantial habitat area between the larger expanse of habitat of the Pilliga to the west and the Nandewar Ranges to the north (Cumberland Ecology). The most recent checks of the Atlas of NSW for the purposes of this review

indicate the records for the species closest to either the Project Site or offsets are from the Horton Falls National Park area, approximately 10km east of the Northern Offsets (OEH 2013). There is also a record of the Regent Honeyeater within the Mount Kaputar National Park in the far north-western sector (Department of Conservation [DEC] 2006), approximately 15 km to the west of the offsets. Most records of the species in the Barraba area are from further to the east, but recent records in general have been very scarce (local residents pers. com 4 September, 9 December 2013). There are no current records known from the vicinity of the Project Site (OEH 2013) but removal of 1665 ha of forest/woodland habitat from the Project Site was identified in the EIA as including potential foraging habitat for the Regent Honeyeater.

As for the Swift Parrot, It is noted that the potential foraging habitat identified for the Regent Honeyeater within the Project Site encompassed all forest and woodland types within the general box–ironbark habitat. This encompassed both known forage tree species (White Box and Yellow Box) and species generally occurring within the general box-ironbark habitat type (Narrow-leaved Ironbark [*Eucalyptus crebra*], Blue-leaved Ironbark [*E. nubile*] and Dwyer's Red Gum [*E. dwyeri*]). Thus, when assessing suitable habitat for the Regent Honeyeater within the offset properties, it is consistent for the offset properties to consider all patches of forest/woodland habitat occurring within the general box-ironbark habitat category as potential foraging habitat, including patches supporting tree species that are not specifically known forage species.

The occurrence of the Regent Honeyeater is dependent on the flowering of favoured food tree species that reliably produce sufficient quantities of nectar and other carbohydrate sources. Lerps also provide an important food resource and eucalypt species that provide a suitable substrate for lerps are an important factor in determining the seasonal distribution of Regent Honeyeaters. The key forage species, or species providing suitable lerps substrate, that occur within the Project Site and/or the offset properties comprise:

- Mugga Ironbark;
- White Box;
- Yellow Box;
- Blakely's Red Gum; and
- Box Mistletoe (*Amyema miquelii*).

From the information available for the Regent Honeyeater habitat requirements and the vegetation mapping of the project site for the EIA, the following key attributes have been identified for the purposes of this report:

- Favoured foraging habitat of box-ironbark woodlands, including Mugga Ironbark White Box, Yellow Box and Blakely's Red Gum;
- Drainage lines;
- Larger trees; and

- More fertile soils.

Mapping undertaken for the EIA indicated the representation of potentially suitable foraging habitat for the Regent Honeyeater within the Project Site and the offset areas. This habitat included White Box, Yellow Box, Blakely's Red Gum and ironbark woodland/open forest, but Mugga Ironbark was not identified in either the Project Site or the offset areas. As noted for the Swift Parrot however, drainage lines were represented to some extent within the Project Site and Western Offsets, and to a greater extent in the Eastern and Northern Offset areas. All of the additional offset areas have also been shown as supporting drainage line habitat as indicated in **Figures B4-B6**.

The few potential minor inconsistencies between the EIA mapped units and EIA plot data, as discussed in **Section 3.1** of this peer review report**,** do not affect the potential habitat suitability of the Project Site for the Regent Honeyeater.

5.2 GENERAL HABITAT OBSERVATIONS

5.2.1 Project Site

Observations of the Project Site confirm the assessments provided in the EIA that suitable potential foraging habitat for the Regent Honeyeater was present. This was represented primarily by numerous mature White Box trees and some Yellow Box and Blakely's Red Gum, with a proportion of these trees occurring on relatively fertile soil. Other areas of forage species occurred on less fertile soil in the more rugged sectors of the project site. As observed for the Swift parrot, Leard State Forest and the Project Site also supported large areas of ironbarks and cypress pine, with only occasional occurrences of box species or Blakely's Red Gum. The favoured foraging tree species, the Mugga Ironbark, however has not been recorded.

The dense regeneration of cypress pine, noted by the author as seeming more prevalent than during the early studies in Leard State Forest in the 1970s (James B Croft and Associates 1979) would also be likely to detract from the habitat value of the Project Site for the Regent Honeyeater over time.

5.2.2 Eastern/Western Offsets

Similar habitat as occurs in Leard State Forest, in terms of the requirements and the Regent Honeyeater, was observed in both the Eastern and Western Offsets, with specific suitable habitat attributes observed comprising:

- Mature White Box and Yellow Box trees;
- Mature ironbark trees;
- Medium to large trees in both groups;

- Some areas of the above tree groups on moderately fertile soils, such as on the Louenville, Teston North and Wallandilly properties; and
- Large trees along drainage lines (Wallandilly).

5.2.3 Northern Offsets

Similar habitat attributes as were observed for the Project Site and the Eastern/Western Offsets were observed in the Northern Offsets, although to a much larger extent than in the Eastern/Western offsets. White Box, Yellow Box and Blakely's Red Gum were observed to be common, although it was apparent that substantial clearing of these species had been undertaken in the past. Yellow Box for instance, was sought after extensively for firewood and representation of this species is now severely limited in more accessible areas (local resident, pers. com. 9 December 2013). As is discussed in **Section 4.2.3,** regeneration of eucalypt species was apparent in many areas, with much of this regeneration quite mature**.** Young regeneration was most often observed to comprise dense stands of immature stringybark species (refer to photographs in **Appendix D),** which do not tend to represent favoured forage species for the Regent Honeyeater (Ingwerson et al, 2013). Relatively even-aged stands of young mature to mature specimens of Blakely's Red Gum were apparent in a number of locations, including the northern, central and far south-eastern sections of the Mt Lindesay property, portions of Old Man Ridge and the far north-western and western sections of the Wirradale property (refer to photographs in **Appendix D)**.

Additionally, the south-eastern sector of the Wirradale property was observed to support what appeared to be Mugga Ironbark specimens within the *Narrow-leaved Ironbark--Cypress Pine Shrubby Wood land/Open Forest*, representing favoured foraging habitat for the Regent Honeyeater, although fruiting material of the ironbark was not available to confirm the taxonomy. The local property owner also referred to specimens of Mugga Ironbark occurring within this habitat amongst the more common Narrow-leaved Ironbark trees.

5.2.4 Shared Offsets

As discussed in the previous chapters, the Shared Offsets property was not subject to any ground–truthing surveys, but the vegetation community mapping undertaken for the purpose of offsetting indicates that the property supports forms of the box–ironbark woodland favoured by the Regent Honeyeater (refer to **Figure B3)**. Based on the assessments conducted by Parsons Brinckerhoff (2010), the areas of *White Box–Narrow–leaved Ironbark–White Cypress Pine Shrubby Open Forest*, *Silver–leaved Ironbark Heathy Woodland* and *White Box-White Cypress Pine Grassy Woodland* (low condition) would represent potential foraging habitat for the Regent Honeyeater.

5.2.5 Additional Offsets

i. Roseglass

Studies of the Roseglass property have identified a moderate potential for the Regent Honeyeater to occur, based on historical records for the species within the local area (Niche Environment and Heritage, 2012). As is evident from examination of **Figure B4** in **Appendix B**, the predominant vegetation community occurring on the property is *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*, with patches of other communities supporting White Box. These communities have been considered as potential foraging habitat for the Regent Honeyeater within the project site and it is consistent therefore to consider the same habitat type as representing potential foraging habitat within the Roseglass property.

Viewing of this offset on Google Earth (2013) shows the property generally to be well vegetated and quite rugged, with numerous gullies and drainage lines aligned south-east to north-west. These gullies are shown on **Figure B4** as supporting *White Box-Tumbledown Red Gum along creek lines* and represent habitat supporting both a favoured forage tree species (White Box) and favoured drainage line habitat.

ii. Bimbooria

The Bimbooria property shares a common boundary with the Roseglass property along the south-western boundary of Bimbooria. The property has been reported as supporting large areas of box-gum woodland habitat, as shown on **Figure B5**, in **Appendix B**. Recent broad reconnaissance surveys have found the habitats to comprise a mixture of *Box-Gum Grassy Woodland, Narrow-leaved Ironbark Woodland, Silver-leaved Ironbark Woodland* and *Cypress Pine Woodland*, as well as areas of *Derived Native Grassland* (Cumberland Ecology, 2013a). A watercourse also runs through the property from the north-west to the south-east and typically supports fringing vegetation of *Box-Gum Grassy Woodland* habitat, which also extends out along associated gullies, as shown on **Figure B5**.

Examination of the Bimbooria property on Google Earth (2013) shows the central portion of the site to be well vegetated, with the watercourse vegetation and more open vegetation on the less rugged topography in the north-east readily distinguishable. Although areas mapped as *Cypress Pine Woodland* do not typically represent favoured foraging habitat for the Regent Honeyeater, following the same procedure as adopted for the assessment of potential habitat for the project site, this habitat is appropriate to be encompassed in the overall category of potential Regent Honeyeater foraging habitat. This is particularly so given that the areas of *Cypress Pine Woodland* as mapped are primarily surrounded by White Box or ironbark-dominated habitat.

iii. Oakdale

The south-eastern sector of the Oakdale property adjoins Leard State Forest on the north-eastern corner of the forest as shown on **Figure B6** in **Appendix B**. Recent broad

reconnaissance surveys have found the property to support patches of woodland and derived grasslands with the main patch of woodland comprising *White Box Grassy Woodland* (Cumberland Ecology, 2013b). The southern edge of this woodland also adjoins Leard State Forest, as indicated in **Figure B6.** All woodland and open woodland patches occurring on the property represent potential habitat for the species, particularly when viewed in the context of the broader landscape and vicinity of Leard State Forest. The headwaters of Oakey Creek also run through the property and the portions of these drainage lines that are vegetated represent potential foraging habitat for the Regent Honeyeater.

5.3 FIELD ASSESSMENTS OF HABITAT FEATURES

5.3.1 Project Site

Plot data, rapid assessments and point descriptions conducted within the Project Site for the purposes of this peer review, found the EIA mapping of the vegetation communities generally to be accurate, as discussed in some detail in **Section 3.3** of this report. The peer review plot data supports the observation that the Project Site supports suitable foraging habitat for the Regent Honeyeater in the form of box-ironbark woodland/open forest. The extent of mature and large mature trees was variable, but overall, mature trees in particular were well represented as described in **Section 4.3.1**. Mature trees were also observed along drainage lines within Leard State Forest. A summary of the fauna habitat assessment data is provided in **Table E2,** Appendix E**.**

Random checks of ironbark species confirmed the occurrence of the three ironbark species previously recorded within the Project Site, viz: Narrow-leaved Ironbark (*E. crebra*), Silver-leaved Ironbark (*E. melanophloia*) and Blue-leaved Ironbark (*E. nubila*). As no records of the favoured ironbark forage species, the Mugga Ironbark have been recorded from the Project Site, the potential value of the ironbark forests to the Regent Honeyeater may be limited.

5.3.2 Eastern/Western Offsets

As indicated in the previous chapters, plot data for the Eastern and Western offsets confirmed the occurrence of the vegetation communities mapped for the EIA, primarily representing box–ironbark woodland/open forest and thus suggesting potential suitable foraging habitat for the Regent Honeyeater. As discussed in **Section 4.3.2, t**he majority of plot data for the Western offsets, typically representing samples of box-gum woodland habitats, indicated the occurrence of mature tree species. The average rating score for maturity of regeneration overall for the Western Offsets (4.1) was less than for the Project Site (4.8), but the level of reliability also was less for the Project Site owing to a smaller dataset. As for the Project Site, the most common form of early regeneration recorded in the Eastern/Western Offset comprised stands of young cypress pine in varying densities. Properties exhibiting this type of regeneration were primarily Kelso, in the south-west of

the Western Offsets and the ironbark dominated sectors of Wallandilly in the far north-east of the Eastern Offsets.

Drainage lines were recorded within both the Eastern and Western Offsets but were best developed in the Eastern Offsets. In particular, plot data and point descriptions in the vicinity of Back Creek, on the Wallandilly property, indicated good quality riparian habitat and adjacent creek flats supporting mature and large mature Yellow Box. White Box also occurred in adjacent areas of the property as discussed in **Section 3.3** of this report.

5.3.3 Northern Offsets

White Box, Yellow Box and Blakely's Red Gum are commonly represented on the Northern Offset properties and represent favoured foraging habitat for the Regent Honeyeater. The area mapped as *Narrow-leaved Ironbark–White Box-White Cypress Pine Shrubby Open Forest* in the far south-east of the Wirradale property was also confirmed from point descriptions and habitat assessments. This habitat also potentially supports some specimens of Mugga Ironbark and thus represents a potential high value resource for the Regent Honeyeater within the locality. This value would be increased by the presence of drainage lines and the reported occurrence of White Box Woodland on the lower slopes/creek flats of this area, representing higher fertility habitat.

As indicated in **Section 4.3.3**, habitat assessment plot data yielded an average maturity of regeneration score of 4.5, indicating the occurrence of relatively mature trees within the areas sampled but not the presence of a climax community. Large mature specimens were recorded more commonly in the less accessible sectors of the offset properties, but also featured as scattered paddock trees of White Box or Yellow Box in the southern sectors of the Northern Offsets. The dataset from the Eastern Offsets was similar in size to the dataset for the Project Site and the average score for the Eastern offsets was 3.8. Further discussion on habitat quality is provided in **Section 5.4**.

Dense cypress pine regeneration, as was noted for the Project Site and the Eastern Western Offsets, was only recorded as a feature in habitat assessments for the *Narrow-leaved Ironbark Shrubby Open Forest* community occurring in the far south-east of the Wirradale property. As indicated earlier in this report, continuation of cypress pine regeneration could be expected to reduce the value of habitat for the Regent Honeyeater in the long term.

5.4 HABITAT CONDITION

As outlined in **Section 2.5.2**, overall evaluation of habitat condition has been drawn from consideration of both general observations of vegetation and habitat condition in the field, and consideration of the fauna habitat assessment data collected from various locations within the Project Site and the offset properties. In relation to the Shared Offset and the additional offsets (Roseglass, Oakdale and Bimbooria), the assessment of condition is as

reported by the respective consultants who have carried out the field surveys and inspections. The assessment of the condition of vegetation at individual sites is provided in the summary tables in **Appendix E.** As discussed in **Section 4.3.1 to Section 4.3.3**, the overall average habitat scores for the Project Site and Eastern/Western Offsets a reasonably comparable, whilst the overall average habitat value score for the Northern Offsets is slightly higher than for the Project Site and the Eastern/Western Offsets

As discussed in **Section 4.5**, an important factor to note is that the vegetation overall at all sites, including the Project Site, was exhibiting signs of severe moisture stress during the review period and the general vigour of plants was very poor. Similarly, there was little evidence of significant flowering or fruiting of forage trees, although Yellow Box was observed to be flowering and fruiting during the latter part of the field surveys. This was particularly evident in the Northern Offsets, where Yellow Box is more prolific and the rainfall per annum is also much greater. Although the Northern Offset properties were also experiencing significant drought conditions, as confirmed by local property owners, the higher rainfall level for the area was potentially one factor contributing to the better condition in ground cover species generally observed in comparison with the Project Site and Eastern/Western Offset properties. Another factor likely to have contributed to the better condition of the ground stratum in the Northern Offset properties is lower grazing pressures.

Negative impacts on habitat condition from exotic species was evident in all areas, with substantial damage to the ground stratum evident from feral pig, with groups of feral pigs observed within the Project Site and in the Northern Offsets. Adverse impacts from feral pigs is likely to have been a long term problem within Leard State Forest and the environs as feral pigs were a problem in the general locality in the 1970s (James B Croft and Associates, 1979). Incidence of exotic weeds was generally low in the offset areas, except in sectors subject to cultivation or poor condition derived grasslands, with the lowest incidence recorded for the Northern Offset properties.

The overall condition of the habitats providing suitable foraging habitat for the Regent Honeyeater was rated as moderate to good with some exceptions where the combination of land practices had adversely and substantially affected the understory strata. These areas also tended to be on more rugged terrain, rocky slopes and poorer soils and were observed primarily on the Kelso, Velyama and Wallandilly properties. It is noted that the assessments of bird habitat condition on the Kelso and Velyama properties for the BMP rated some habitat as 'poor' or 'poor to fair (refer to **Table D10**, Appendix D of the BMP), with the areas described corresponding with the areas considered of lesser quality during the review field assessments. Some adjustments to the condition ratings for these properties have thus been recommended.

5.5 OUTCOMES FOR REGENT HONEYEATER HABITAT

The majority of woodland/forest habitat occurring on the offset properties is considered to represent suitable foraging habitat for the Regent Honeyeater of equivalent quality to the habitats represented within the Project Site. Although some sectors of the offset

properties potentially support fewer large mature trees/ha than the Project Site, mature trees are well represented in most sectors. The indications are that regeneration is well advanced in many areas following heavy clearing activities four to six decades previously. The suspected occurrence of one of the forage tree species favoured by the Regent Honeyeater, the Mugga Ironbark, adds value to the Northern Offsets as potential habitat for the honeyeater. Additionally, the offsets provide the habitat value of more extensive representation of drainage lines, including sheltered watercourses encompassed by the favoured box–ironbark habitat. The Northern Offsets also provide the advantage in many sectors of direct connections with large tracts of habitat associated with Mount Kaputar National Park and other forested areas in the locality. The potential for habitat value to be affected adversely in the long term by dense cypress pine regeneration applies to the project site and offset properties alike.

Areas of offset habitat estimated as providing foraging habitat for the Regent Honeyeater and the other subject threatened fauna species and equivalent in quality to the Project Site habitats are provided in **Appendix F, Table F1.**

Chapter

6

Results for Threatened Species - South-Eastern Long-Eared Bat (*Nyctophilus Corbeni*)

6.1 RESULTS FROM DESKTOP ASSESSMENTS

As referred to in Chapter 1 of this report, the threatened microbat species referred to in Conditions 9 and 10 of the Project Approval and in the EIA and BMP for the Project as the Greater Long-eared Bat, has been reclassified as the South-eastern Long-eared Bat (*Nyctophilus corbeni).* The updated taxonomic classification is adopted for this report.

Desktop assessments of the EIA and BMP indicated the following procedures relevant to the determination of the South-eastern Long-eared Bat occurrence and habitat suitability:

- Relatively comprehensive fauna surveys within the Project Site, with limitations to the surveys in accordance with what would generally be expected for such surveys (short term seasonal surveys);
- More limited surveys of the offset areas, with the focus of surveys in the Eastern and Western Offsets being to confirm the occurrence of habitat suitable for the species detected within Leard State Forest. As the South-eastern Long-eared Bat was detected within Leard state forest during the EIA studies, it is assumed that specific consideration therefore was given to assessing suitable habitat for the species within the Eastern and Western Offsets ;
- Northern Offset surveys focussed on general and tree hollows habitat assessments and microchiropteran bat trapping using harp traps;
- Harp traps were set at four locations within the Wirradale property as shown on **Figure D2 of the BMP** over a minimum two-night period, with a total of 15 trap nights sampled**.** Trap locations were primarily within areas mapped as White Box-Stringybark Grassy Woodland or White Box-Stringybark Shrubby Woodland for the BMP; and
- There were some limitations to the timing of the microchiropteran bat surveys for the northern offsets.

