Senate Standing Committee on Environment and Communications
Legislation Committee
Answers to questions on notice
Environment portfolio

Question No: 118

Hearing: Supplementary Budget Estimates

Outcome: Outcome 1

Programme: Environment Assessment and Compliance Division

Topic: MAULES CREEK COAL MINE

Hansard Page: N/A

Question Date: 29 October 2014

Question Type: Written

Senator Waters asked:

Please table the independent review referred to in the Department's response to QoN 62 of Budget Estimates 2014, that is http://www.aph.gov.au/~/media/Committees/ec_ctte/estimates/bud_1415/Environment/answers/q62.pdf

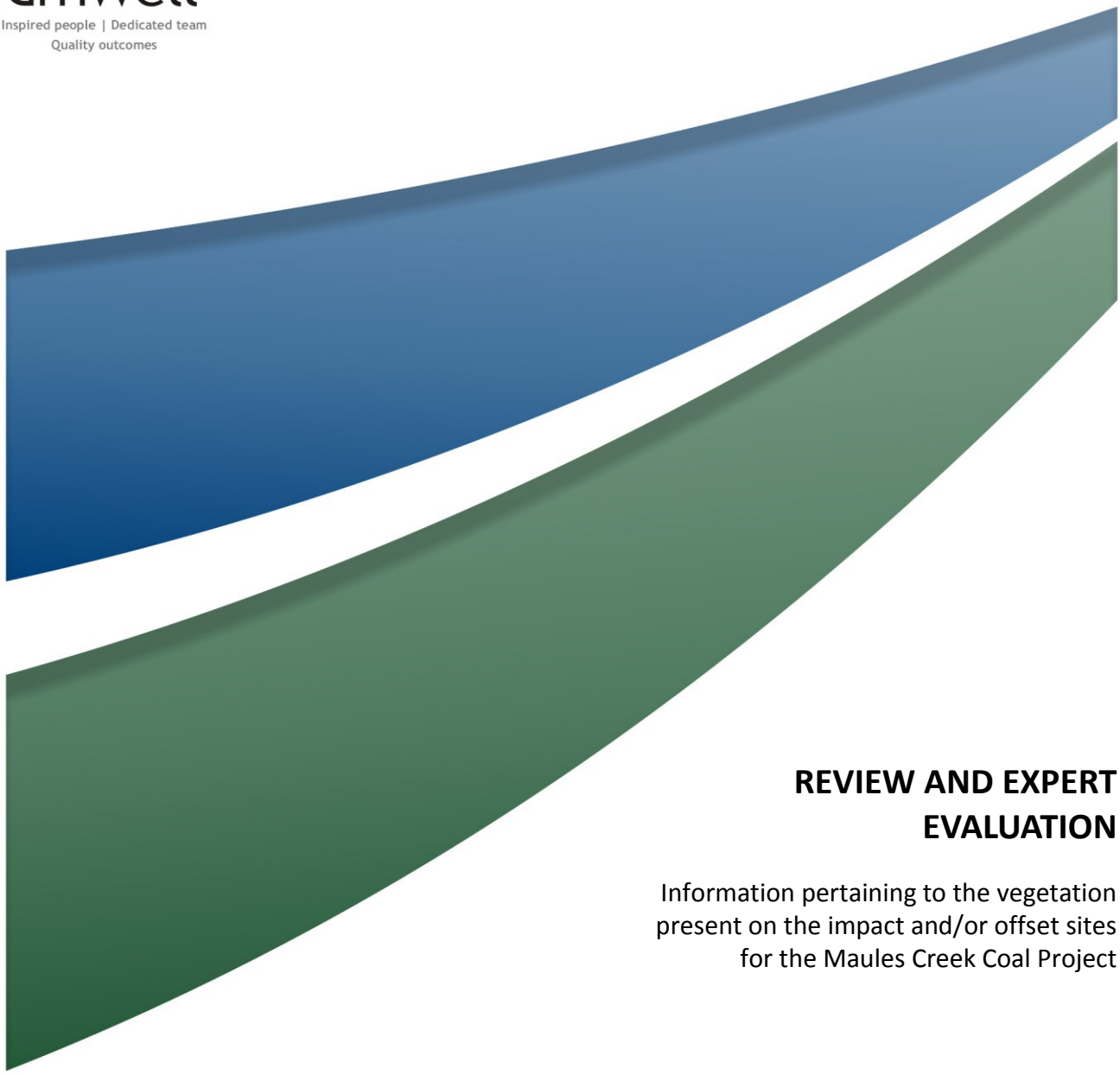
Answer:

As requested please find attached a copy of:

Umwelt (Australia) Pty Limited (March 2014). *Review and Expert Evaluation: Information pertaining to the vegetation present on the impact and/or offset sites for the Maules Creek Coal Project*. Prepared for the Department of the Environment.

umwelt

Inspired people | Dedicated team
Quality outcomes



REVIEW AND EXPERT EVALUATION

Information pertaining to the vegetation present on the impact and/or offset sites for the Maules Creek Coal Project

March 2014

REVIEW AND EXPERT EVALUATION

Information pertaining to the vegetation present on the impact and/or offset sites for the Maules Creek Coal Project

March 2014

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Australian Government
Department of the Environment