Records of the South-eastern Long-eared Bat were detected from three widely separated locations within Leard State Forest, as shown on **Figure 3.3** of the EIA, but the species was not confirmed as occurring within the offset areas. This species was originally recorded (under the former taxonomic classification of *N. timoriensis*) within Leard State Forest in

the 1970s by the author of this review and Fred van Gessel during the early ecological studies in the forest (James B. Croft and Associates, 1979). Trapping for this early survey was conducted using mistnets in relatively open habitat (use of mistnets in dense shrubby habitat is impractical). The removal of 1665 ha of woodland/forest habitat for the Project was recognised during the EIA process as likely to have a significant impact on the local occurrence of the South-eastern Long-eared Bat (Cumberland Ecology 2011). As for the Swift Parrot and the Regent Honeyeater, it is noted that the 1665 ha considered as potential habitat for the microbat species encompassed all forest and woodland communities within the project site, and thus was not restricted to a specific habitat type or habitat structure.

The most recent checks of the Atlas of NSW for the purpose of this review indicate the records for the species closest to either the Project Site or offsets (excluding the records within Leard State Forest) are from the Mount Kaputar National Park, in habitat immediately adjacent to the south-eastern extremity of the Wirradale property. Other records in the locality are from the Horton Falls National Park area, approximately 10km east of the Northern Offsets, and from the far north-western sector of the Mount Kaputar National Park approximately 15 km to the west of the offsets (OEH 2013). The South-eastern Long-eared Bat therefore is known from the immediate locality of the Northern Offsets.

It is of relevance to note that the Horton Falls area is located at elevations of approximately 700m to 960m (Google 2013) whilst the lower portions of Mount Kaputar National Park, in the vicinity of the South-eastern Long-eared Bat records, range from approximately 380m to 600m. For comparison, the locations within Leard State Forest at which the species was captured ranged from approximately 330m to 600m. The general area of records further to the north, in the vicinity of Warialda, is at elevations ranging from approximately 350m to 500m, whilst the general location of records south of Inverell is at elevation of approximately 750m to 900m (Google Earth, 2013). The Northern Offsets are at elevations ranging from approximately 600m in the far south-eastern sector to 1070m in the far north, with the majority of the offset properties at elevations between 800m and 950m (Google Earth 2013).

The ecology of the South-eastern Long-eared Bat is little known and only limited studies have been conducted on foraging behaviour. Studies in Victoria found the species to roost as solitary individuals, to change roosts frequently and to move large distances between roosts (Lumsden et al 2008). Roost sites were located in either dead spouts on Mallee eucalypts, under bark or fissures of Buloke (*Allocasuarina leuhmannii*) or Belah (*Casuarina cristata*). Studies in South Australia also found roost sites to include dense foliage (Dominelli 2000), which is characteristic of the *Nyctophilus* genus in general (Dominelli 2000, author's observation). The South-eastern Long-eared Bat seems to be most strongly associated with the box-ironbark-cypress pine communities (OEH 2013) and large vegetation remnants in western NSW (Goonoo, Pilliga West and Pilliga East) appear to represent strongholds of the species. Limits to distribution have been suggested as the change to grasslands and shrublands in the north-west and the transition to more moist forest types in coastal areas. Habitat at capture sites has typically been found to support a dense understory and a distinct canopy (Turbill and Ellis 2006).

From the information available for the South-eastern Long-eared Bat habitat requirements and the vegetation mapping of the project site for the EIA, the following key attributes have been identified for the purposes of this report:

- Favoured foraging habitat of box-ironbark woodlands
- Presence of tree hollows;
- Dense shrub layer;
- A distinct canopy layer; and
- Large vegetation patches.

Mapping undertaken for the EIA indicated the representation of potentially suitable foraging habitat for the South-eastern Long-eared Bat within the offset areas. This habitat included a range of box-ironbark-cypress pine woodland/open forest, also encompassing shrubby forest habitat. Tree hollow counts for the Project Site found an average density of 100 hollows/ha, with the majority of hollows being up to 15cm diameter. Additional surveys also established a variable density of tree hollows on the offset properties, densities ranging from 10 to 110 hollows/ha, with an overall average of 106 hollows/ha. Similar data collected for the EIA for the Project Site also yielded variable densities, with an overall average of 110 hollows/ha. The majority of hollows were found to be below 16 cm diameter and this was also the case for the offset properties (refer to **Table D11, Appendix D** of the BMP and **Table 3.4** of the EIA).

No specific data is available at this stage on hollow density for the additional offsets (Roseglass, Oakdale and Bimbooria).

6.2 GENERAL HABITAT OBSERVATIONS

6.2.1 Project Site

Suitable foraging habitat for the South-eastern Long-eared Bat was observed on the Project Site, represented by large areas of box-ironbark-cypress pine communities with varying densities and proportions of shrub cover. Canopy cover within the Project Site was also observed to be variable, with overall structure ranging from open woodland to open forest. This variation is structure was also recorded during the studies conducted by the author of this review in the 1970s, when the overall structure of the Leard State Forest was found to range from woodland to open forest (Croft and Associates 1979). Numerous roosting opportunities for the subject microbat species were observed in the forest in the form of decorticating or exfoliating bark or fissures in the bark or tree trunk. Previous studies in the Leard State Forest in the 1970s found that heavy logging of ironbarks had left numerous ironbark stumps with the bark in various stages of decortication. This feature provided shelter habitat for numerous reptiles and invertebrates. It would therefore be expected that any ironbarks exhibiting signs of decortication would provide

potential roost sites for the South-eastern Long-eared Bat, as well as hollows and dense foliage.

The dense regeneration of cypress pine, noted as seeming more prevalent than during the early studies in Leard State Forest in the 1970s (James B Croft and Associates 1979) would be likely to detract from the habitat value of the Project Site for the South-eastern Long-eared Bat over time. Continued dense regeneration of cypress pine could be expected to inhibit understory species development and subsequently reduce the density and complexity of the understorey strata, with associated impacts on insect prey populations.

6.2.2 Eastern/Western Offsets

Some habitat similar to that occurring within Leard State Forest, in terms of the requirements and habitat suitability for the South-eastern Long-eared Bat, was observed in both the Eastern and Western Offsets, primarily in the Western Offsets on the Teston South and Louenville properties. In these locations, shrubby White Box-cypress pine and Narrow-leaved Ironbark-cypress pine woodland/open forest adjoining similar habitat within the Project Site and providing highly suitable habitat for the subject bat species. These areas also adjoin the Leard Conservation Area and thus form part of a large vegetation patch that is considered a favourable habitat feature for the species (Turbill and Ellis 2006).

Suitable habitat within the Eastern Offsets was less well represented, but sections of the Wallandilly property supported shrubby box woodland, particularly along with the watercourse in the southern sector of the property. This location also connects, to a minor extent, with the northern section of Leard State Forest and there is good opportunity for enhancing this connection with future restoration works.

The dense regeneration of cypress pine noted for the Project Site was also observed on the Kelso and Wallandilly properties, particularly in areas dominated by ironbarks. Continued regeneration of cypress pine in this manner would be likely to detract from the habitat value of some portions of these properties for the South-eastern Long-eared Bat over time.

6.2.3 Northern Offsets

Similar habitat attributes as were observed for the Project Site and the Eastern/Western Offsets, were observed in the Northern Offsets, although to a much larger extent than in the Eastern/Western offsets. Much of the box-gum habitat occurring over large areas of the offset properties supported varying extents of shrubby woodland or open forest habitat. Although much of the habitat was observed to be fragmented to some extent, there was also a general level of common connectivity between most habitat patches. Habitat in the far west, south and east of the Wirradale property, and along the eastern boundary of the Mt Lindesay property also adjoins much larger expanses of vegetation and these areas thus form part of the desirable large habitat areas for the South-eastern Long-eared Bat.

As was discussed in **Section 4.2.3,** regeneration of eucalypt species was apparent in many areas, with much of this regeneration quite mature**.** Young regeneration was most often observed to comprise dense stands of immature stringybark species (refer to photographs in **Appendix C**), and does not represent typically favoured foraging habitat for the South-eastern Long-eared Bat (Ingwerson et al, 2013). Such areas however, and other even-aged stands of more mature regeneration of species such as Blakely's Red Gum, typically either supported variable patches of shrubs or adjoined shrubby habitat. This type of habitat would represent favourable foraging habitat for the South-eastern Long-eared Bat and was evident in a number of locations, including the northern, central, eastern and far western sectors of the Northern Offsets.

Additionally, the south-eastern sector of the Wirradale property was observed to support a large expanse of *Ironbark-Cypress Pine Shrubby Woodland/Open Forest*, representing likely favoured foraging habitat for the South-eastern Long-eared Bat

6.2.4 Shared Offsets

The vegetation community mapping undertaken for the purpose of offsetting (Parsons Brinckerhoff, 2010) indicates that the majority of the Shared Offset property supports *White Box–Narrow–leaved Ironbark–White Cypress Pine Shrubby Open Forest*, with smaller areas of *Silver–leaved Ironbark Heathy Woodland*. Both of these communities would be expected to represent suitable foraging habitat for the South-eastern Long-eared Bat. Patches of Dwyers Red Gum Woodland encompassed within, or connecting with these habitats would also be expected to represent potential foraging and roosting habitat. Examination of recent aerial photographs of the area indicates that the Shared Offsets currently are disconnected from other larger areas of habitat to the north-east and west by cleared agricultural land. This factor potentially reduces the habitat value of this offset, although the location of the offset also suggests the potential to function as a stepping stone habitat between the larger remnants. This supposition is supported by the occurrence of records of the species immediately to the west in the Pilliga East State Forest (OEH 2013).

6.2.5 Additional Offsets

i. Roseglass

Studies of the Roseglass property have identified a moderate potential for the South-eastern Long-eared Bat to occur, based on known records for the species in the locality (Niche Environment and Heritage, 2012). As is evident from examination of **Figure B4** in **Appendix B**, the predominant vegetation community occurring on the property is *Narrow-leaved Ironbark-White Cypress Pine Shrubby Open Forest*, covering a total area of 827 ha. This would represent suitable potential foraging habitat for the subject species. Patches of other communities supporting White Box would also be likely to support some foraging and roosting habitat for the species.

Viewing of this offset on Google Earth (2013) shows the property generally to be well vegetated and quite rugged, with numerous gullies and drainage lines aligned south-east to north-west. These gullies are shown on **Figure B4** as supporting *White Box-Tumbledown Red Gum along creek lines* and represent habitat supporting favoured drainage line habitat.

ii. Bimbooria

The Bimbooria property shares a common boundary with the Roseglass property along the south-west boundary of Bimbooria. Recent broad reconnaissance surveys have found the habitats to comprise a mixture of *Box-Gum Grassy Woodland, Narrow-leaved Ironbark Woodland, Silver-leaved Ironbark Woodland* and *Cypress Pine Woodland,* as shown on **Figure B5**, in **Appendix B** (Cumberland Ecology, 2013a). A watercourse also runs through the property from the north-west to the south-east and typically supports fringing vegetation of *Box-Gum Grassy Woodland* habitat, which also extends out along associated gullies, as shown on **Figure B5**.

Examination of the Bimbooria property on Google Earth shows the central portion of the site to be well vegetated, with the watercourse vegetation and more open vegetation on the less rugged topography in the north-east readily distinguishable. The Roseglass vegetation is also connected with a larger habitat remnant and the site vegetation as a whole represents potential habitat for the South-eastern Long-eared Bat.

iii. Oakdale

The south-eastern sector of the Oakdale property adjoins Leard State Forest on the north-eastern corner of the forest as shown on **Figure B6** in **Appendix B**. Recent broad reconnaissance surveys have found the property to support patches of woodland and derived grasslands with the main patch of woodland comprising *White Box Grassy Woodland* (Cumberland Ecology, 2013b). The southern edge of this woodland also adjoins Leard State Forest, as indicated in **Figure B6.** Shrubby habitat occurs along the headwaters of Oakey Creek, and connects with vegetation not included in the offset property but running through the property within a travelling stock reserve (Cumberland Ecology, 2013b). Given the fragmented nature of the habitats within the Oakdale property, the potential for these habitats to represent high-quality foraging and roosting habitat for the South-eastern Long-eared Bat is more limited. However, the proximity of the vegetation patches to Leard State Forest and some connectivity with the forest habitats provides the Oakdale habitats with a minor value as potential habitat for the subject species.

6.3 FIELD ASSESSMENTS OF HABITAT FEATURES

6.3.1 Project Site

Plot data, rapid assessments and point descriptions conducted within the Project Site for the purposes of this peer review, found the EIA mapping of the vegetation communities generally to be accurate, as discussed in some detail in **Section 3.3** of this report. The peer review plot data found the extent of hollows to be variable, as were other factors such as loose/shedding bark and shrubby understorey, but overall, mature trees in particular were well represented as described in **Section 4.3.1.** The extent of representation of old growth trees was variable, as would be expected within a state forest that has been subject to logging activities, with rating scores for the occurrence of old growth trees ranging from 0 to 5 in the areas specifically sampled. The average score (from a relatively small dataset) for old growth trees within the Project Site was 3.2. The representation of hollow-bearing trees was similarly variable, with scores ranging from 0 in the Western sector of the Project Site to 6 in one location within Leard State Forest (waypoint 110, **Figure C1**, **Appendix C**). The average score for hollow-bearing trees for the Project Site was 2.8, providing an overall rating of moderate low value. It is important to note that these values were derived from a rapid assessment process which is designed to provide a basis for comparative assessments between areas, as well as from a relatively small dataset, but it is indicative of some variation in the density of hollow-bearing trees..

6.3.2 Eastern/Western Offsets

As indicated in the previous chapters, plot data for the Eastern and Western offsets confirmed the occurrence of the vegetation communities mapped for the EIA, primarily representing box–ironbark woodland/open forest and thus suggesting potential suitable habitat for the South-eastern Long-eared Bat. The majority of plot data for the Western Offsets, typically representing samples of box-gum woodland habitats, yielded variable rating scores for the species' habitat features, with both higher and lower ratings than recorded for the Project Site. The number of old growth and hollow-bearing trees was also highly variable, with some areas, such as on Louenville, scoring very highly. The average score (from a larger dataset than for the Project Site) for old growth trees within the Western Offsets was 3.2, which is comparable with the score for the Project Site, with individual scores ranging from 1 to 5.

The representation of hollow-bearing trees was similarly variable, with scores ranging from the 0 on the Teston South property to 5 on the Louenville property (waypoint 166, **Figure C1**, **Appendix C**), with an average score of 1.8. This is lower than for the Project Site (2.8) and represents an overall rating of low value. The average score for decorticating bark and fissures was higher at 3.

With regard to the Eastern Offsets, plot data in the vicinity of Back Creek, on the Wallandilly property, indicated good quality habitat, with a high density of old growth White Box, Yellow Box and Cypress Pine trees. The average score for old growth trees in this sector was 5.3, indicating a high value. The representation of hollow bearing trees in

this sector was more variable with scores ranging from 0 to 5, with an average score of 2.5. However, the average score for decorticating bark and fissures was higher at 4, which is comparable with the average score for the same attribute within the Project Site. Habitat on the Warriahdool property however, was of a much lesser quality.

6.3.3 Northern Offsets

Shrubby box-ironbark-cypress pine habitat is well represented on the Northern Offset properties, particularly in the area mapped as *Narrow-leaved Ironbark–White Box-White Cypress Pine Shrubby Open Forest* in the far south-east of the Wirradale property. This was confirmed from point descriptions and limited habitat assessments. Areas dominated by White Box Woodland also occur on the lower slopes/creek flats of this area, but these areas were not accessed during the review process. It is noted that some comments were raised in submissions and specialist reports (North West Ecological Services, 2013) regarding the low likelihood of the South-eastern Long-eared Bat occurring at elevations above 900 m on the Northern offset properties. As noted earlier in this chapter, the species has been recorded in the general vicinity of Horton Falls National Park, with this general area located at elevations of between 700m to 960m and south of Inverell in the Tingka area, with elevations of approximately 750m to 900m (Google Earth, 2013). Such elevations are not dissimilar to those of the Northern Offset properties, which vary in height from approximately 600m to 1070m.

Additionally, it is also noted that records for the species obtained within Mount Kaputar National Park and specifically referred to in submission documents (North West Ecological Services, 2013, undated), appear to have been recorded at elevations estimated to range between approximately 330m to 600m (Google Earth 2013). The area in question adjoins the south-eastern sector of the Wirradale property supporting potential favourable foraging habitat for the South-eastern Long-eared Bat and occurring at elevations ranging from below 600 m to 845 m. It therefore seems reasonable to conclude that the south-eastern sector of the Wirradale property provides highly suitable potential habitat for the subject species. Further to this, based on the occurrence of the species at higher elevations in the Horton Falls National Park area, it also seems reasonable to conclude that other sectors of the Northern Offsets properties would represent suitable potential habitat for the South-eastern Long-eared Bat.

Habitat assessment plot data was variable, with some areas scoring very highly, in terms of habitat attributes for the South-eastern Long-eared Bat, and others yielding relatively low scores. This variation reflected a range of factors including:

- Whether the location of the plot was within grassy or shrubby habitat;
- The extent and timing of previous clearing activities in the area;
- The extent of old growth tree retention; and
- The species of trees present at the site and their capacity for hollow development and/or provision of shelter sites in the form of loose bark or fissures.

As for the Project Site and Western/Eastern Offsets, the plot data indicated a high variation in the representation of habitat attributes, with rating scores for old growth trees ranging from 0 in a number of areas to 6, also at a number of locations. The average score for old growth trees was 2.7, indicating a value of moderately low to moderate. The representation of hollow bearing trees in this sector was also highly variable, with scores ranging from 0 to 5, with an average score of 2.1. The average score for decorticating bark and fissures was higher at 3, which is less than for the Project Site and the Western/Eastern offsets. However, data on this attribute was obtained from only the one plot within the *Narrow-leaved Ironbark Shrubby Open Forest* community, which represents a large are of habitat that is most likely to have contributed higher values, both for the decorticating bark/fissures attribute and the representation of shrubby habitat. The score for these attributes therefore potentially has been underestimated. In general, this sector of the Northern Offsets represents a potential high value of habitat for the South-eastern Long-eared Bat.

Dense cypress pine regeneration, as was noted for the Project Site and the Eastern/Western Offsets, was only recorded as a feature in habitat assessments for the *Narrow-leaved Ironbark Shrubby Open Forest* community occurring in the far south-east of the Wirradale property. As indicated earlier in this report, continuation of Cypress Pine regeneration could be expected to reduce the value of habitat for the South-eastern Long-eared Bat in the long term.

Summaries on plot data and details on habitat condition are provided in **Appendix E** and **Appendix G**,

6.4 OUTCOMES FOR THE SOUTH-EASTERN LONG-EARED BAT HABITAT

Large portions of the woodland/forest habitat occurring on the offset properties are considered to represent suitable foraging habitat for the South-eastern Long-eared Bat and to be of equivalent or better quality overall to the habitats represented within the Project Site. This assessment takes into account all habitat features assessed. Although the offset properties may support a lower density in old-growth trees in many sectors and a corresponding lower average hollow density than the Project Site, mature trees are well represented in most offset woodland/forest habitats, and many of these trees support suitable roosting sites for the species in the form of either hollows or loose bark or fissures. Consideration of the more detailed hollow counts undertaken for the purposes of the EIA and BMP also indicate that, at least in some sectors of the offset areas, the density of hollows/ha is comparable with the densities for the Project Site.

Other habitat features representing favourable habitat for the South-eastern Long-eared Bat are well represented within the offset properties. These features include:

- The occurrence of large habitat patches;
- Connectivity with very large areas of high quality known habitat (Mount Kaputar National Park);

- Prevalence of dense/complex shrubby habitat; and
- Occurrence of high quality drainage line habitat.

The potential for habitat value to be affected adversely in the long term by dense Cypress Pine regeneration applies to the Project Site and offset properties alike.

Areas of offset habitat estimated as providing foraging habitat for the South-eastern Long-eared Bat and other subject threatened fauna species, and equivalent to, or better in quality than the Project Site habitats, are provided in **Appendix E, Table E1.**

Chapter

7 Conclusions and Recommendations

7.1 CONCLUSIONS

The independent review process has relied on a range of procedures to assess the quantity and condition class of *White Box–Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* Critically Endangered Ecological Community (CEEC) and the quantity and quality of habitat for the Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat within all proposed offset areas, as required by Condition 10 of the Approval Conditions for the Maules Creek Project. The results from the combined desktop assessments, field inspections, surveys and data analysis has led to the conclusion that the proposed offset package complies with Conditions 9, 10 and 12, providing that the additional offset properties of Roseglass, Oakleigh/Oakvale and Bimbooria are included as offsets. Reports on the attributes of these properties that would contribute effectively to the offset package have been subject to desktop assessments for the purpose of this peer review. On the basis of these reports and the assessments thereof, suitable representations of the Box-Gum Woodland CEEC and box-gum and box-ironbark woodland habitat favoured by the subject threatened fauna species, occur on these additional properties.

Specific conclusions relevant to the Box-Gum Woodland CEEC and threatened fauna species habitat are provided below.

7.1.1 Quantity and Condition Class of White Box–Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The desktop assessments conducted to verify the plot data and their correspondence with mapping units, as prepared for the EIA and BMP for the Project, found overall conformity between the map units and plot data attributes, with only minor discrepancies. This observation applied both to the Project Site and to the offset sites. Verification of the mapping procedures and outcomes also found only minor variations and community overlap discrepancies (~1%) that were not deemed to affect any offset outcomes substantially.

Taking into account the broad definition of the CEEC, the majority of areas mapped as CEEC conformed to the community definition as provided in the Listing/Conservation Advice for the *White Box–Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. There were however, some sectors of vegetation mapped as CEEC that did not conform to the community definition and the total areas of CEEC in these sectors required some adjustments. This was

mainly the case for the larger Northern Offsets that exhibited a greater complexity in vegetation types than the Eastern/Western Offsets and Project Site. Conversely, in the Eastern Offsets, substantial portions of a vegetation patch mapped primarily as non-CEEC for the EIA was found to comply with the community definition, either as the woodland or as the Derived Native Grassland (Box-Gum Woodland). Adjustments were therefore made accordingly to the offset calculations for this area. The sum of required variations to offset calculations for the CEEC was not large overall, but taking these variations into account, it was recommended that additional offsets supporting areas of the CEEC were required to fulfil the Approval Conditions. With the addition of the Roseglass, Oakleigh/Onavale and Bimbooria properties, that provide a further 728 ha of CEEC, the requirement for the Maules Creek offsets to provide a total of 5532 ha of *White Box–Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* is fulfilled.

In relation to the requirement for the offset CEEC to be of equivalent or better quality than the CEEC to be impacted by the Project, the review found most areas of CEEC woodland/forest inspected or surveyed were in moderate to good condition. Communities generally were comparable with the Project Site CEEC in benchmark ratings for community attributes, based on a combination of plot data, rapid assessments and point observations. It was noted that there was substantial variation in some attributes of the offset communities, such as old growth trees, structural characteristics and density of grass and ground cover species, This was observed also to apply to representations of the CEEC within the Project Site. Allowance was made in the assessment of CEEC quality for the effects of prolonged drought conditions on vegetation vigour. In this respect, it was noted that the vegetation on both the Project Site and offset properties was exhibiting signs of severe moisture stress throughout the survey period. It was also observed however that a number of areas of the CEEC on the Northern Offset properties appeared to be in better condition than the areas on either the Project Site or the Western/Eastern Offsets. This observation applied to both woodland areas and derived grasslands and was attributed to the location of the Northern Offsets being within a higher rainfall area.

The overall conclusion is that the offsets comply with the requirement for equivalent or better quality CEEC in relation to the Project Site CEEC.

7.2 THREATENED FAUNA SPECIES

As for the CEEC assessments, the desktop assessments confirmed the vegetation community mapping, relevant to habitat for the Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat, to be reasonably accurate. Some minor adjustments to habitat areas were made and one more significant adjustment was made for the Northern Offsets that resulted in an increase in the total area of suitable habitat within the offset site. In conjunction with the habitat provided by

the inclusion of the additional offsets, the total quantity of offset habitat provided is 12,035 ha, complying with the 9334 ha specified in the Approval Conditions

In relation to the requirement for the offset habitats to be of equivalent or better quality than the habitats to be impacted by the Project, the final assessment has taken into account the following factors:

- The principles applied to the definition of potential habitat for the subject species within the Project Site for the EIA and BMP, which considered all woodland/forest vegetation to be cleared as potential foraging habitat,
- The occurrence of habitat of variable quality within the Project Site, including Derived Native Grassland and other grassland habitats;
- The definitions and guidance provided in the document 'How to Use the Offsets Assessment Guide;'
- The combined habitat requirements for each of the subject species; and
- The likelihood that most habitats would be in better condition under more favourable seasonal conditions.

The review found most areas of forest/woodland habitat inspected or surveyed within the offsets to be in moderate to good condition. Most areas were comparable with the Project Site habitats in key attributes relevant to the threatened species and overall habitat ratings based on the results of the review field surveys and assessments. Some habitat attributes, particularly old growth trees and hollows were potentially better represented within Leard State Forest but these attributes are not essential requirements for all three subject species. Other key habitat features favoured by the Swift Parrot, Regent Honeyeater and/or South-eastern Long-eased Bat, including large and small habitat patches, favoured forage tree species, drainage lines with large mature trees, shrubby understory and decorticating/exfoliating bark and fissures, are well provided for by the offsets. As for the CEEC, allowance was made in the assessment of habitat quality for the effects of prolonged drought conditions on vegetation vigour.

The total offset habitat comprises 6,355 ha of good condition habitat suitable for the subject threatened fauna species combined and 5,323 ha of low to moderate condition habitat, representing varying levels of habitat value to these species. The low to moderate condition habitat incorporates woodland/ forest areas with lower quality understorey or ground cover development, small vegetation patches and other vegetation types that would provide some potential as foraging habitat for one or more of the Swift Parrot, Regent Honeyeater and/or South-eastern Long-eared Bat, , equivalent to the lower quality habitat of the project site.

The conclusion therefore is that the offsets comply overall with the requirement for equivalent or better quality habitats for the three subject threatened fauna species in relation to the Project Site habitats.

7.2.1 Recommendations

On the basis of the peer review assessments and findings, it is recommended that the additional offsets of Roseglass, Oakleigh/Onavale and Bimbooria be included in the offset package for the Project. It is also recommended that, for the purposes of development and ongoing management of the offset properties, the vegetation and habitat mapping be refined and amended to take account of the revisions identified during the peer review process. Verification of the additional offset community boundaries and habitats, taking into account the verification processes employed for the purposes of this peer review, is also strongly recommended.

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Appendix A

Vegetation Community & Fauna Habitat Tables from EIA & BMP

Table A.1 Vegetation Areas within the Eastern, Western, Northern and Shared Properties (Source Cumberland Ecology, Biodiversity Management Plan, 2013)

Vegetation Communities	Eastern Properties						Northern Properties		Shared Property	Western Properties					SubTotal (ha)
	Blue Range	Cattle Plain	Teston North	Tralee	Wallandilly	Warriahdool	Mt Lindesay	Wirradale	Shared Offset	Kelso	Louenville	Olivedeen	Teston South	Velyama	
liff and scree Thickets (Rainforest Species)											0.53				0.53
Manna Gum - Yellow Box - Blakely's Red Gum open forest							139.68	245.85							385.53
Melaleuca riparian forest	9.04	2.68	6.18	14.63	66.55	35.16		4.61							138.85
Narrow-leaved Ironbark - Brown Bloodwood - White Cypress Pine shrubby open forest													0.00		0.00
Narrow-leaved Ironbark - White Cypress Pine shrubby open forest								853.61		270.42	33.70		416.12	79.36	1653.21
River Red Gum riparian woodlands and forests										11.89		8.30			20.19
Stringybark - Blakely's Red Gum grassy open forest							770.30								770.30
Stringybark - Blakely's Red Gum shrubby open forest							84.94								84.94
White Box - Blakely's Red Gum - Melaleuca riparian forest	19.74		10.23	4.49					11.09				4.82		50.37
White Box - Narrow-leaved Ironbark - White Cypress Pine grassy open forest			0.05	0.01	53.29	58.32				16.49	151.10		185.79	23.23	488.28
White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest						0.75			369.43		0.28		34.93	4.13	409.52
Belah woodland													4.21	6.94	11.15
Dwyer's Red Gum - Ironbark woodland			2.84	8.62							3.09		211.64		226.19
Dwyer's Red Gum woodland									176.73				3.59		180.32
Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland				1.75	161.61	16.05				44.01		4.95		6.50	234.87
Regrowth - White Cypress Pine									10.70						10.70
Rough-barked Apple - Blakely's Red Gum riparian grassy woodland							25.34	223.22							248.56
Silver-leaved Ironbark heathy woodland						42.47			69.42						111.89
Weeping Myall grassy open woodland														0.15	0.15
White Box - stringybark grassy woodland							553.72	881.39							1435.11

White Box - Stringybark shrubby woodland							139.21	192.30							331.51
White Box - White Cypress Pine grassy woodland	2.26	35.98	48.74	16.96	99.27	91.14		226.75							521.10
White Box - White Cypress Pine grassy woodland (low condition)									72.56						72.56
White Box - Wilga - Belah woodland													85.75	18.26	104.01
Yellow Box - Blakely's Red Gum grassy woodland					0.02										0.02
Total Forest and Woodland	31.04	38.66	68.04	46.46	380.74	243.89	1713.19	2627.73	709.93	342.81	188.70	13.25	946.85	138.57	7489.86
Tea-tree shrubland in drainage lines								69.61							69.61
Total shrubland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.61	0.00	0.00	0.00	0.00	0.00	0.00	69.61
Derived Native Grassland (Box Gum Woodland)							577.56	1406.40					105.90	71.62	2161.48
Derived Native Grassland (Non-threatened)								74.09						94.10	168.19
Total Derived Native Grassland	0.00	0.00	0.00	0.00	0.00	0.00	577.56	1480.49	0.00	0.00	0.00	0.00	105.90	165.72	2329.67
Derived Native Grassland (Low Diversity - Box Gum Woodland)		103.09	51.69	69.48	0.43	74.87		87.94	2.44	22.12			101.41	126.13	639.60
Improved Pastures							131.98						37.14	62.61	231.73
Low Diversity Native/Exotic Grassland and Cultivation	692.05	139.19	170.77	224.18	1471.60	687.11				134.31	270.19	177.90	81.22	426.16	4474.68
Total Other Grassland	692.05	242.28	222.46	293.66	1472.03	761.98	131.98	87.94	2.44	156.43	270.19	177.90	219.77	614.90	5346.01
Total Vegetation in each Property (ha)	**723.09**	**280.94**	**290.50**	**340.12**	**1852.77**	**1005.87**	**2422.73**	**4265.77**	**712.37**	**499.24**	**458.89**	**191.15**	**1272.52**	**919.19**	**15235.15**
Total Box Gum Woodland (remnant vegetation and derived native grassland) (ha)	**22.00**	**35.98**	**59.02**	**21.46**	**152.58**	**149.46**	**2066.60**	**2983.61**	**11.09**	**16.49**	**151.10**	**0.00**	**382.26**	**113.11**	**6164.76**
Total Vegetation to be protected in Conservation Management Zones (ha)	**127.42**	**154.27**	**204.53**	**103.17**	**822.53**	**202.52**	**2277.55**	**3536.06**	**356.18**	**499.24**	**303.62**	**45.08**	**302.76**	**398.77**	**9333.70**
Total Box Gum Woodland (remnant vegetation and derived native grassland) in Conservation Management Zones (ha)	**21.65**	**35.95**	**57.84**	**17.19**	**98.29**	**64.46**	**2035.89**	**2335.79**	**5.54**	**16.49**	**151.04**	**0.00**	**82.04**	**109.40**	**5031.57**
% Total Vegetation to be conserved from each property	**17.62**	**54.91**	**70.41**	**30.33**	**44.39**	**20.13**	**94.01**	**82.89**	**50.00**	**100.00**	**66.16**	**23.58**	**23.79**	**43.38**	**61.26**
% Total Box Gum Woodland (remnant vegetation and derived native grassland) to be conserved from each property (ha)	**98.41**	**99.92**	**98.00**	**80.10**	**64.42**	**43.13**	**98.51**	**78.29**	**49.95**	**100.00**	**99.96**	**N/A**	**21.46**	**96.72**	**81.62**

Table A.2 Area Condition of Habitat for Threatened Species to be Conserved in the Eastern, Western, Northern and Shared Properties (Source: Cumberland Ecology Biodiversity Management Plan, 2013)

OFFSETS	[a] HABITAT for Wide-foraging Bird Species (White-throated Needletail, Fork-tailed Swift, Square-tailed Kite, Spotted Harrier, Little Eagle)		[b] HABITAT for Forest and Woodland Species*		[c] Potential HABITAT for Koala		[d] Potential HABITAT for *Pultenaea setulosa*		[e] Potential HABITAT for *Pomaderris queenslandica*	
Property (describe each discrete property separately)	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re-vegetated (ha)**	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re-vegetated (ha)**	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re- vegetated (ha)**	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re-vegetated (ha)**	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re-vegetated (ha)**
Blue Range	30.69	96.7	0	127.4	0	30.7	0	0	0	28.4
Cattle Plain	38.6	115.6	36.0	118.3	36.0	2.7	0	0	0.0	2.7
Teston (nth)	66.1	138.4	0.1	204.5	0.1	63.3	0.1	2.8	0.0	15.7
Tralee	35	68.1	0.0	103.2	0	26.5	0	8.6	0	9.5
Wallandilly	266.7	555.8	122.8	699.7	122.8	143.9	10.5	0	0.0	56.2
Warriahdool	89.7	112.9	64.5	138.1	64.5	25.2	0	0	0.0	25.2
Mt Lindesay	2260.4	17.5	1456.7	821.2	686.4	1.9	0	0	0.0	226.1
Wirradale	3495.9	40.1	1942.2	1593.7	1088.9	432.9	853.4	0	853.4	420.1

Shared	355.0	1.3	124.1	232.1	0	41.8	35.8	183.6	35.8	189.2
Kelso	342.8	156.4	342.8	156.4	72.4	0	286.9	0	282.3	0.0
Louenville	188.6	115.0	188.6	115.0	151.0	0	188.1	0	34.5	0.0
Olivedeen	13.2	31.8	13.2	31.8	13.2	0	0	0	8.3	0.0
Teston (sth)	246.6	56.2	175.1	127.6	10.6	52.9	175.1	0	83.1	0.0
Velyama	116.9	281.9	83.0	315.8	25.2	16.1	79.5	0	57.8	0.0
TOTAL	**7546.3**	**1787.7**	**4549.1**	**4784.8**	**2271.1**	**837.9**	**1629.4**	**195.1**	**1355.1**	**973.1**

Table A.3 Summary of EPBC Matters - Condition Areas of Box Gum Woodland and Habitat for Threatened EPBC Fauna to be Conserved in the Eastern, Western, Northern and Shared Properties (Source Cumberland Ecology Biodiversity Management Plan 2013)

OFFSETS						Box Gum Woodland and Derived Grasslands provided (ha)			HABITAT for EPBC Matters of National Environmental Significance (Regent Honeyeater, Swift Parrot and Greater Long-eared Bat)	
Property (describe each discrete property separately)	**Size property (ha)**	**Location property (map co-ordinates)**		**Current tenure (+security of acquisition)**	**Proposed long- term protection mechanism (covenant, CA, National Parks etc)**	**Condition 'A' (not included in EPBC listing)**	**Condition 'B' (patches of >0.1 ha with more than**	**Condition 'C' (patches of >2 ha with at least 20 mature**	**Good condition vegetation (ha)**	**Low or moderate condition vegetation to be re-vegetated (ha)**
		LATITUDE	LONGITUDE			*An overstorey of eucalypt trees exists, but there is no substantial native understorey*	*A native understorey exists, but the trees have been cleared*	*Both a native understorey and an overstorey of eucalypts exists in conjunction*		
Blue Range	748	30°31'7.3 S	150°5'47.4 E	Private ownership	CA or other	0	0	21.7	0	127.4
Cattle Plain	284	30°30'57.6 S	150°7'38.1 E	Private ownership	CA or other	0	0	36.0	36.0	118.3
Teston (nth)	292	30°31'58.8 S	150°6'38.7 E	Agreement in Place	CA or other	0	0	57.8	0.1	204.5
Tralee	342	30°32'2.6 S	150°7'26.2 E	MCC Owned	CA or other	0	0	17.2	0	103.2
Wallandilly	1890	30°30'47.9 S	150°9'56.4 E	Private Ownership	CA or other	0	0	98.3	122.8	699.7
Warriahdool	1011	30°31'22.5 S	150°8'40.7 E	MCC Owned	CA or other	0	0	64.5	64.5	138.1