Project Director: **Travis Peake**
Project Manager: **Peter Cowper**
Report No. **8055/R01/V2**
Date: **March 2014**

umwelt

Canberra

PO Box 6135
56 Bluebell Street
O'Connor ACT 2602

Ph. 02 6262 9484

www.umwelt.com.au

TABLE OF CONTENTS

1.0 Introduction 1
1.1 Scope of Review 1
1.1.1 Limitations of this Review 2
1.2 Authors of this Review 3
2.0 Approach and Review Method 4
2.1 Summary of Methods 4
2.1.1 Box – Gum Woodland 4
2.1.2 Threatened Fauna 5
3.0 Review 7
3.1 Hansen Bailey (2011) 7
3.1.1 Chapter 7.6 Ecology 7
3.1.2 Chapter 7.7 Maules Creek Biodiversity Offset Strategy 8
3.2 Cumberland Ecology (2011) 9
3.2.1 Chapter 1 Introduction 9
3.2.2 Chapter 2 Methods 9
3.2.3 Chapter 3 Results 15
3.2.4 Chapter 6 Biodiversity Offsetting 16
3.3 NWES (2013) 17
3.3.1 Overview 17
3.3.2 Methods 18
3.3.3 Results 21
3.4 Greenloaning Biostudies (2013) 22
3.4.1 Approach to Assessment 22
3.4.2 Methods 22
3.4.3 Results and Assessment 23
3.5 Hewlett Hunter (2014) 25
3.5.1 Methods 25
3.5.2 Results 25
4.0 Summarised Assessment 27
5.0 Conclusions 33
6.0 References 34

1.0 Introduction

The Department of the Environment (hereafter referred to as the Department) administers Australia's national environment law, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act protects certain aspects of Australia's natural and cultural heritage, called matters of national environmental significance (NES). The matters of national environmental significance include listed threatened species and ecological communities, among others.

Actions which are likely to have a significant impact on one or more matters of NES must be referred to the Minister for the Environment for assessment and approval. Once approved, the person taking the action must comply with the conditions of any approval.

The Department requires confirmation that vegetation offered as an offset for an approved project meets the requirements of the approval conditions. Umwelt (Australia) Pty Limited (Umwelt) was engaged by the Department to undertake a review of selected documents relating to the Maules Creek Coal Project with reference to methodologies applied in determining the presence, extent and quality of habitat for selected matters of NES.

1.1 Scope of Review

The scope of the review as prescribed in the project brief and reproduced below is as follows:

- *Review, comparison and evaluation of the methodologies used in the four information sources listed below for their ability to identify and accurately predict the quantity and condition class of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands ecological community (as per the EPBC Act listing), and the quality and quantity of habitat for the Regent Honeyeater, Swift Parrot and Greater Long-eared Bat*[1]*.*
- *With respect to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands ecological community, the review must specifically evaluate the methodologies used in the information sources for conformity to the EPBC Act definition and condition thresholds for determining the presence of the critically endangered community, as described in the following Commonwealth documents:*
  - *Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (2006)*
  - *EPBC Act policy statement 3.5 - White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands (2006)*
  - *Species list*[2] *for the EPBC Act policy statement 3.5 - White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands - 22 May 2006*
  - *Advice on the presence of hybrids in listed ecological communities (2011)*
- *Reasoned evaluation regarding the relative level of accuracy of the findings presented in each of the four information sources.*

[1] This species was originally listed under the EPBC Act as Greater Long-eared Bat *Nyctophilus timoriensis* however the current listing, reflecting updated taxonomic description is South-eastern Long-eared Bat *N. corbeni*. This report adopts the current nomenclature from this point forward.

[2] Available at the same URL as the policy statement, refer to References section of report

The primary information sources for the review are:

1) Environment Assessment, prepared by James Bailey (Hansen Bailey 2011):
    a) Main Report - Section 7.6: Ecology;
    b) Main Report - Section 7.7: Maules Creek Biodiversity Offset Strategy; and
    c) Appendix I Ecological Impact Assessment – Sections 1 (Introduction), 2 (Methodology), 3 (Results), 6 (Biodiversity Offsetting) (Cumberland Ecology 2011).
2) Report prepared by North West Ecological Services on behalf of the Maules Creek Community Council and Northern Inland Council for the Environment (NWES 2013).
3) Independent Peer Review of Offsets for the Maules Creek Mine Project – EPBC 2010/5566 (December 2013), prepared for Whitehaven Coal Pty Ltd by Greenloaning Biostudies Pty Ltd (2013).
4) Preliminary Overview of Independent Assessments of Wirradale & Mt Lindesay Offset Mapping: Updated amended version with additional survey sites (March 2014), prepared by Dr John Hunter (Hewlett Hunter 2014).

1.1.1 Limitations of this Review

Given the scope of this review, consideration is given to the extent to which guidelines and policy have been cited and described in the context of methodologies and assessment of results, in addition to the quality of data that would be expected to result from effective implementation of the described methods. However, it is not possible to comment on the degree to which the methods as described were implemented in the field, the competency of the individuals undertaking the work or other unwritten interpretations that may have influenced decisions made in the process of undertaking the various assessments.

Also, as the authors of this review have undertaken a purely desktop exercise and have no direct field experience of the Maules Creek project area, Leard State Forest or proposed offset sites, no comment is offered as to the actual accuracy of findings. The only exception to this is where the implications of applying a certain methodology or interpretation of policy would lead to a potentially inaccurate outcome based on the experience of the authors.