Mt Lindesay	2430	30°19'42.1 S	150°16'57.1 E	MCC Owned	NP, CA or other	0	577.3	1458.6	1456.7	821.2
Wirradale	4321	30°22'54.6 S	150°15'47.8 E	MCC Owned	NP, CA or other	0	818.7	1517.1	1942.2	1593.7
				Boggabri / MCC Owned						
Kelso	508	30°36'26.1 S	150°3'36.3 E	Private ownership	CA or other	0	0	16.5	342.8	156.4
Louenville	459	30°34'53.3 S	150°4'59.8 E	Agreement in Place	CA or other	0	0	151.0	188.6	115.0
Olivedeen	193	30°35'24.4 S	150°3'9.4 E	MCC Owned	CA or other	0	0	0	13.2	31.8
Teston (sth)	1273	30°34'5.7 S	150°7'0.1 E	MCC Owned	CA or other	0	18.6	63.4	175.1	127.6
Velyama	919	30°36'9.5 S	150°5'5.9 E	MCC Owned	CA or other	0	71.6	37.8	83.0	315.8
TOTAL	**15554**					**0**	**1486.2**	**3545.4**	**4549.1**	**4784.8**

Appendix B

Vegetation Community Maps of Offset Areas

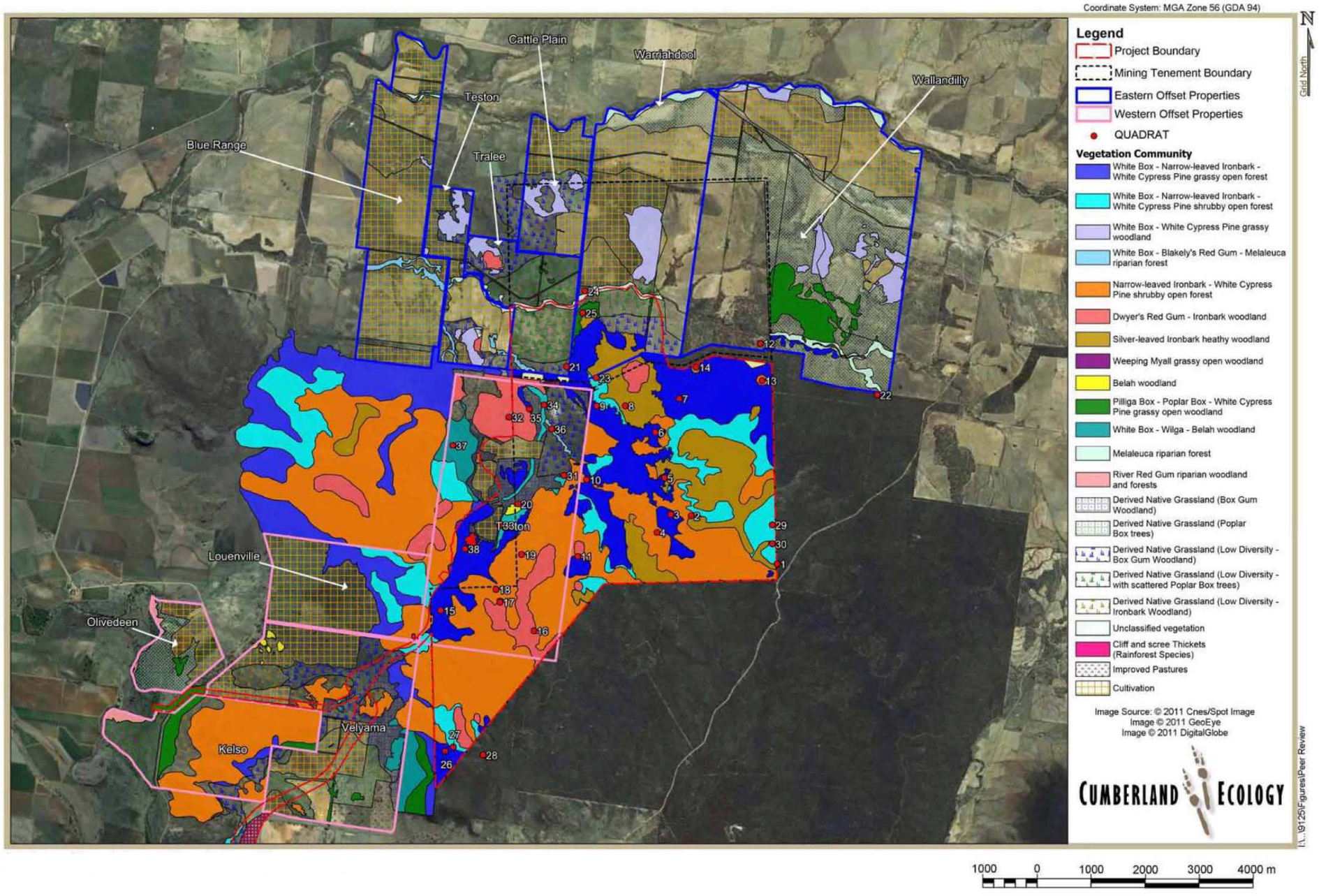


FIGURE B.1 VEGETATION COMMUNITIES IN THE EASTERN AND WESTERN OFFSET AREAS (SOURCE: CUMBERLAND ECOLOGY, BMP, 2013)

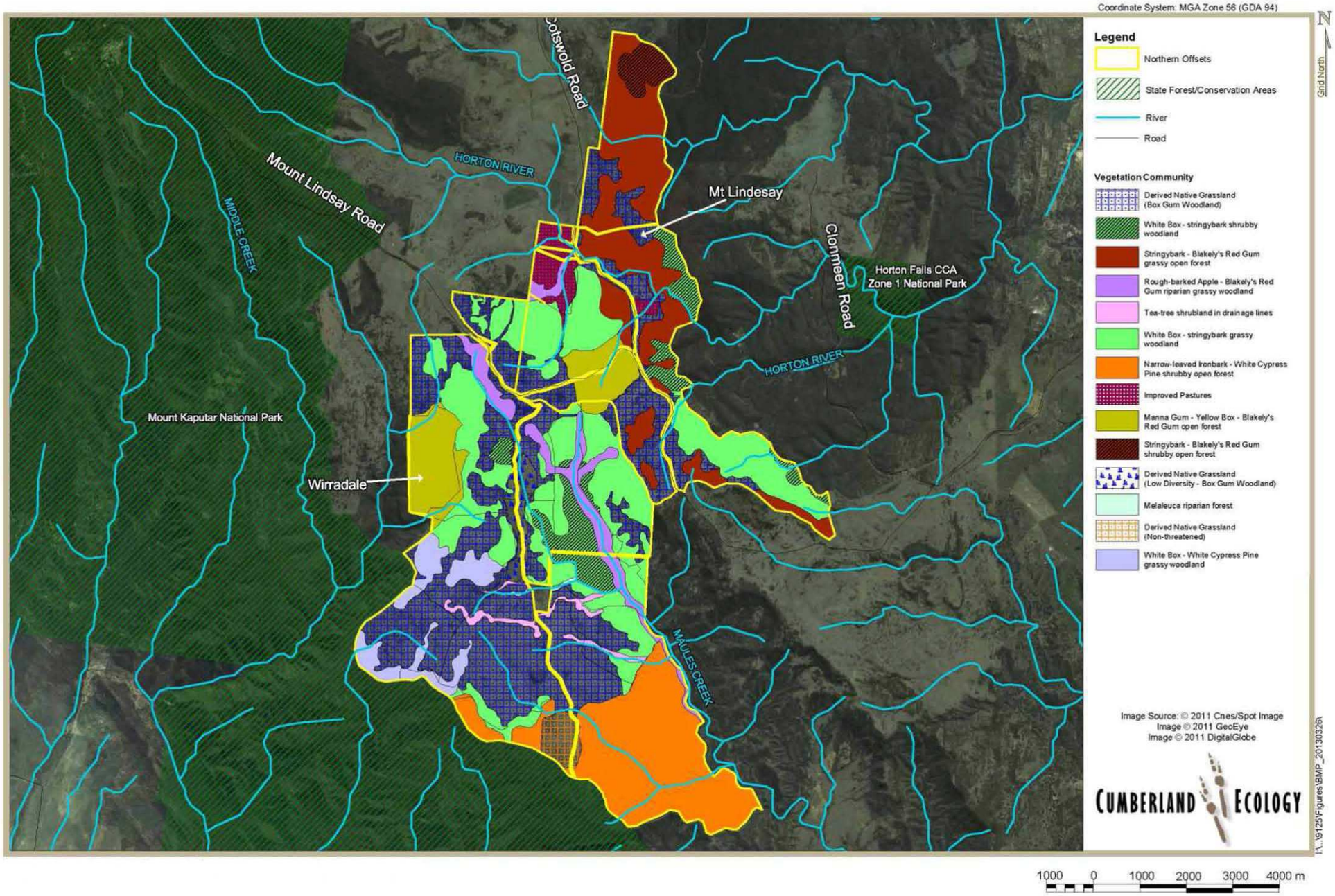


Figure B.2 VEGETATION COMMUNITIES IN THE NORTHERN OFFSET AREAS (SOURCE: CUMBERLAND ECOLOGY, BMP, 2013)

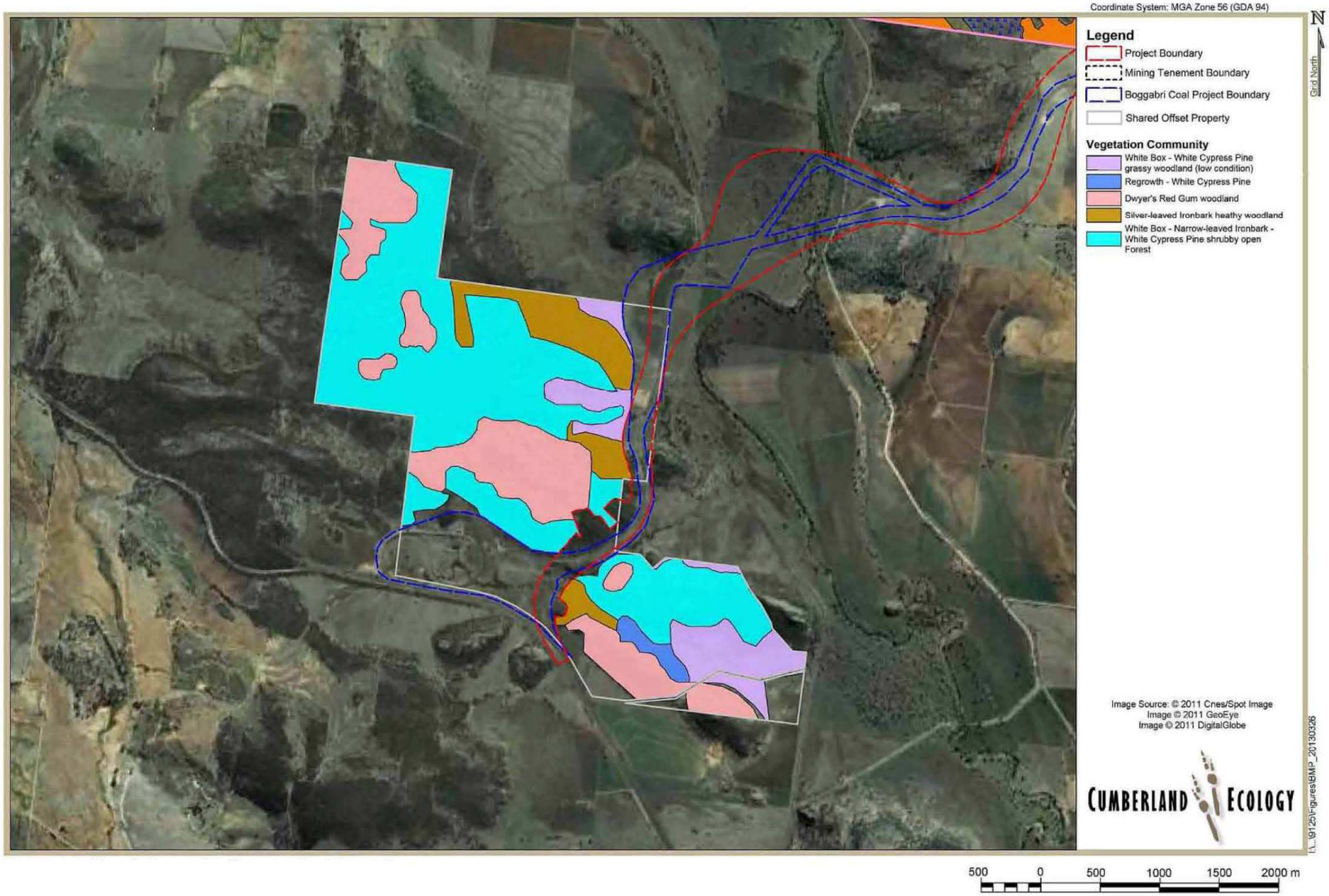


Figure B.3 VEGETATION COMMUNITIES IN THE SHARED OFFSET AREAS (SOURCE: CUMBERLAND ECOLOGY, BMP, 2013)

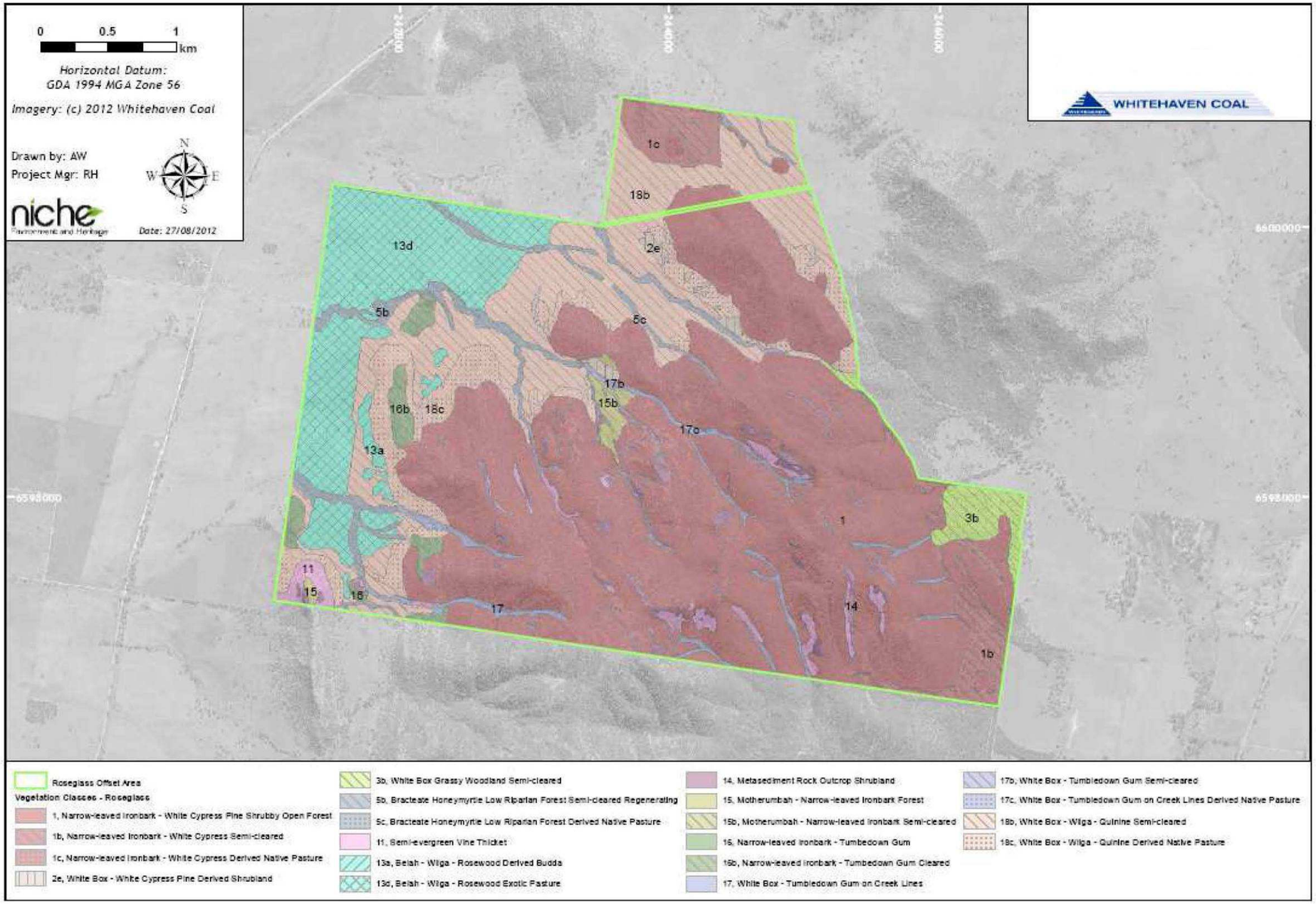


Figure B.4 VEGETATION COMMUNITIES OF ROSEGLASS PROPERTY (SOURCE: NICHE ENVIRONMENT, 2012)

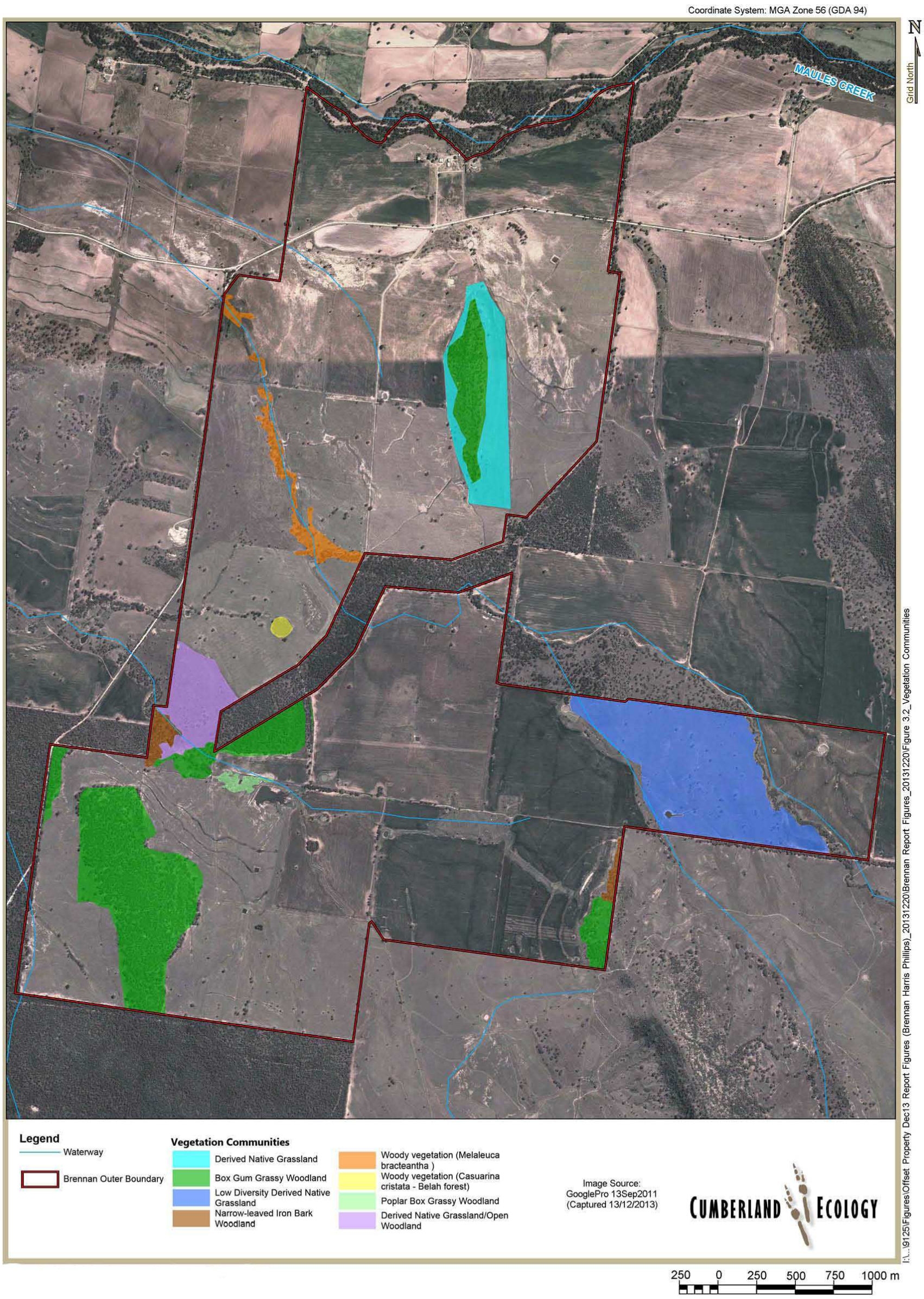


Figure B.5 VEGETATION COMMUNITIES OF OAKLEIGH AND ONAVALE PROPERTIES (SOURCE: CUMBERLAND ECOLOGY)

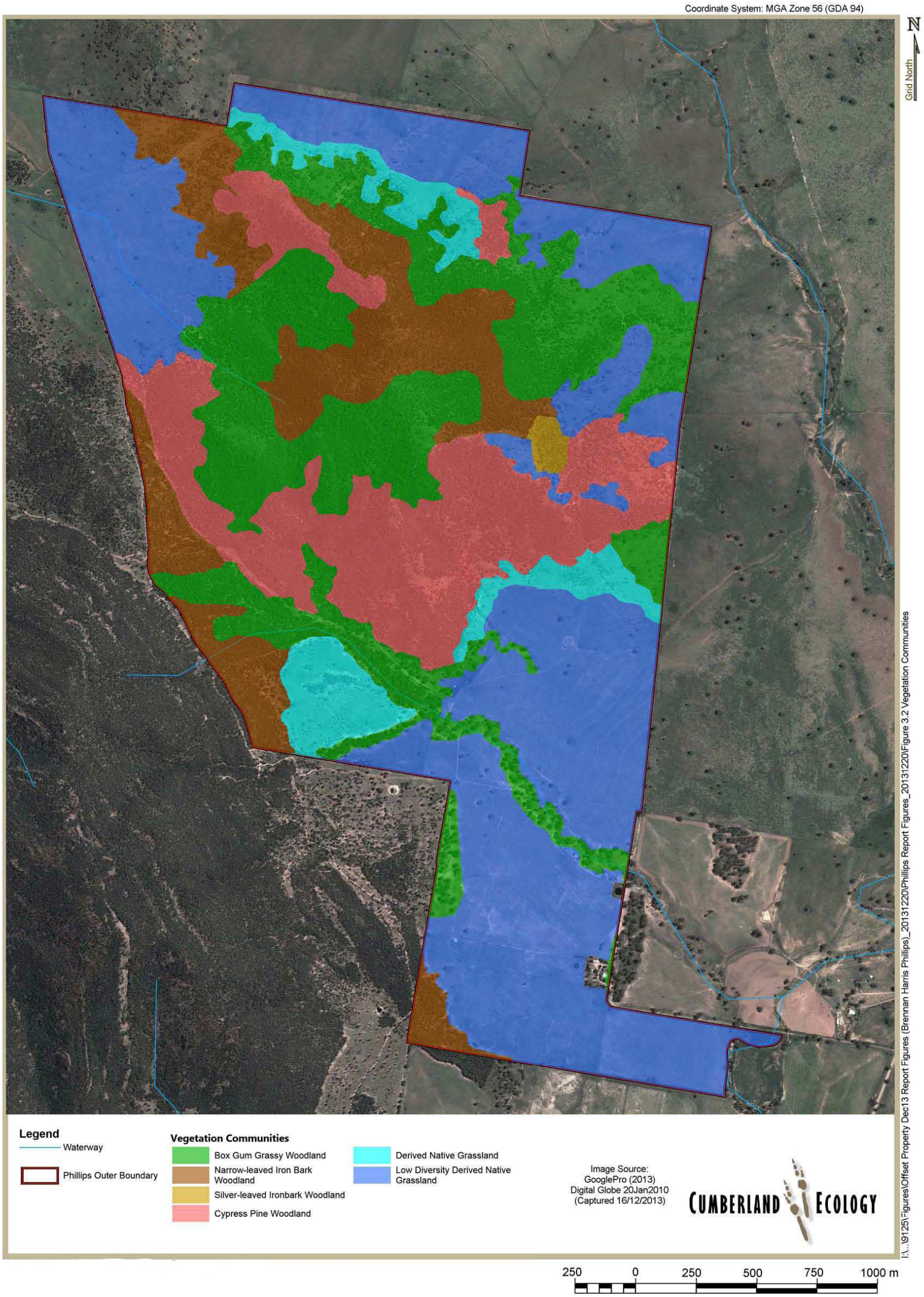


Figure B.6 VEGETATION COMMUNITIES OF BIMBORIA PROPERTY

Appendix C

Survey Point Locations

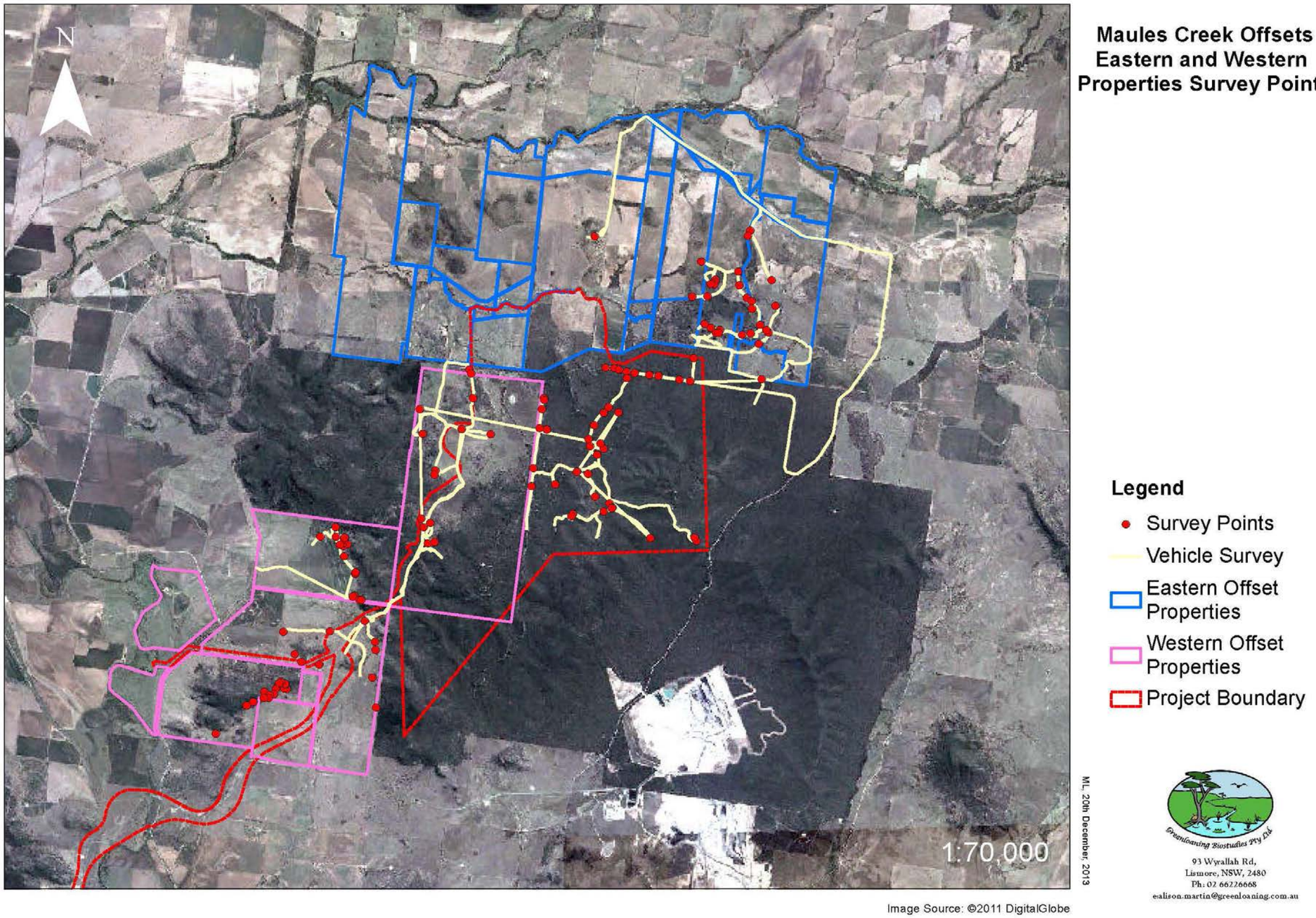
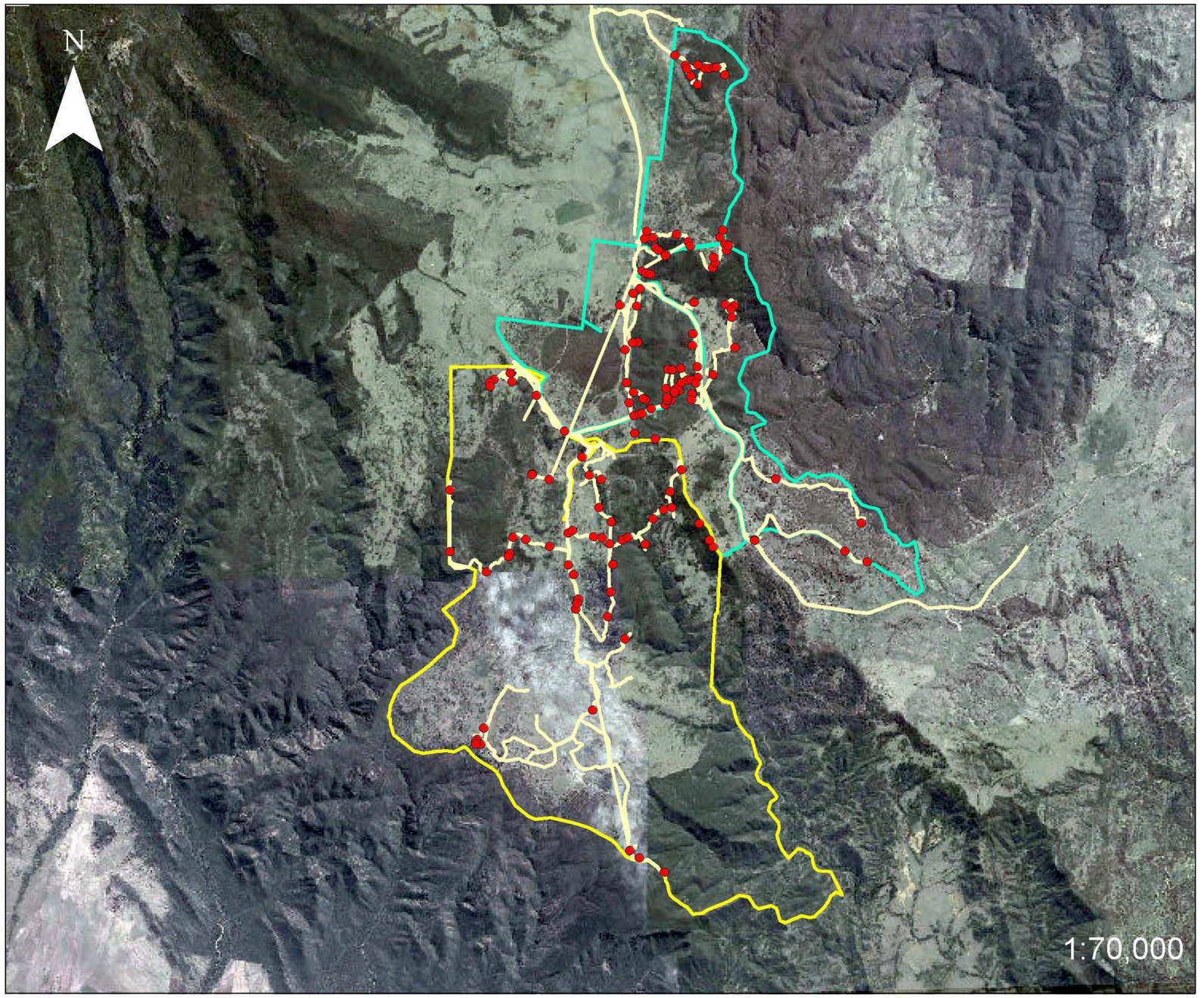


Figure C.1 Survey Points and Tracks in the Eastern and Western Area



Maules Creek Offsets
Northern Properties
Survey Points

Legend

- Survey Points
- Vehicle Survey

Northern Properties

- Mt Lindesay
- Wirradale

ML, 20th December, 2013

Image Source: ©2011 DigitalGlobe

Greenloaning Biostudies Pty Ltd
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Lismore, NSW, 2480
Ph: 02 66226668
e:alison.martin@greenloaning.com.au