This review presents an opinion from the perspective of the authors' experience based on reasonable expectations for outcomes in ecological survey and assessment that would result from the methods as described and as taken in good faith to have been implemented as described. In accordance with the brief, this review is limited specifically to the methods described and implications of those methods and does not comment more broadly on the adequacy of the assessments.

1.2 Authors of this Review

This report has been prepared by Peter Cowper and reviewed by Travis Peake, both qualified ecologists, experienced in the interpretation and application of Commonwealth and other policy. In addition to this, both Peter and Travis have applied experience in the survey, identification and assessment of all matters of NES that are the focus of the review.

Peter Cowper *B Nat Res*
Manager Canberra Office, Associate

Peter is an environmental consultant with over 17 years of experience in environmental impact assessment; ecological survey and assessment; and geo-spatial analysis and cartography principally across eastern Australia and selected international locations. Peter has developed a specialist capability in environmental impact assessment, approvals management and strategic environmental planning from professional experience in ecological survey and assessment, spatial data analysis and provision of expert advice.

Peter's background includes a wide range of skills including substantial experience in the survey and assessment of terrestrial species, communities and populations throughout Australia and internationally. While having broad experience across all aspects of terrestrial ecology, he has specific experience in the survey and assessment of grassy ecosystems in the southern tablelands and surrounding regions and in particular those listed under NSW, ACT and Commonwealth legislation. Peter has also taken lead roles in the preparation of strategic assessment documents under Part 10 of the EPBC Act in addition to assessments under the Part 9 approvals process for a range of matters of national environmental significance including grassy ecosystems and associated species.

Travis Peake *B Nat Res (Hons)*
Umwelt Ecology Manager, Associate

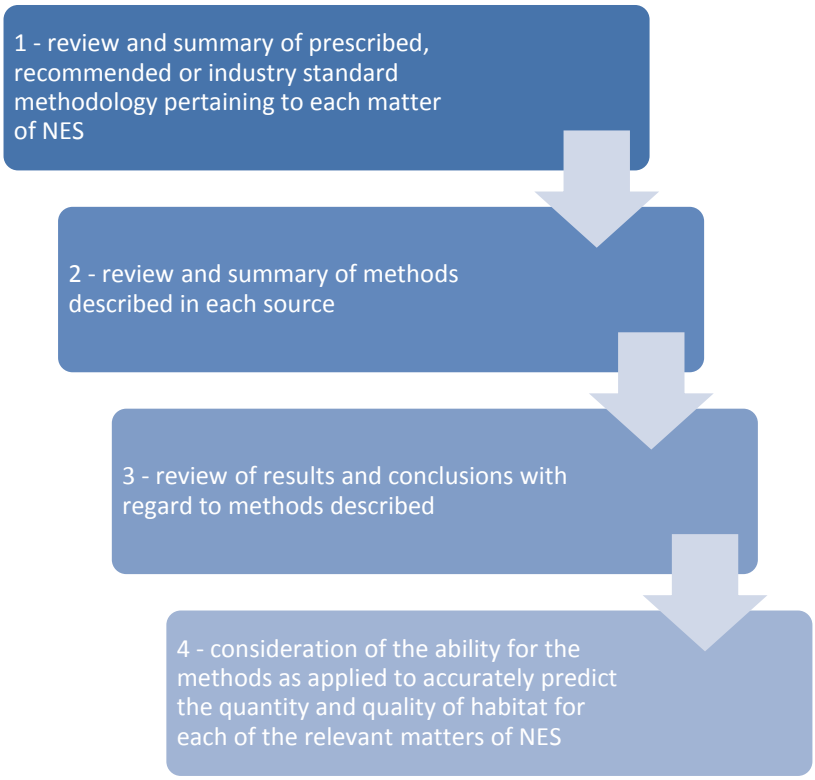
Travis has extensive experience in ecological assessment and management, in both strategic and impact assessment roles. Over the last 19 years, Travis has undertaken numerous specialist ecological studies in addition to managing complete ecological assessments for specific developments, and strategic ecological investigations. His experience underpins strengths in the technical aspects of ecological survey design, implementation and significance assessment for complex projects, and also in the preparation of clear management guidelines for community, local government and State government audiences.

Travis has extensive experience in the mapping, field sampling and condition assessment of box gum woodland in New South Wales, including the application of robust and repeatable methods to delineate box gum woodland condition types (including areas of hybridisation) to determine whether or not they meet the listed community and the approaches required to recover and manage the community.

2.0 Approach and Review Method

The approach to the review adopted a step-wise process to establish a clear understanding of criteria against which the sources were being compared. This allowed for consistent identification of the elements that comprised or influenced the methods described in the sources and the manner in which they were reported or were inferred to have been applied. The following diagram illustrates this process.

Figure 1 – Approach to Review Process



2.1 Summary of Methods

The following sections provide a summary of the methods prescribed or recommended in various state or Commonwealth publications or industry standard approaches as they relate to the matters of NES relevant to this review.

2.1.1 Box – Gum Woodland

Box – gum woodland is the term adopted in this report for the critically endangered ecological community listed as 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland'. The community is described in the Threatened Species Scientific Committee's listing advice (TSSC 2006) which includes among other components, discussion on floristics, structure, national extent and condition. The TSSC (2006) document provides the legal definition of the community as listed and must be referred to as the primary source for its identification and assessment of significance when considering a specific occurrence.