Figure C.2 Survey Points and Tracks in the Northern Area

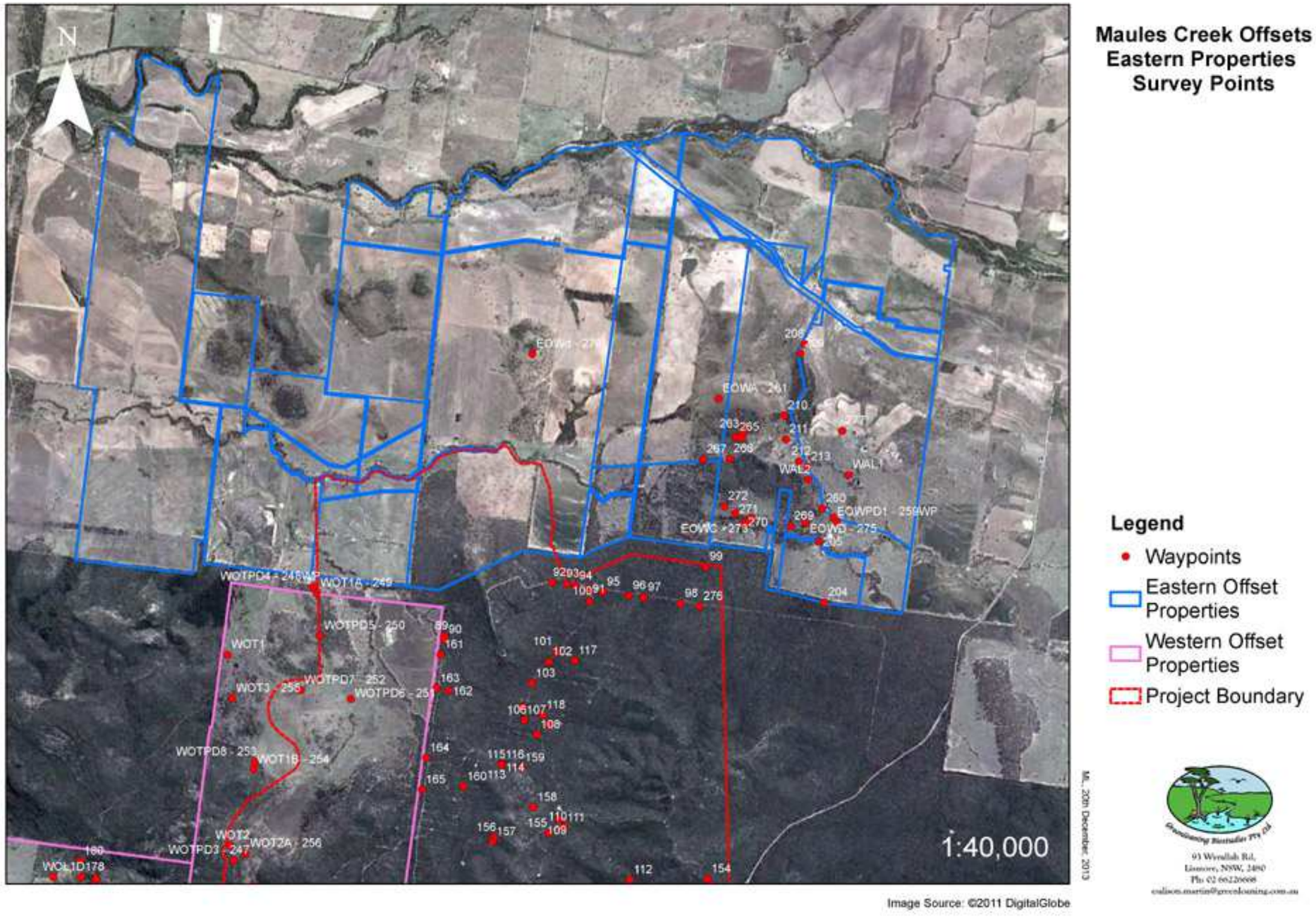


Figure C.3 Waypoints in the Eastern Area

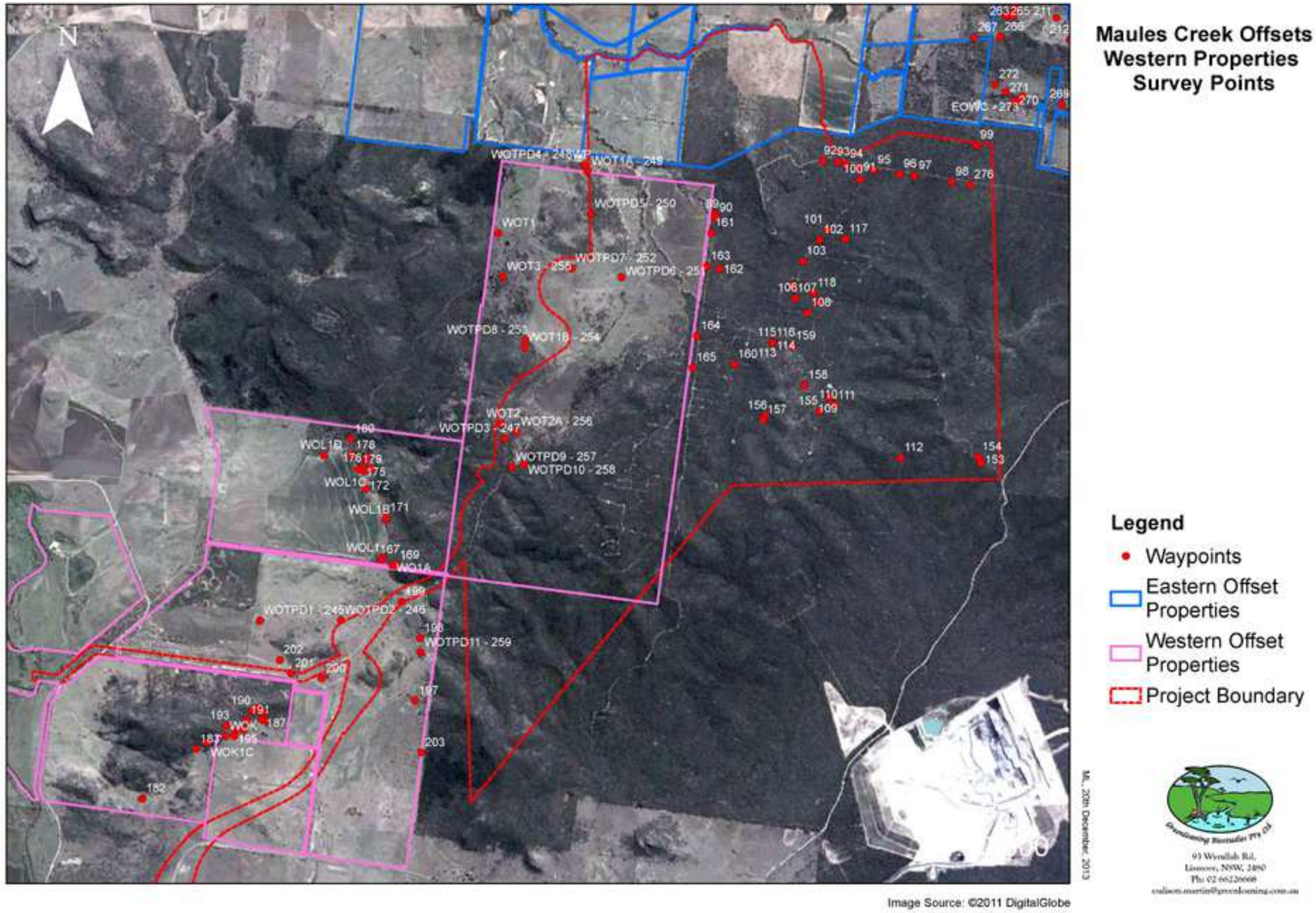


Figure C.4 Waypoints in the Western Area

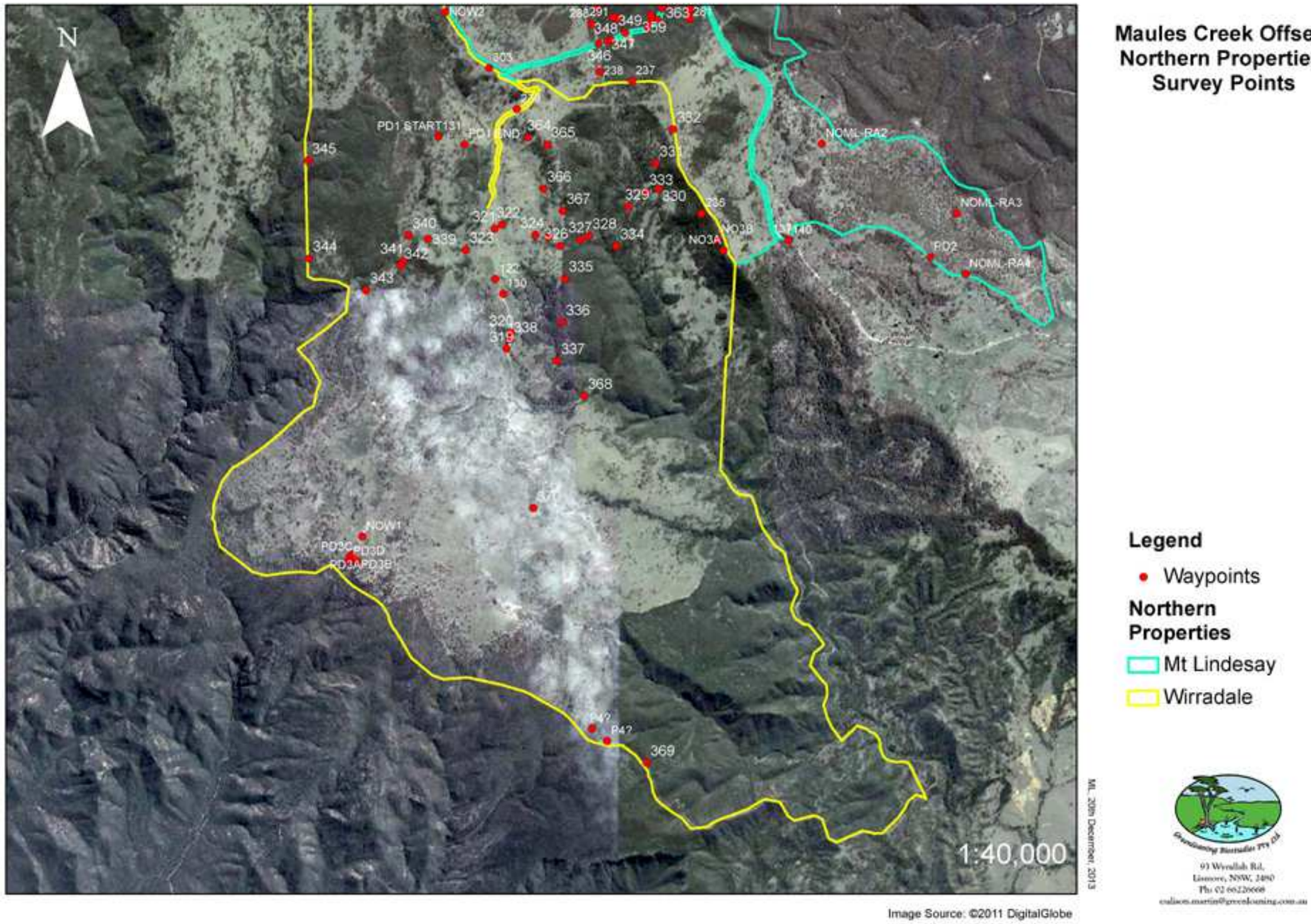


Figure C.5 Waypoints Northern Area (Wirradale)

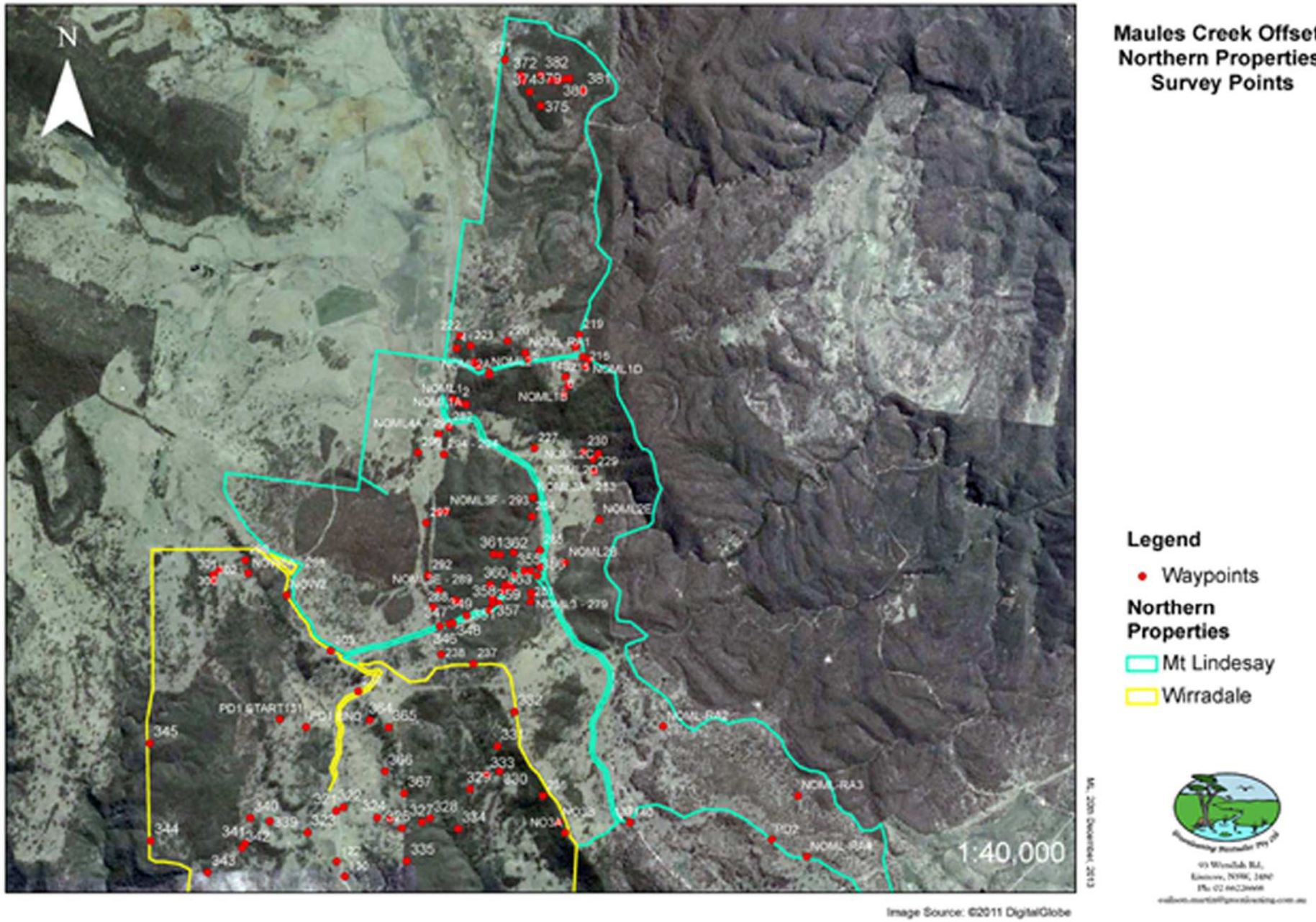


Figure C.6 Waypoints In The Northern Area (Mt Lindesay)

Appendix D

Photographs

Photograph D.1 **White Box Grassy Woodland Plot in Project Site**

Photograph D.2 **White Box Woodland with dense regeneration of Cypress Pine – Project Site.**

Photograph D.3 White Box Grassy Woodland – Western Project Site

Photograph D.4 White Box Grassy Woodland Plot – Western Offset

Photograph D.5 **Leard State Forest in distance (centre left) from Northern Offset – Derived Native Grassland in foreground. White Box Grassy/Shrubby Woodland beyond.**

Photograph D.6 **White Box Grassy Woodland – Eastern sector of Northern Offsets with Derived Native Grassland in foreground**

Photograph D.7 **Dense Regeneration of Blakely's Red Gum – Eastern Sector of Northern Offsets.**

Photograph D.8 **Habitat hollows – Northern Offsets (Narrow-leaved Ironbark – White Cypress Pine Shrubby Open Forest)**

Photograph D.9 Variations in CEEC within Project Site

Photograph D.10 Variations in CEEC within Project Site

Photograph D.11 Variations in CEEC within Project Site

Photograph D.12 Mixed age stand with Stringybark regeneration - Wirradale

Photograph D.13 **Blakely's Red Gum Grassy Woodland showing some grass growth after rain in November**

Photograph D.14 **Grassy Yellow Box Woodland, Mount Lindsay**

Photograph D.15 Leard State Forest

Photograph D.16 Wallandilly Offset Property

Photograph D.17 Poor condition of ground cover during surveys

Appendix E

Summary Table of Field Data Attributes and Community/Habitat Condition

Table E.1 SUMMARY OF POINT DESCRIPTION DATA

Site code	Waypoint	Dominant/ Co-dominant species	Condition	Conforms to Box-Gum Woodland	Comments
LS2	92	White Box - Narrow leaved Ironbark	Moderate - Good	Yes to west	Ironbark to east
	93	White Box - Narrow leaved Ironbark	Moderate - Good	Yes	Ironbark to west
	94	White Box - Silver-leaved Ironbark	Moderate	Yes	Silver-leaved Ironbark to east
	95	White Box - Silver-leaved Ironbark	Moderate	Yes	Silver-leaved Ironbark to west
	96	White Box - Narrow leaved Ironbark	Moderate	Yes	Boundary of White Box and Narrow-leaved Ironbark
	97	White Box - Narrow leaved Ironbark	Moderate	Yes	Ironbark to west
	98	White Box - Narrow leaved Ironbark	Moderate	Yes	Narrow-leaved Ironbark to east
	99	White Box - Narrow leaved Ironbark	Moderate	Yes	Near boundary. Narrow-leaved Ironbark to east and south
	100	White Box - Silver-leaved Ironbark	Moderate	No	White Box to south
	101	White Box - Narrow leaved Ironbark	Moderate	Yes	Ironbark to south
	102	White Box - Narrow leaved Ironbark	Moderate	Yes	Boundary - Ironbark to north
	103	White Box - Narrow leaved Ironbark	Moderate	Yes	Boundary - Narrow-leaved Ironbark to south
	104	White Box - Narrow leaved Ironbark	Moderate	Yes	Boundary - White Box to south
	105	White Box - Narrow leaved Ironbark-Siler-leaved	Moderate	Yes	Silver-leaved Ironbark to east, shrubby patches

		Ironbark			
	106	White Box - Narrow leaved Ironbark- Siler-leaved Ironbark	Moderate	Yes	Silver-leaved Ironbark to east, shrubby patches
	107	White Box - Narrow leaved Ironbark- Siler-leaved Ironbark	Moderate	Yes	Silver-leaved Ironbark to east, shrubby patches
	108	White Box - Narrow leaved Ironbark	Moderate	Yes	White Box to south
LSFPL2	117	White box	Moderate - Good	No	Shrubby
	118	White Box	Moderate	Yes	Grassy woodland
	155	White Box- Ironbark	Moderate	Yes	Boundary White Box - Ironbark, gully area
	156	Ironbark	Moderate	No	Occasional White Box - Shrubby corner increases upslope.
	158	Silver-leaved Ironbark	Moderate	No	White Box - Silver-leaved Ironbark boundary
	160	White Box - Ironbark	Moderate - Good	Yes	Shrubby
	161	White Box - Ironbark	Moderate - Good	Yes	Narrow-leaved Ironbark to south. Shrubby to north
	162	White Box - Ironbark	Moderate - Good	Yes	Narrow-leaved Ironbark to south. Shrubby to west
	164	White Box - Ironbark	Moderate - Good	Yes	White Box to east and south, Ironbark to north
	165	White Box	Moderate - Good	Yes	Along southern edge of track
NOML PD3A	125		Moderate	No	Derived Grassland
PD3B	126	Blakely's Red Gum	Moderate		Blakely's Red Gum adjoining Derived Native

					Grassland
PD3C	127	White box	Moderate	Yes	Grass woodland. Narrow Ironbark below slope
PD3D	128	White box	Good	No	Shrubby
	291	Blakely's Red Gum - Stringybark.	Moderate - Good	Yes in sectors	Shrubby US on ridges, with grassy patches
NOW PD1	132	White Box - Blakely's Red Gum - Stringybark	Moderate - Good	Yes	
	133	White Box - Stringybark - Angophora	Moderate - Good	Yes	Some shrubby patches
NOML PD2	139	Blakely's Red Gum	Good	Yes	Grassy open woodland
WAL					
	205	Red Gum - Ironbark - Popular- Cypress.	Good	No	
	206	Yellow Box	Moderate	Yes	Along watercourse
	208	Ironbark- White Box	Low - Moderate	Yes	Scattered tree species and derived native grassland.
	209	Cypress- Ironbark	Moderate	No	Fairly open and grassy
	210	White Box- Cypress	Moderate - Good	Yes	Patchy WB and occasional Yellow Box. Regenerating Cypress and Derived Grassland.
	211	White Box	Moderate - Good	Yes	Open woodland/derived grassland
	212	White Box	Moderate	Yes	North - WB, dense cypress regeneration. South- occasional WB and vine thicket
	213	Ironbark- Cypress- White Box	Moderate	No	Dense cypress regeneration
	276	Ironbark	Good	No	Shrubby

Western Offsets					
WOL1A	186	White Box	Low - Moderate	Yes	Shrub cover moderate and scattered range from 10-50%.
WOL1	160	White Box	Moderate - Good	Yes	Shrubs scattered
	171	White Box - Pine	Moderate	No	Shrubby very sparse
	174	White Box - Pine	Moderate - Good	Yes	Not shrubby understorey very sparse
	175	Belah	Moderate	No	Belah patch.
	176	Belah	Moderate	No	NE upper edge.
	177	Belah	Moderate	No	NW upper edge.
	178	Belah	Moderate	No	SE lower edge.
	179	Belah	Moderate	No	SE lower edge.
	180		Moderate	No	Shrub layer increasing to N, quite dense E.
WOK1					
	183	White Box - Cypress	Moderate	No	Shrubby woodland.
	185	White Box - Cypress	Moderate	No	Dense growth cypress. Overall shrub cover 30-50%.
	187	White Box	Moderate	No	Shrubby woodland.
	188	White Box - Ironbark	Moderate	No	Patchy Shrub and Rocky.
	189	White Box - Ironbark	Moderate	No	Patchy Shrub and Rocky.
	190	Cypress Pine - Ironbark	Moderate	No	

	191	White Box	Moderate	No	Shrubby/rocky. Moderate slope.
	192	White Box- Cassia- Ironbark- Pine	Low - Moderate	Yes	Sparse groundcover.
	193	White Box - Cypress	Low - Moderate	Yes	Some WB regenerating, Moderate-steep slope. Partially rocky.
	195	White Box- Cypress	Low - Moderate	Yes to NW	Rocky slope, Cypress pine regeneration. White Box more pronounced to NW
Velyama	197	White Box- Ironbark	Moderate	Yes	Very open shrub layer.
Velyama	198	Whitewood - White Box	Moderate	Yes	White Box scattered. Rocky hills in the north.
Velyama	200	White Box	Low Yes		Box Thorn present in patches. Derived Native Grassland.
	201	Ironbark - Cypress - Wilga	Moderate	No	
Velyama	202	Cypress	Low	No	Isolated White box, Ironbark scattered along ridge. Dense cypress regeneration.
Velyama	203	White Box	Low - Moderate	Yes	Scattered white box. Box thorn dense patches, open areas. Derived Native Grassland
WOTPD1	245	Cypress - Whitewood	Low	No	Very occasional White Box. Scattered Wilga. Dense Cypress regeneration.
WOTPD2	246	Ironbark	Low	No	Very occasional White Box.
WOTPD3	247	White Box	Moderate - Good	Yes	Change shrubby to grassy.
WOTPD4	248	Ironbark - White Box - Wilga	Moderate - Good	Yes	Grassy.
WOTPD5	250	White Box	Moderate - Good	Yes	White box coming in around gully.
WOTPD6	251	Belah	Low	No	Derived Grassland low diversity, Ironbark.
WOTPD8	253	Box - Wilga	Low - Moderate	Yes	Derived grassland
WOTPD9	257	White Box	Moderate - Good	Yes	Boundary shrubby and grassy.