Key elements of the community description include:

- Floristic composition including:
  - Diagnostic canopy species;
  - Associated and occasionally co-dominant canopy species;
  - Shrubs and ground layer vegetation;
  - Important species.
- Structural characteristics overall and within each stratum;
- Distribution and associated variation in floristics across its geographic and altitudinal range;
- Condition classes describing both when the community is either present or degraded to the point where it no longer meets requirements to be included in the listed definition;
- Minimum area over which the community would be considered to be present;
- Definition of the extent of a 'patch'.

Due to the technical nature of the listing advice, a flowchart presented in the Policy Statement (DEH 2006) describes a visual process for landholders to determine whether a given area of land supports the listed community. The flowchart includes all of the key elements described in the listing advice and is generally a reliable tool to assist in determining the likely presence of the listed community however should not be relied upon as the definitive statement on box – gum woodland.

More recently, the National Recovery Plan for box – gum woodland (DECCW 2010) produced an updated flowchart (refer to Appendix 2 in DECCW, 2010) that included a minor clarification as to the approach in assessing the ground layer vegetation. This did not have the effect of amending the listing advice.

Further discussion as to the application of the listing advice to identification of box – gum woodland is raised in consideration of the four documents subject to this review.

2.1.2 Threatened Fauna

A diversity of survey guidelines for flora and fauna have been published in the recent past however with most direct relevance to this review are guidelines produced by the Commonwealth and the NSW Government.

Survey guidelines for regent honeyeater and swift parrot are described in the 'Survey Guidelines for Australia's Threatened Birds' (DEWHA 2010a). This document identifies methods that are appropriate for the detection and assessment of population size of the then list of threatened Australian birds. While it includes a brief description of the habitat and life cycle of each species, it does not describe methodologies for habitat assessment. Similarly, survey guidelines for Australia's threatened bats (DEWHA 2010b) include recommendations for the approach to detecting the presence of south-eastern long-eared bat in addition to a brief description of habitat and life cycle.

The NSW Department of Environment and Conservation (DEC 2004) draft guidelines has been used in NSW as a reference for minimum effort in undertaking ecological surveys. The guidelines include a description of the process for undertaking surveys from the planning

stage through implementation to assessment and relate to all taxa however are designed to facilitate effective assessment under the relevant State legislation. As noted by DEC (2004):

> The Guidelines aim to inform the process of survey and assessment of threatened biodiversity by describing and discussing:
>
> - the chronological steps within the threatened biodiversity assessment process;
> - the strategies, policies and legislation relevant to threatened biodiversity;
> - appropriate survey techniques for detecting threatened biodiversity;
> - the information required for an Assessment of Significance; and
> - reporting requirements and standards.
>
> The Guidelines aim to provide a consistent and systematic approach to survey and assessment of threatened biodiversity. In particular, the guidance provided will assist in:
>
> - setting appropriate aims for survey and assessment of threatened biodiversity;
> - the planning of suitable survey techniques and the appropriate level of effort;
> - the provision of adequate reporting;
> - a justifiable interpretation of results; and
> - making an informed and justifiable decision.

Relevant to this review, included in the guidelines are approaches to undertaking surveys for the detection of targeted species in addition to considerations for the assessment of habitat. These guidelines represent a reasonable statement of what comprises an industry standard (NSW specific) to minimum survey effort and the design of an appropriate ecological survey to detect the presence and likely significance of a given site for targeted species and biodiversity in general.

A typical approach to ecological assessment in NSW would give due regard to both the NSW and national guidelines when undertaking surveys for the relevant taxa.

3.0 Review

3.1 Hansen Bailey (2011)

The Environmental Assessment (EA) was prepared by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Aston Coal 2 Pty Limited to support an application for Project Approval under Section 75E of the *Environment Planning and Assessment Act 1979* (EP&A Act).

The relevant chapters of the Environmental Assessment (EA) for review are identified in the scope as being:

- Chapter 7.6 Ecology; and
- Chapter 7.7 Maules Creek Biodiversity Offset Strategy.

As a general observation, it is noted that the EA provides no citation for the Cumberland Ecology report upon which it is based with the only references appearing in the marginal information on various figures (refer to Figure 24, p. 117; Figure 25, p. 121; and Figure 26, p. 130). This citation reads 'Cumberland Ecology 2010' and does not correlate with the date of the final ecological report as provided for the purpose of this review which was dated to July 2011 (refer to **Section 3.2**). It is uncertain whether this is a typographic error or it relates to an earlier version, or another report by Cumberland Ecology.

3.1.1 Chapter 7.6 Ecology

Notwithstanding the above general observation, in introducing the ecology section of the EA, Hansen Bailey (2011) present a summary of the work described by Cumberland Ecology with references to guidelines including:

> The detailed baseline ecological surveys completed between 2008-2010 were undertaken in accordance with the Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (DECC 2004) [sic.]. Floristic sampling was designed to meet the SEWPaC (formally the Department of Environment and Heritage) guidelines for the identification of the EPBC Act listed CEEC White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands (Box Gum Woodlands and Derived Grasslands).

This description includes a misattribution of the 'Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities', which upon review of Cumberland Ecology (2011) should have read DEC (2004) and is the same source as introduced in **Section 2.1.2** of this report (above). Also, the guideline for box – gum woodland refers to DEH (2006) despite the lack of attribution, this is also confirmed upon review of Cumberland Ecology (2011) and subsequent citation in the EA.

Beyond these points, review of Chapter 7.6 of the EA is effectively a reiteration of information presented by Cumberland Ecology (2011). Comment on the methodology and subsequent issues with respect to the scope of this review are addressed in more detail in **Section 3.2** below.

3.1.2 Chapter 7.7 Maules Creek Biodiversity Offset Strategy

Chapter 7.7 of the EA discusses the biodiversity offset strategy. This section cites no primary sources for information that has informed the preparation of the strategy beyond references in the marginal information on Figure 26 (page 130) noting that information in the figure is derived from:

- Boggabri Coal 2009/2010;
- LPI 2009/2010;
- Aston 2010; and
- Cumberland Ecology 2010.

In review of the EA references list, the first two do not appear but are assumed to refer to EPBC referrals, the third is assumed to be 'Aston Resource (2010)' being the Prospectus for the Initial Public Offering of 67,114,094 Ordinary Shares in the Aston Resources Limited while the reference to 'Cumberland Ecology 2010' is also not included in the references list. It is unclear what elements of each source contributed to the strategy and as such it is not possible to assess the veracity of information depicted or consider the basis upon which that information was collected.

Beyond this, discussion of the approach to assessing areas for suitability as an offset include several references as reproduced in **Table 3.1**.

Table 3.1 – Offset Assessment Methods Described by the EA

Chapter	Page	Comment
7.7.1	128	High level vegetation mapping was undertaken via helicopter surveys to confirm areas containing Box Gum Woodland and Derived Grassland. This initial vegetation mapping was used to prioritise areas containing Box Gum Woodland that would assist as part of a Biodiversity Offset Strategy in maintaining and improving the biodiversity outcomes within the region. By priority, access was arranged with the respective landholders and field surveys were undertaken by teams of ecologists to validate the findings from the helicopter surveys and assist in completing preliminary mapping of vegetation communities on key properties. Suitable lands were acknowledged during this process and used in the development of the Biodiversity Offset Strategy for the Project. Further detailed surveys of the shortlist of properties are imminent.
7.7.2	129	The NSW Government has developed a biodiversity banking and offsets scheme (BioBanking Scheme) to assist in addressing the loss of biodiversity values, including Threatened species. This Scheme was established under Part 7A of the TSC Act and uses offsets (where appropriate) to assist in addressing the cumulative effects of development in NSW and in particular, to help meet the goal of maintaining or improving biodiversity. The NSW BioBanking Scheme and associated tools, developed by OEH (DEC 2008b)[3] have been used as a guide to developing the biodiversity offset requirements for the Project.

The first reference to field methodology in Chapter 7.7.1 through the use of helicopters would allow for familiarisation with a broad area. Information gained through this process would be largely subjective and the detail possible would be very dependent on the altitude and speed

[3] Does not appear in EA references list however review of Cumberland Ecology (2011) suggests this is a reference to the now superseded 2008 'Principles for the use of biodiversity offsets in NSW' and not to the 'BioBanking Assessment Methodology'

of flight. While this approach may result in the identification of areas with potential to be considered part of the offset, a spatial analysis using Geographic Information System (GIS) software and appropriate datasets would enable creation of a predictive model that could subsequently be verified in the field. Regardless, this first step would produce a list of potential sites albeit in a relatively *ad hoc* manner. Such sites would need to be subjected to detailed surveys to verify whether they met the criteria to be considered box – gum woodland.

This discussion of characteristics for each of the offset areas refers to Appendix I to the EA (Cumberland Ecology 2011). This is discussed further in **Section 3.2**.

3.2 Cumberland Ecology (2011)

Cumberland Ecology was commissioned by Hansen Bailey on behalf of Aston Resources Limited (Aston Resources) to undertake an ecological impact assessment of the proposed Maules Creek Coal Project. The ecological impact assessment forms part of the Environmental Assessment (EA) prepared by Hansen Bailey to support an application for Project Approval under Part 3A of the EP&A Act.

The relevant chapters of the Ecological Impact Assessment (EIA) for review are identified in the scope as being:

- Chapter 1 Introduction;
- Chapter 2 Methods;
- Chapter 3 Results; and
- Chapter 6 Biodiversity Offsetting

3.2.1 Chapter 1 Introduction

The EIA is introduced by way of a brief introduction and background to the project inclusive of discussion of earlier assessments associated with the application and subsequent development approval granted in 1990. Description of a range of biophysical elements is presented in Chapter 1, which also includes reference to an extensive range of studies including previous investigations into soils, rehabilitation trials in addition to flora and fauna surveys. The chapter also describes the nature of the proposal and introduces the legislative context.

There is no discussion relating to methodology in this chapter.

3.2.2 Chapter 2 Methods

The methodology is introduced with a discussion of the overall approach identifying the original intent of the report and subsequent change in focus from being a review and update of earlier work to being an ecological impact assessment for which a ‘highly accurate vegetation map’ needed to be produced.

With respect to field studies undertaken for the Maules Creek project, the EIA states (p. 2.1):

> Detailed surveys were completed in 2008 to provide updated flora and fauna baseline data for the Project Boundary in compliance with the OEH guidelines for flora and fauna survey (DEC (NSW), 2004). Floristic sampling was designed to meet SEWPaC (formally the Department of the Environment, Water, Heritage and the Arts) guidelines for identifying the critically endangered Box Gum Woodland and Derived Grasslands (DEC (NSW), 2005n).