WOTPD10	258	White Box	Moderate	Yes	Shrubby to E, Grassy to North.
WOTPD11	259	White Box - Vine thicket	Moderate	Yes in sections	NE - White Box, S- vine thicket species in rocky areas.
Eastern Offsets					
EOW					
	260	Ironbark - White Box - Cypress	Moderate	Yes	Upslope and partially cleared.
	261	Ironbark - White Box - Cypress	Low - Moderate	Yes	Derived Native Grassland.
	262	Ironbark - Cypress	Low - Moderate	No	
	263	White Box	Moderate	Yes	Starts above Ironbark.
	265	White Box - Ironbark - Cypress	Moderate	Yes	Patch of White Box.
	266	White Box - Ironbark - Cypress	Low - Moderate	No	Patch of White Box. Surrounded by Ironbark - Cypress.
	267	White Box	Moderate	Yes	Extends along lower slopes
	269	Yellow Box - Cypress	Moderate - Good	Yes	Grassy area and Yellow Box regenerating.
	270	Yellow Box - Cypress	Good	Yes	Very Grassy. Close to boundary of Bimble Box and Yellow Box.
	271	Cypress	Moderate	No	Grassland with dense young Cypress regeneration - Derived Native Grassland
	272	Yellow Box - Cypress	Moderate	Yes	Lots of Cypress regeneration.
	277	Ironbark - White Box	Moderate	Yes - to the east	Dominant Ironbark to North-East and ridges. White Box to East and South-east.
EOWd	278	White Box	Moderate	Yes	Rocky knoll.

Northern Offsets					
NOW					
	300	Blakely's Red Gum	Moderate	Yes	To South.
	301	Blakely's Red Gum - Box - Angophora	Moderate	Yes	
	302	Blakely's Red Gum	Moderate	Yes	
	303	Blakely's Red Gum	Moderate	Yes	Regeneration.
	321	Derived Native Grassland	Low	No	Track junction
	322	Yellow Box - Stringybark	Moderate - Good	Yes	Grassy, some rocky patches
	323	Blakely's Red Gum - Yellow Box - White Box	Good	Yes	Blakely's Red Gum regeneration
	324	White Box - Blakely's Red Gum - Cypress	Moderate	Yes	Derived grassland on ridge to East.
	325	Blakely's Red Gum - Cypress	Moderate	Yes	
	326	White Box	Moderate - Good	Yes	Into shrubby on top of ridge.
	327	White Box - Stringybark	Good	Yes	Open grassy patch.
	329	White Box - Stringybark	Good	Yes	Grassy. White Box dominant patches.
	330	Ribbon Gum - White Box - Stringybark -	Moderate	Yes (some areas)	Ribbon Gum down drainage line, White Box - Stringybark to SE and Angophora - Stringybark - grassy to NE. Red Gum present.

		Angophora			
	331	Angophora - Apple Box - Yellow Box - Stringybark.	Good	Yes (eastern sector)	East dominant Yellow Box - Stringybark - grassy. Further upslope shrubby Stringybark.
	332	Apple Box - Blakely's Red Gum	Good	Yes	Partially cleared
	333	Derived Native Grassland	Good	Yes	Derived grassland
	334	White Box	Moderate	Yes	Open grassy, patchy shrub cover. Stringybark - Angophora present.
	336	Blakely's Red Gum	Moderate - Good	Yes in open	Patchy to shrubby. Stringybark - Angophora present.
	337	Yellow Box - Apple Box - Stringybark.	Good	No but yes to NW	Shrubby. North-west is grassy open.
	339	White Box - Yellow Box - Blakely's Red Gum.	Moderate - Good	Yes	
	341	Apple Box - Stringybark	Good	No	Woodland forest community shrubs initially increase.
	342	White Box - Stringybark.	Moderate	Yes	
	343	White Box - Stringybark.	Moderate - Good	Yes	Grassy across gully. White Box East, Shrubby Stringybark to West.
	344	White Box	Moderate	Yes	Grassy open with shrubby edges.
	345	White Box	Good	Yes	Grassy and patchy shrubs with numerous patches over 30% grass cover.
	357	Blakely's Red Gum	Good	Yes	Tree transect, Stringybark - Yellow Box- Angophora
	362	Stringybark - Angophora	Good	No	Tree transect, Blakely's Red Gum - Apple Box - Yellow Box- Ribbon Gum - Mountain Gum.
	364	Stringybark - Blakely's Red Gum - Ribbon Gum	Good	Yes to SE	Blakely's Red Gum mainly downslope. Upslope more shrubby. Ahead Yellow Box - Blakely's Red Gum.

	366	Yellow Box - Blakely's Red Gum	Yes	Some sections	Shrubby with grassy patches.
	367	Stringybark - Yellow Box.	Good	No	Shrubs decrease downslope to grassy woodland.
	368	Blakely's Red Gum - Yellow Box - Angophora	Good	Yes	Grassy.
	369	Stringybark	Good	No	Tree transect, Blakely's Red Gum - Apple Box - Yellow Box- Angophora
	370	White Box.	Low - Moderate	Yes	Derived Grassland
NOML					
	4	Red Gum - Box - Stringybark	Good	No	Shrubby woodland/open forest
	5	Yellow Box - Apple box	Moderate - Good	Yes	Partially cleared
	6	Stringybark	Moderate - Good	No	Extends to the south
	216	Blakely's Red Gum - Stringybark - Yellow Box	Good	No	Shrubby
	219	Yellow Box - Blakely's Red Gum - Stringybark	Good	Yes	
	220	Yellow Box - Stringybark	Good	No	Shrubby. Derived grasslands to North.
	221	Blakely's Red Gum -Yellow Box - Stringybark	Good	Yes	Shrubby to the west
	222	Blakely's Red Gum	Good	Yes	
	227	Blakely's Red Gum -Yellow Box	Yes	Yes downslope area	Shrubby to grassy slope.

	229	Blakely's Red Gum - Stringybark - Yellow Box	Moderate - Good	Yes	
	230	Blakely's Red Gum - Stringybark - Yellow Box	Good	Yes	Shrubby but grassy downslope.
	236	Stringybark	Moderate - Good	No	Blakely's Red Gum - Yellow Box - Apple Box
	237	Stringybark - Yellow Box.	Moderate	Yes to W & SW	Grassy South, leafy North with more Blakely's Red Gum coming in.
	238	Blakely's Red Gum - Stringybark.	Good	Yes	Occasional Yellow Box.
	239	Stringybark	Good	No	Across gully.
	281	Stringybark - Apple Box	Moderate	No	Some Yellow box. Shrubs more pronounced however still patchy, Grass cover moderate to sparse.
	282	Yellow Box - Cypress	Moderate	No	Grassy.
	284	Apple Box - Stringybark - Ribbon Gum.	Good	No	Shrubby.
	285	Stringybark- Blakely's Red Gum	Moderate - Good	Yes to the west	Grassy.
	287	Stringybark - Apple Box - Angophora	Good	No	Grassy and patchy shrubs. Stringybark dominated patches. To East Yellow Box - Edge of woodland forest Mountain Gum - Apple Box - Blakely's Red Gum.
	288	Ribbon Gum	Moderate - Good	No	
	290	Yellow Box - Apple Box - Stringybark.	Good	Yes	Grassy
	291	Blakely's Red Gum - Stringybark	Good	Yes	In some sectors

	292	Blakely's Red Gum	Good	Yes	
	296	Apple Box	Low	No	
	297	Apple Box - Blakely's Red Gum - Ribbon Gum - Stringybark	Moderate	Yes	On edge of CEEC
	298	Ribbon Gum - Yellow Box - Angophora	Moderate	No	Blakely's Red Gum patches nearby
	361	Stringybark - Apple Box	Good	No	DSF open forest/woodland. Occasional Yellow Box and Mountain Gum.
	371	Red Stringybark	Moderate	No	Apple Box - Ribbon Gum. Grassy.
	372	Blakely's Red Gum - Stringybark.	Good	Yes	Lots of leaf litter, patchy shrub, some grass. Grass better developed in some sectors - large old growth tree.
	374	Stringybark - Mountain Gum	Good	No	Except for storm damage
	375	Stringybark	Good	No	Apple Box. Mountain Gum to West.
	376	Yellow Box - Stringybark - Apple Box	Good	Yes	
	377	Yellow Box	Good	Yes	Grassy plateau area
	378	Yellow Box	Good	Y	Starts to fade out.
	379	Yellow Box	Good	Yes	Grassy
	380	Blakely's Red Gum - Stringybark - Yellow Box	Good	Yes	Grassy. Occasional Angophora.
	381	Mountain Gum - Apple Box -	Good	No	Grassy, drainage line.

		Angophora			
	382	Yellow Box - Blakely's Red Gum	Good	Yes	Grassy. Stringybark coming in.

Table E.2 SUMMARY OF VEGETATION PLOT DATA IN PROJECT SITE AND OFFSETS

Site code	Waypoint	Elevation (m)	Dominant/Co-dominant species	Non-grassy native ground cover	Number of Important species	Condition	Conforms to Box-Gum Woodland	Comments
LSF1	109	357	White Box	19+	4	Mod	Yes	Very dry, grass patchy
LSF1A	91	314	Silver-leaved Ironbark- White Cypress Pine	7+	2	Mod	No	
LSF2			White Box	31+	3	Good	Yes	Very dry
LSF3	154	407	White Box	15+	2	Good		
PL	157	365	White Box	16+	2	Mod - Good	Yes	
PL	158	353	White Box-Cypress Pine	17+	1	Good	Yes	
WOT3	255	312	White box – Cypress Pine	15+	2	Good	Yes	In project area. Grassy.

Table E.3 SUMMARY OF PLOT DATA IN EASTERN OFFSETS

Site code	Waypoint	Elevation (m)	Dominant/Co-dominant species	Non-grassy native ground cover	Number of important species	Condition	Conforms to Box-Gum Woodland	Comments
WAL1	207	324	Yellow Box - White Box	16+	2	Good	Yes	Grey-crowned babbler found.
WAL2	214	337	White Box - Cypress	14+	2	Good	Yes	Grassy
EOW1		349	White Box- Cypress	12+	2	Good	Yes	Grassy
EOW1A	261	347	Derived Native Grassland	16+	2	Moderate	Yes	Class B condition
EOW1B	264	349	White box	15+	2	Good		Grassy woodland. Cypress, Ironbark present.
EOW1C	273	297	Derived Native Grassland (Yellow Box)	13+	1	Good	Yes	Good Yellow Box regeneration. Class B condition
EOW1D	275	311	Yellow Box - Cypress	13+	1	Good	Yes	Grassy open woodland.
EOWd	278	300	White box	12+	0	Moderate	Likely in better season/ more time	Rocky knoll. Grassy.

Table E.4 SUMMARY OF PLOT DATA IN WESTERN OFFSETS

Site code	Waypoint	Elevation	Dominant/Co-dominant species	Non-grassy native ground cover	Number of important species found	Condition	Conforms to Box-Gum Woodland	Comments
WOT 1	119	310	White Box	25+	6	Good	Yes	Grassy
WOT 1A	249	300	White Box - Cypress - Ironbark	14+	2	Moderate-Good	Yes	Grassy woodland
WOT1B	254	362	White box - Cypress - Wilga	14+	2	Good	Yes	Grassy.
WOT2	120	384	White Box	22+	7	Good	Yes	Grassy.
WOT2A	256	371	White Box	13+	1	Moderate	Yes	Grassy open woodland. Some disturbance to ground cover by pigs.
WOK1	186	296	White Box - Cypress	19+	3	Good	Yes	Grassy
WOK1C	173	323	White Box - Cypress	17+	1	Moderate	Yes	
WOK2	194	299	White Box - Cypress	21+	4	Moderate	Yes	
WOK RA	196	324	White Box - Cypress	15+	4	Moderate	Yes	
WOL1	166	312	White Box	14+	1	Moderate-Good	Yes	Cattle present
WOL1B	170	316	White Box	13+	4	Good	Yes	Grassy

WOL1C	173	310	White Box - Cypress	13+	1	Moderate	Yes	Open woodland
WOL1D	181	285	White Box - Wilga	15+	2	Moderate	Yes	Open woodland

Table E.5 SUMMARY OF PLOT DATA IN NORTHERN OFFSETS

Site code	Waypoint	Elevation	Dominant/Co-dominant species	Non-grassy native ground cover	Number of important species	Condition	Conforms to box-gum woodland	Comments
NOML RA1	134		Yellow box - Blakely's Red Gum	16+	4	Good	Yes	
NOML RA2	135	984	White Box	12+	3	Good	Yes	
NOML RA3	136	959	Yellow box - Blakely's Red Gum - Stringybark - Angophora	13+	5	Good	Yes	
NOML RA4	138	1022	Blakely's Red Gum- Apple box - Stringybark	15+	5	Good	Yes	
NOML1	1	882	Yellow Box - Stringybark- Mountain Gum	15+	3	Good	Yes	
NOML1A	3	905	Yellow Box - Blakely's Red Gum - Stringybark	13+	3	Good	Yes	Shrubby upslope
NOML1B	7	1047	Derived Grassland	15+	1	Good	Yes	Class B condition
NOML1D	217	1051	Yellow Box - Stringybark	12+	0	Moderate-Good	No	
NOML1E	218	1039	Yellow Box	15+	4	Good	Yes	Grassy woodland
NOML1F	223	966	Yellow Box - Blakely's Red Gum	15+	3	Good	Yes	Derived Grassland-Class B condition

NOML1G	224	948	Blakely's Red Gum	15+	2	Good	Yes	Grassy woodland
NOML2	225	961	Stringybark - Apple box - Yellow Box	16+	3	Moderate-Good	Yes	Moderate slope - drier conditions
NOML2A	226	962	Yellow box	13+	1	Moderate-Good	Yes	Moderate slope - drier conditions
NOML2B	228	917	Stringybark - Blakely's Red Gum - Yellow Box	13+	3	Good	Yes	Grassy woodland
NOML2C	231	895	Yellow Box	17+	1	Good	Yes	
NOML2D	232	876	Yellow Box - Ribbon Gum	14+	2	Good	Yes	
NOML2E	233	889	Yellow box - Stringybark - Blakely's Red Gum	12+	3	Good	Yes	Grassy woodland
NOML3	279	959	Stringybark	14+	1	Good	No	Plus *E. Blaklei*
NOML3A	283	941	Yellow box	16+	3	Moderate	Yes	Scattered Shrub, lots of leaf litter and grass in scattered clumps.
NOML3B	286	940	Blakely's Red Gum	14+	1	Good	Yes	
NOML3E	289	943	Stringybark - Blakely's Red Gum - Yellow Box	13+	1	Good	No	Shrubby woodland
NOML3F	293	926	Stringybark	14+	2	Good	No	Yellow Box and Blakely's Red Gum present. Patchy shrub and grass.
NOML3G	294	924	Stringybark - Yellow Box	16+	2	Good	Yes	Grassy open woodland.
NOML4	280	955	Stringybark - Blakely's Red Gum	12+	3	Good	Yes	Marginal structural conformity to CEEC

NOML4A	295	909	Apple Box	12+	3	Low-Moderate	No	Rocky Knoll
NOML5A	373	1061	Blakely's Red Gum - Yellow Box - Stringybark	13+	2	Good	Yes	Variable Grassy patches
NO3A	234	1047	Yellow Box	14+	4	Good	Yes	Grassy woodland
NO3B	235	1044	Stringybark - Yellow Box and Blakely's Red Gum	17+	3	Good	Yes	Yellow Box and Blakely's Red Gum present. Grassy woodland.
NO4A	240	935	Apple Box - Stringybark	15+	3	Good	No	Grassy - Ribbon Gum and Blakely's Red Gum adjacent
NO4B	241	934	Blakely's Red Gum	12+	13	Moderate-good	Yes	Yellow box, Stringybark, Ribbon Gum present. More grass starting to develop after rain.
NOW1	129	910	White Box	14+	4	Good	Yes	Derived Grassland occasional White Box. Class B condition.
NOW2	121	1001	Yellow Box - Blakely's Red Gum - Apple Box	15+	2	Good	Yes	High quality Blakely's Red Gum woodland along ridge and downslope to West. Dense shrub in small

								patches.
NOW A	320	320	White Box	10+	0	Low	No	Derived Grassland. Box Gum woodland to NE.
NOW B	328	869	White Box - Stringybark	19+	3	Good	Yes	Grassy
NOW C	335	904	Yellow box - Stringybark	10+	3	Moderate-Good	No	Lots of Leaf litter, little grass.
NOW D	340	885	Blakely's Red Gum	15+	4	Good	Yes	Grassy.
NOW E	365	995	Blakely's Red Gum	15+	2	Moderate	Yes	Grassy. Yellow Box present.
NOW5A	299	983	Stringybark - Apple Box	15+	2	Moderate	No	

Table E.6 SUMMARY OF FAUNA HABITAT VALUES - LEARD STATE FOREST

Connectivity	Dis	OG	Mr	SD	Alt	FH	GD	TH	SF	Total	Average	Comments
4	2	3	5	3	2	1	6	1	4	31	3.1	Location N.W Rd/ South Lawler's Rd Junction. Grassy Understory
4	2	4	5	3	2	2	6	5	3	36	3.6	Abundance of leaf litter. Gully. Mod-dense grass cover.
4	2	5	5	3	2	2	6	6	3	38	3.8	More grass
4	2	4	5	3	2	2	6	2	2	32	3.2	More dense grass cover.
3	2	0	4	3	2	2	4	0	3	23	2.3	Grassy near gully, scattered shrub patches
19	10	16	24	15	10	9	28	14	15	160	16	
3.8	2	3.2	4.8	3	2	1.8	5.6	2.8	3	32	3.2	

LEGEND	
Dis	Level of disturbance
OG	Representation of old growth trees
Mr	Maturity of regeneration
SD	Structural diversity
Alt	Alternative habitat availability
FH	Forage species presence
GD	Extent of ground debris
TH	Representation of hollow-bearing trees
SF	Occurrence of special habitat features

SCORE (VAULES)	
1	Very Low
2	Low
3	Moderate
4	Moderately High
5	High
6	Very High

Table E.7 SUMMARY OF FAUNA HABITAT VALUES – EASTERN OFFSETS

Aspect	Habitat Type	Connectivity	Dis	OG	Mr	SD	Alt	FH	GD	TH	SF	Total	Average	Comments
	WB/YB/RRG	2	2	2	4	3	2	3	3	1	2	24	2.4	Grey crowned babblers, Dam nearby
	of the new the	3	3	5	3	3	3	3	3	2	2	30	3.0	Actual hollows = 2
SW	Grassy gully with Cypress Pine and White Box	3	3	6	3	3	2	2	0	5	6	33	3.3	White Box present
NW	Grassy Gully - Yellow Box, Ironbark, Cypress Pine	3	2	5	4	4	3	3	0	3	6	33	3.3	
SW	Yellow Box, Ironbark, White Box	3	2	5	5	3	3	3	2	0	6	32	3.2	Gently sloping, open grassy habitat
			12	23	19	16	13	14	8	11	22	152	15.2	
			2.4	**4.6**	**3.8**	**3.2**	**2.6**	**2.8**	**1.6**	**2.2**	**4.4**	**30.4**	**3.04**	