References in this passage are consistent with those described in **Section 2.1** despite misattribution of the SEWPaC guidelines to another source. These guidelines are appropriate however the EIA does not acknowledge the listing advice (TSSC 2006) as being the requirements to satisfy with respect to the presence or absence of box – gum woodland.

This chapter also includes a brief discussion of other studies either within or adjacent to the project boundary undertaken between the mid 1970's (cited by CE, 2011 as 'James B. Croft & Assoc 1979') to an almost concurrent series of investigations undertaken by Parsons Brinckerhoff (PB 2010) on the adjacent Boggabri Coal Continuation Project. Cumberland Ecology (2011) note that reference to, and review of, the results of PB (2010) provided the EIA with a greatly increased flora and fauna database for the purpose of assessment. From this it is understood that the PB (2010) report and associated data was relied upon by Cumberland Ecology (2011) in assessing flora and fauna present within the Maules Creek project area however it is not discussed how this source was integrated into the assessment or otherwise verified as being acceptable for inclusion.

Table 2.1 of the report (p. 2.3) summarises the field survey effort for field surveys between July 2008 and December 2010.

It is also understood that a more recent report by Cumberland was prepared to provide more detailed information on habitat condition on the Maules Creek project area and identified offset sites. This additional report prepared for the biodiversity offset management plan also included field surveys however, as it is not within the scope of this review, the more recent (2013) report by Cumberland Ecology is not considered.

Flora Surveys and Box – Gum Woodland Methods

i. Vegetation mapping

The flora surveys are described in the EIA as being comprised of four primary elements commencing with a field validation of the original mapping described in the 1979 report by James B Croft & Associates in addition to the 1985 report by Dames and Moore. Field methods reported to have been undertaken include:

- 1,000m^2 quadrats (20m x 50m) to assess community floristics and structure;
- Meandering transects to identify community boundaries; and
- Detailed 'GPS walks' to record the position of vegetation community boundaries.

Somewhat in contrast to the summary of methods in Chapter 2.1, the EIA's executive summary also notes (p. S.2):

> The flora survey effort included: surveys of all recognisable plant communities; flora quadrats within 400m^2 (20 m X 20 m) and 1000m^2 (20 m x 50 m) (totalling 38 quadrats). Boundary walks, meander transects and opportunistic observations were also undertaken to maximise the detection of general, threatened and regionally significant flora species.

The location of 400m^2 quadrats as opposed to the 1,000m^2 quadrats is not distinguished in Chapter 2 or subsequently in other parts of the EIA. The basis for different plot sizes is also not explained however it can be inferred that if 400m^2 quadrats were implemented, this was on the basis of the DECC (2004) guidelines as a standard quadrat size, while the 1,000m^2 quadrats were the result of misinterpreted guidelines for the identification of box – gum woodland (DEH 2006) and lack of reference to the listing advice (refer to discussion in the following section).

Notwithstanding the minor inconsistencies, this approach is considered to be reliable in achieving the objectives of the survey and would have resulted in information describing the structure, floristics and distribution of vegetation communities. Figure 2.1 (p. 2.7) illustrates the location of 38 quadrats however there is no indication of where survey effort for other components of the methodology were employed. In the absence of a method describing the stratification process and survey design principles, it is not possible to determine the adequacy of survey effort, however the general methods as reported are consistent with industry approaches.

Information gathered in this first phase is reported to have been assessed in GIS over multi-layered satellite imagery. It is noted however that the software used is incapable of independently manipulating the different frequency bands of the Geo-Eye 1 satellite imagery and as a result the main benefit of this imagery would have been the high resolution which can be up to 1.65 metres in the multispectral range[4]. This imagery would have allowed for visual appreciation of vegetation patterns and in places would allow for classification of broad vegetation types including understorey differences in places. However this would not have allowed for an automated classification and other spatial analysis methods of vegetation mapping in taking advantage of the multi-spectral aspect of the imagery. It is unclear what aerial imagery was used for assessment of the proposed offset sites however references on maps produced by Cumberland Ecology (2011) suggest a range of sources but no guidance as to the resolution or other characteristics of the imagery.

ii. Criteria for the identification of box gum woodlands and derived grasslands

The second element of the flora surveys is described in the EIA as relating specifically to the identification of box – gum woodland. As previously noted, the EIA adopted the flowchart presented in DEH (2006) and does not refer to the listing advice for further context. Accordingly, there is one key limitation to the approach taken by Cumberland Ecology (2011) in interpreting the criteria for the minimum area over which the community is considered to be present (0.1 hectares). In addition to this, the EIA does not identify how the extent of the 'patch' was determined and when considered in conjunction with the minimum area issue is likely to have resulted in an underestimation of the extent of the community, particularly in the case of derived native grassland variants. This limitation in the interpretation by Cumberland Ecology (2011) is expressed as follows (p. 2.4)

> ... if one or more of these trees [white box, yellow box or Blakely's red gum] are present or was historically present as dominants, a quadrat should be completed within a plot of 1000 m^2 (0.1 ha). SEWPaC has published a list of plants characteristics of Box Gum Woodland and Derived Native Grasslands: if the survey plot contains 12 native herb species (excluding native grasses) and at least one is an "important" native plant as signified in the list of characteristic species, then the plant community is said to be present.

Presence of the community is determined by the existence of all diagnostic features within the distinguishable 'patch', not within a 0.1 hectare plot. Neither the identification guidelines of DEH (2006) or listing advice of TSSC (2006) prescribe that a 0.1 hectare plot needs to be completed. They do however note that the community must be considered at a minimum size

[4] http://www.satimagingcorp.com/satellite-sensors/geoeye-1.html

of 0.1 hectares indicating this is the smallest scale at which the community can be mapped as a 'patch'. This condition must also be considered alongside the definition of a 'patch' which in the glossary to the listing advice is described as follows:

> Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:
> - an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
> - the area over which the understorey is predominantly native.
>
> Patches must be assessed at a scale of 0.1 ha (1000m^2) or greater.

The first condition defining the extent of the patch would be relevant to ecotonal areas where the box – gum woodland grades into natural grasslands and defines the extent to which the ecotone should be considered part of the woodland community as opposed to the grassland. The alternative condition is where the understorey is predominantly native, which is also one of the mandatory elements for presence of the listed community and must also be present in the case that the first condition is to be met.

Interpretation of the listing advice in the manner as described by Cumberland Ecology (2011) where the requisite number of non-grass native species (and an important species) are not met within a given 0.1 hectare plot, would potentially result in an under estimation of the extent of the community. This would be more likely in derived communities and other situations where understorey condition was not as high such that the ground layer vegetation diversity conditions were met within a 0.1 hectare plot. Meandering searches within a candidate 'patch' would enable compilation of a flora inventory which would assist in determining presence of the community. This would also need to be supported by describing full floristic plots with sufficient replicates in order to quantify condition, structure and overall quality within the extent of the 'patch'.

iii. Floristic census and targeted surveys

Cumberland Ecology (2011) identify that the flora assemblage for the Maules Creek project area was described with quadrat sampling, random meander surveys and through targeted searches for threatened species. While these methods are consistent with DECC (2004) recommendations, there is no discussion as to site stratification for implementation of the identified methods.

iv. Quadrat sampling

The fourth element described by Cumberland Ecology (2011) related to the information gathered during quadrat surveys. The selection of quadrat locations is described as being targeted to 'areas most representative of the condition and composition of the vegetation patch'. It is uncertain as to whether the use of the term 'patch' in this instance refers to the definition in the listing advice (TSSC 2006).

Despite the erroneous conclusion in the EIA that the DEH (2006) flowchart recommends the implementation of 0.1 hectare quadrats, the information described as having been targeted would provide sufficient information to consistently and reliably describe the floristics, structure, condition and relative quality of the vegetation surveyed.

Fauna Survey Methods for Matters of NES

With reference to the scope of this review, the fauna survey methods described by Cumberland Ecology (2011) follow the recommendations of DEC (2004) and is based on stratification by broad vegetation types across 'box woodlands' and 'ironbark forests'

presumably following the classification of earlier studies on the Maules Creek project area and Leard State Forest in general. This is described as having been undertaken at a ratio of 2:1 across these stratification units presumably reflecting the relative composition of the project area with respect to these broad vegetation types.

Review of Table 2.3 (pp. 2.8-2.9) suggests that the following methods relevant to the species subject to this review were employed:

- Regent honeyeater and swift parrot:
  - Diurnal bird census; and
  - Area searches.
- South-eastern long-eared bat:
  - Harp trapping; and
  - Ultrasonic recording.

Despite this, the report is not entirely clear about the methods employed and survey effort applied. For example:

- Appendix F identifies that mist netting was also undertaken for bats over 26 nights, this is not mentioned in any other location in the report;
- Figure 2.2 identifies an additional 13 diurnal bird census locations not aligned to the '500m fauna survey grid'; and
- Figure 2.2 identifies 72 of the reported 81 locations for the '500m fauna survey grid' with the grid appearing to extend to the west of the map view presented.

Given the uncertainties in the discussion of methodologies, consideration of efforts with respect to fauna by this review is restricted to items where inconsistency between methods described in various parts of the report does not factor. For example, no further consideration is given to mist netting as this is not discussed either in terms of results, placement of survey sites, target species and who undertook the survey given a specific license is required for this work. Consideration is only given to methods that are described and for which corresponding results are discussed.

A further chapter (Ch. 2.3.4) discusses habitat assessment as another method employed that would be relevant to the fauna considered in this review. The EIA discusses the habitat assessment methodology for four broad habitat types of:

- Remnant woodland and open forest;
- Wetland;
- Riparian vegetation associated with minor tributaries and drainage lines; and
- Grassland.

These broad habitats were assessed as follows (p. 2.16):

> Habitat condition was assessed by noting ground, shrub/understorey and canopy cover, number and size of hollows present, habitat features such as bush rock and fallen trees, and signs of fauna usage such as scats and scratches.
>
> Fauna habitat assessments also included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the Project Boundary was undertaken and considered.

It is also noted that a specific assessment of hollows across the 81 points of the '500m fauna survey grid' was also undertaken. This assessment classified hollows according to apparent diameter and also included collection of data pertaining to the tree species, DBH (diameter at breast height) and total number of hollows per tree across a 1,000m^2 (20m x 50m) plot at each location. Results from this were used to calculate an estimate of hollows per hectare across the project area.

These methods as described for habitat assessment would have provided quantitative data on hollows but only qualitative information on other aspects of habitat. While this would allow for an assessment of relative quality of the area for the subject species at a basic level, comparative analysis would not be possible. Had alternate methods such as the BioBanking Assessment Methodology (DECC 2008) been implemented, biometric data relating to a range of habitat attributes would have been collected and provided the basis for a more detailed analysis. Despite the limitations of the BioBanking Assessment Methodology, the collection of field data is guided by a repeatable methodology that results in consistent empirical data, enabling comparison of different sites, even if collected by different observers.