Table E.8 SUMMARY OF FAUNA HABITAT VALUES – WESTERN OFFSETS

Site	Aspect	Habitat Type	Connectivity	Dis	OG	Mr	SD	Alt	FH	GD	TH	SF	Total	Average	Comments
WOT1	E	White Box Grassy Woodland	4	3	1	4	3	2	3	4	0	0	24	2.4	Plot subject to previous grazing
WOT2	E	White Box Grassy Woodland	4	4	1	4	3	2	3	4	0	2	27	2.7	Mod. Grass cover. Plot subject to previous grazing.
WOL1 166	SW	WB, Wilga, grassy wld.	4	3	2	1	3	2	3	3	2	3	26	2.6	Against S boundary. Clumps of shrubs.
WOL 173	S	WB open woodland - patches wilga	4	3	4	4	4	3	3	5	5	3	38	3.8	Dense patches of shrubs.
WOL1D 181	SE	WB wld, patches wilga etc.	4	3	3	4	4	3	2	5	3	5	36	3.6	Adj. dry water course.
WOK1B 183	E	WB/cypress, shrubby W/F	3	3	4	4	4	3	3	3	2	6	35	3.5	Adj. to gully.
WOK1 186	SE	WB/wilga Grassy wld.	3	3	3	4	4	3	3	5	1	3	32	3.2	Patches of dense shrub.
187	SE/E	WB shrubby wld.	3	2	4	4	4	3	3	3	2	6	34	3.4	Dense shrubby US.
190	E	IB/CY	3	4	4	4	3	4	3	4	0	2	31	3.1	321 elev. Dense cypress. Nearby slope, some dense cover, WB.
194	NE	WB/CY	3	4	5	4	3	3	3	3	1	4	33	3.3	Gullies adj. WB dominant in overstorey.
196	NE	WB/ cypress, wilga	3	4	4	4	3	4	3	2	1	3	31	3.1	Some patches dense shrub around WB.
Totals			38	36	35	41	38	32	32	41	17	37	**347**	**34.7**	

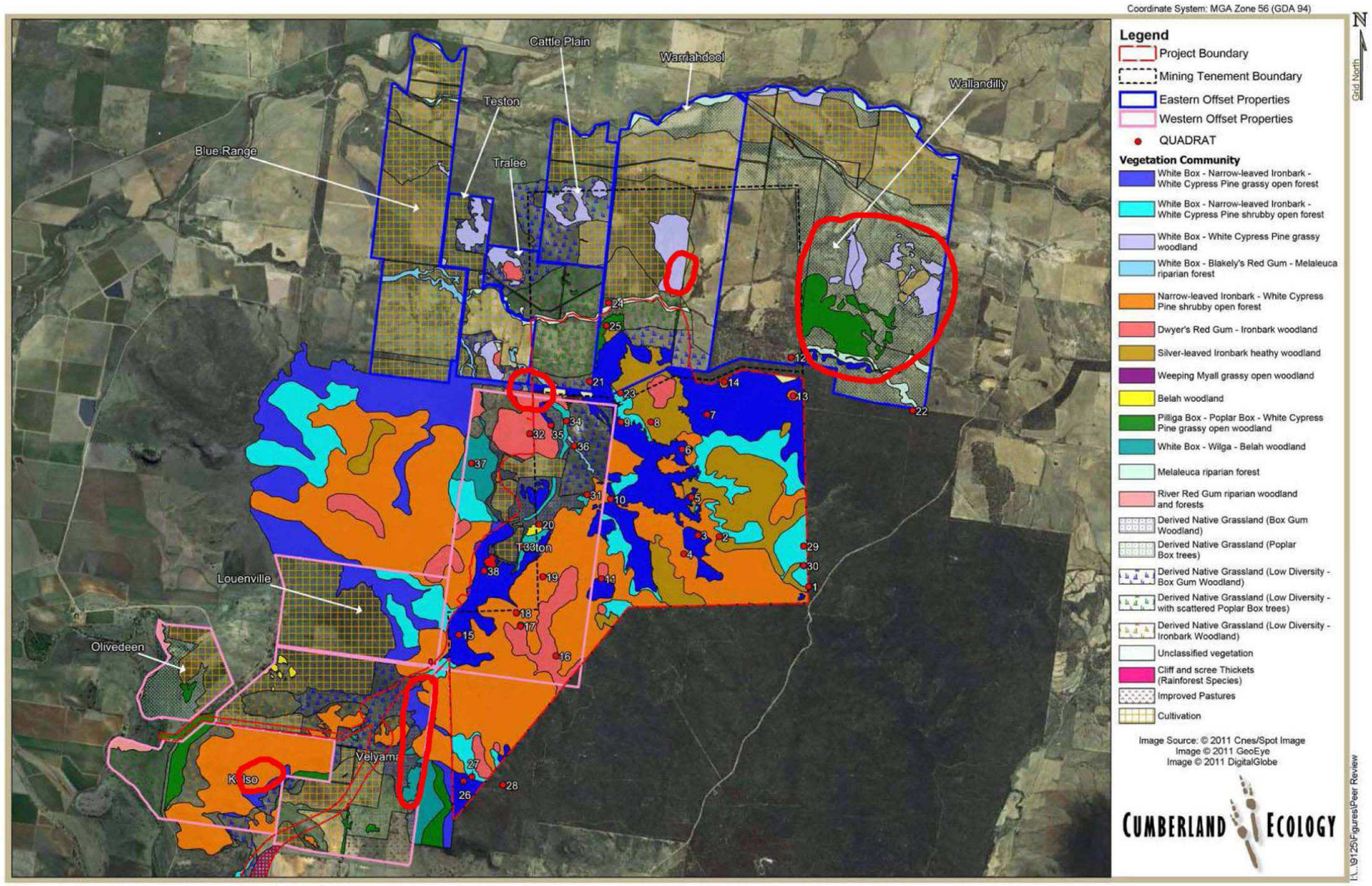
Table E.9 SUMMARY OF FAUNA HABITAT VALUES – NORTHERN OFFSETS

Site	Aspect	Habitat Type	Connectivity	Dis	OG	Mr	SD	Alt	FH	GD	TH	SF	Total	Ave	Comments
NOML1	W	Open forest YB/BRG/StB	5	3	3	5	2	3	3	6	5	4	39	3.9	
NOMLE	W	YB/StB	5	3	1	3	3	3	2	2	2	2	26	2.6	Rocky knoll
NOML2C	SW	DSF/w on steep slope- StB , AB, YB/BRG	3	3	5	4	4	4	2	5	3	6	39	3.9	Creek nearby, rocky ..?
NOMLD	SW	YB/StB. DSW/DSF - grassy, shrubby.	6	2	3	4	3	3	2	3	1	6	33	3.3	
NO3	NW	DSW, BRG/ StB/YB.	5	2	6	4	3	2	2	5	3	2	34	3.4	Ridgeline very open.
NO4A	E	DSF- Ribbon gum BRG- A	3	2	3	5	4	2	1	2	3	6	31	3.1	Drainage line, Dense grasses.
NO4B	NE	BRG/YB/StB	3	3	2	4	2	2	2	6	1	4	29	2.9	Very open & shrubby patches
NOML3A		YB/StB/ *E. dalrympleana*	3	3	2	5	3	3	1	3	1	4	28	2.8	Very dense leaf litter
NOML3B		BRG/YB/AB	3	2	1	4	3	3	2	4	0	6	28	2.8	Grassy, Shrubs patches
NOML3E	SW	Gully- grassy YB/AB StB, *E. dalrympleana*	3	2	3	5	4	3	1	5	3	6	35	3.5	Gully, Shrubby patches (6 hollows).
NOML3F		StB, YB, BRG, Ang. - Grassy & shrubby alternating.	3	2	4	5	3	3	2	6	2	6	36	3.6	Grassy, Shrubs patchy, Gully adj.
NOML4		STB/YB/BRG, open forest/ with very dry, grassy cover mod.	3	2	0	5	3	3	1	5	3	6	31	3.1	Scattered shrub patches. Sheltered gull adj.
		E. Blakelyi	4	2	2	4	3	1	1	4	1	2	24	2.4	Dense grass

		woodland													
NOW B	NE	Open woodland on grassy slope.WB-StB- Cyp-Ang	3	2	0	4	3	2	1	6	0	6	27	2.7	Rocky slope
NOW C	N	Woodland/forest - YB-BRG-StB	3	2	0	4	2	3	2	6	3	6	31	3.1	Dense leaf litter
NOW D	W	BRG-WB woodland	4	2	1	4	3	2	2	5	2	3	28	2.8	Shrubbier upslope. Rocky
NOML5A		BRG-redStB-YB woodland	5	2	3	5	3	3	2	6	3	6	36	3.6	Ridge top shrubby patches. On Mt Lindesay. Open areas and shrubby patches.
NOW	E	DSF E/F Patchy shrubs and grasses.	3	2	3	5	4	3	2	5	3	5	35	3.5	Shrubby patches.
NOW a	E	DSF/W More grassy than wp361, shrubs more patchy	3	2	5	5	4	3	2	5	5	6	40	4.0	Shrubby patches, Dense grass
NOWb	E	DSF/W. IB/Cy.	6	3	5	4	4	3	2	4	4	6	41	4.1	Shrubby, IB's
			74	46	52	88	63	54		93	48	98	651	65.1	
Summary			3.7	2.3	2.6	4.4	3.15	2.7	0	4.65	2.4	4.9	32.55	3.25	

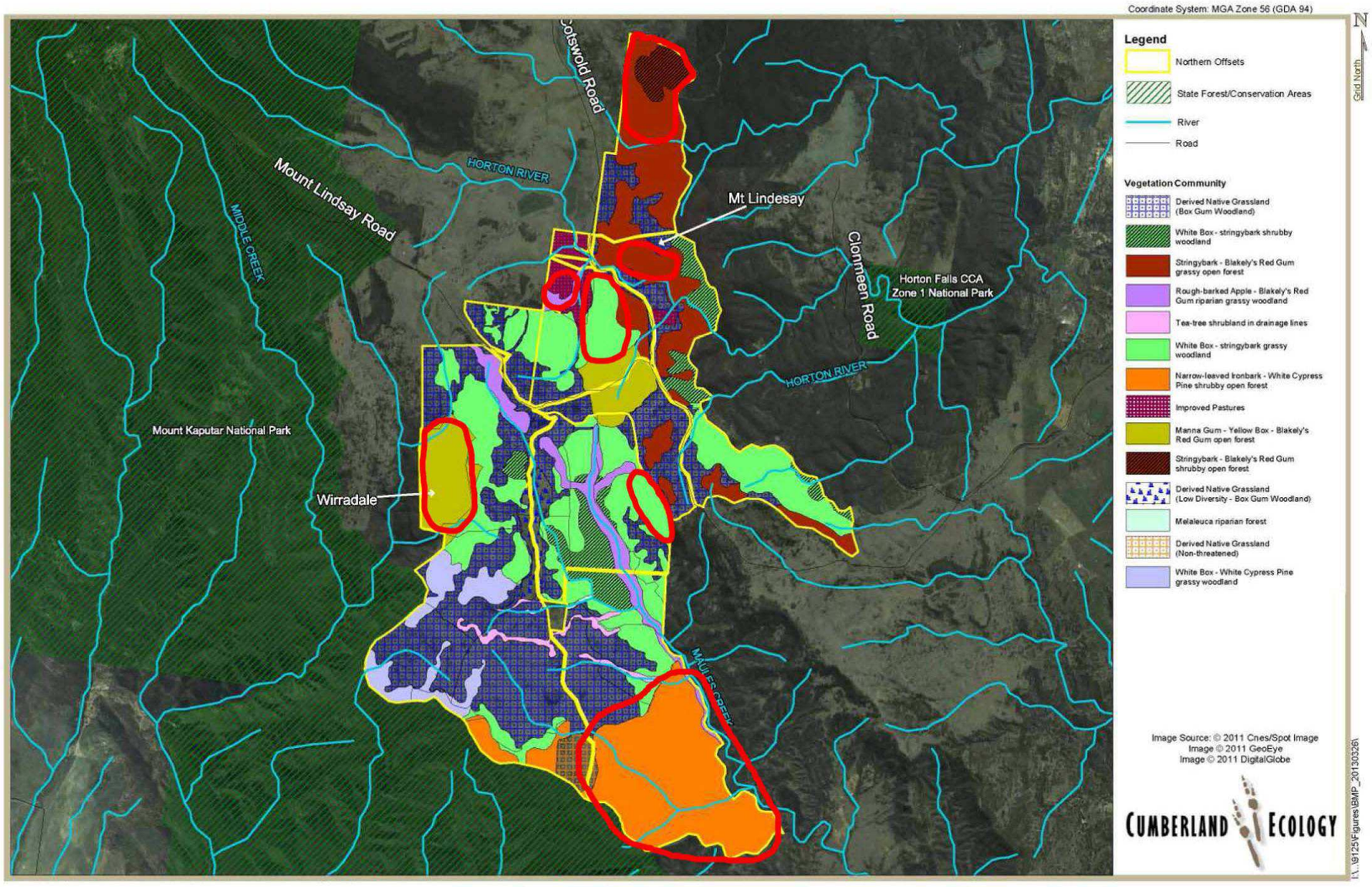
Appendix F

Key Areas for Mapping Amendments



Original map source: Cumberland Ecology Biodiversity Management Plan, 2013

Figure F.1 Key Areas for Mapping Amendments in the Eastern and Western Sectors



Original map source: Cumberland Ecology Biodiversity Management Plan, 2013

Figure F.2 Key Areas for Mapping Amendments in the Northern Sectors.

Appendix G

Comparative Summary Table of Clearing and Revised Offset Areas (Including Additional Offsets)

Table G.1 Summary of proposed offset areas showing recommended variations from original offset totals

OFFSETS	Box Gum Woodland and Derived Grasslands provided (ha) (derived from BMP - Table 4.29 and Corresponding with Management Zone Totals in Attachment A - Approval Conditions)			Variations for Box Gum Woodland and Derived Grasslands provided (ha)							HABITAT for EPBC Matters of National Environmental Significance (Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat [Greater Long-eared Bat]) (derived from BMP - Table 4.29 and Corresponding with Management Zone Totals in Attachment A - Approval Conditions)			Variations for HABITAT for EPBC Matters of National Environmental Significance (Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat					
Property	Derived Grassland	Box-Gum Woodland	**Total area of offsets (ha) (Combined)**	Positive Variation (Derived Grass-land)	Positive Variation (Box-Gum Wood-land)	Negative Variation (Derived Grass-land)	Negative Variation (Box-Gum Wood-land)	**Adjusted Total Derived Grass-land**	**Adjusted Total Box-Gum Wood-land**	**Adjusted Total Area of Offsets**	Good condition vegetation (ha)	Low or moderate condition vegetation to be re-vegetated (ha)	**Total Habitat Offset Area**	Positive Variation - Good condition vegetation (ha)	Positive Variation - Low or moderate condition vegetation (ha)	Negative Variation - Good condition vegetation (ha)	Negative Variation - Low or moderate condition vegetation (ha)	**Adjusted Total - Good condition vegetation (ha)**	**Adjusred Total - Low or moderate condition vegetation (ha)**	**Adjusted Total Habitat Offset Area Estimate (if required)**
Northern Offsets																				
Mt Lindesay	577.3	1458.6	**2035.9**	7.34	21.5		275.23	584.64	1204.87	1789.51	1456.7	821.2	2277.9	230.9		50.3	218.3	1637.3	602.9	**2240.2**
Wirradale	818.7	1517.1	**2335.8**		20.89	3.37	113.2	815.33	1424.79	2240.12	1942.2	1593.7	3535.9	458.4	44			2400.6	1637.7	**4038.3**
Western Offsets								0	0	0										
Kelso	0	16.5	**16.5**					0	16.5	16.5	342.8	156.4	499.2		40.2	40.2		302.6	196.6	**499.2**
Louenville	0	151	**151**					0	151	151	188.6	115	303.6					188.6	115	**303.6**
Olivedeen	0	0	**0**					0	0	0	13.2	31.8	45					13.2	31.8	**45**
Teston (sth)	18.6	63.4	**82**		14			18.6	77.4	96	175.1	127.6	302.7					175.1	127.6	**302.7**
Velyama	71.6	37.8	**109.4**		36		36	71.6	37.8	109.4	83	315.8	398.8		20	**20**		63	335.8	**398.8**
Eastern Offsets																				
Blue Range	0	21.7	**21.7**					0	21.7	21.7	0	127.4	**127.4**					0	127.4	**127.4**
Cattle Plain	0	36	**36**					0	36	36	36	118.3	**154.3**					36	118.3	**154.3**

Teston (nth)	0	57.8	**57.8**					0	57.8	57.8	0.1	204.5	**204.6**					0.1	204.5	**204.6**
Tralee	0	17.2	**17.2**					0	17.2	17.2	0	103.2	103.2					0	103.2	**103.2**
Wallan-dilly	0	98.3	**98.3**	198.06	107		34.75	198.06	170.55	368.61	122.8	699.7	822.5	106.2		106.2		122.8	699.7	**822.5**
Warriah-dool	0	64.5	**64.5**					0	64.5	64.5	64.5	138.1	202.6		30	**30**		34.5	168.1	**202.6**
Shared Property																				
	0	5.6	5.6						5.6	5.6	**124.1**	**232.1**	**356.2**							356.2
SUB-TOTAL	**1486.2**	**3545.5**	**5031.7**	**205.4**	**199.39**	**3.37**	**459.18**	**1688.23**	**3285.71**	**4973.94**	**4549.1**	**4784.8**	**9333.9**	**795.5**	**134.2**	**246.7**	**218.3**	**4973.8**	**4468.6**	**9798.6**
Additional Properties																				
Roseglass	97	262	**359**					97	262	**359**	864.5	425.5	**1290**							1290
Oakleigh/ Onavale	49	111	**160**					49	111	**160**	134	129	**263**							263
Bimbooria	40	169	**209**					40	169	**210**	383	300	**683**							683
SUB-TOTAL	186	542	728	0	0			186	542	729	1381.5	854.5	2236							2236
TOTAL	1672.2	4087.5	5759.7	205.4	199.39	3.37	459.18	1874.33	3827.71	5702.94	5930.6	5639.3	11569.9	795.5	134.2	246.7	218.3	4973.8	4468.6	12034.6