Surveys of Offset Sites

Chapter 2.6 of the EIA describes a separate methodology for assessing potential offset sites commencing with a GIS assessment based on estimation of box – gum woodland (page 2.22). Datasets used in this estimation are not identified.

The second stage of the offset assessment methodology describes a preliminary method that as noted in the EIA would need to be supported by more detailed survey. The field assessment of offset sites is described as follows:

> Cumberland Ecology has to date conducted preliminary site inspections of over 300 properties between September 2010 and May 2011, in order to develop a short list of candidate properties for further consideration. The on ground survey has therefore been limited to making notes and conducting rapid assessments of the vegetation type and condition, to enable production of a preliminary vegetation map of the candidate properties.

This approach to the identification of offset sites should be suitable for the detection of box – gum woodland if interpretation of the listing advice was correct. However, this is unlikely to have been the case for the offset sites given the issues identified in relation to the Maules Creek project site and the assumed consistency (on behalf of the authors) in application to offset sites. It is noted in the EIA however that further detailed surveys of the properties likely to comprise the offset were imminent at the time of writing however the focus and methodologies for those surveys is not described.

Habitat within the offset sites was described by the recording of notes about observed features within the areas inspected in addition to desktop review of known occurrences of threatened species in the vicinity of the candidate sites. This method is non-systematic and on the description provided is likely to have resulted in the collection of qualitative information only.

3.2.3 Chapter 3 Results

Box – Gum Woodland

The results section presents an overview of general vegetation community characteristics and distribution within the project area in addition to very brief descriptions of the communities mapped. While several of the described vegetation communities are discussed as being consistent with the definition of box – gum woodland there is no analysis to identify the extent to which they are consistent, or any discussion of quality as might be determined by species richness, projected foliage cover, tree age classes and other ecological metrics. The results presented are not supported by evidence in the report collected during field surveys or through subsequent analysis.

As raised previously, interpretation of the minimum area over which the community occurs as a prescription for the need to undertake 1,000 m^2 quadrat surveys, in combination with a lack of consideration of the extent of the 'patch' as defined by TSSC (2006), has the potential to under estimate the extent of more disturbed examples of the community such as the derived native grasslands. This is demonstrated in Chapter 3.2.5 (p. 3.21) where it is stated:

> To be identified as Derived Native Grasslands, at least 12 native forbs with one being a recognised "important" species must be present within a 0.1 ha plot

This does not consider the extent of the 'patch' over which the criteria for meeting the community's description must be met concurrently with other criteria relating to other aspects defining the community's presence. The definition of the 'patch' does not specify requirements for species diversity but needs to be read in conjunction with other criteria that do. Separate consideration of this leads to a loss of context and subsequent misinterpretation of the listing advice.

Consideration of the updated flow chart presented by DECCW (2010) confirms that the intent of the 0.1 hectare minimum size inferred from the DEC (2006) flowchart was not to specify a survey method. Instead it was to expedite identification of the community if present by initiating the assessment in areas that appeared to support the highest ground layer vegetation diversity while being mindful that the community cannot be mapped as being present in discrete areas smaller than 0.1 hectares.

Fauna

Surveys undertaken by Cumberland Ecology (2011) were successful in detecting the presence of south-eastern long-eared bats from three locations within the project area as part of surveys undertaken in 2008 using harp traps (Appendix C, Table C.1).

While neither swift parrots nor regent honeyeaters were recorded it is acknowledged that the area does provide vegetation that could support these species including trees that flower during the cooler months. As the survey periods described in the EIA cover winter periods when both species tend to disperse it is probable that these species were not present in the area at that time. Due to the low numbers and or infrequent historical use of the area by these species it is unlikely that additional survey would have detected them within the timeframe of the project, particularly since none of the other contemporary reports referred to in the EIA identified either swift parrot or regent honeyeater as being present.

The results suggest that sufficient survey effort was employed to detect the target species and suggests that 1,665 hectares of potential habitat for the threatened birds and known habitat for the south-eastern long-eared bat would be directly impacted with a further 1,063 hectares being indirectly impacted (Table 4.3, pp.4.27-4.28). What the methods do not allow for is a quantitative assessment of population extent and density for the threatened species recorded.

The quality of habitat is discussed in general terms (Ch. 3.4) and results of the habitat assessment include discussion of findings regarding tree hollow frequency and other habitat attributes such as bush rock, fallen logs, canopy tree flowering periods, caves and so forth. From this it is inferred that the project area supports a diversity of habitats including structural and floristic diversity with the potential to support a wide range of fauna.

More detailed analysis of the implications of the habitat assessment with regard to the matters of NES considered in this review is not included in the EIA with only generalised discussion of habitat as suggested in Table 4.3 where the entire area is considered to be habitat. While non-site specific references are made to varying habitat quality (Ch. 4.2, p 4.8), habitat attributes in the discussion are averaged across the project area. This does not permit an adequate assessment of the value of the avoidance measures proposed (refer to Executive Summary, Ch. S5.1, p. S.6), staging of construction to minimise environmental impacts or detailed consideration of the impact of other aspects of the project.

3.2.4 Chapter 6 Biodiversity Offsetting

The introduction to Chapter 6 states that:

> The Offset Strategy has been devised to comply with the current principles for offsetting set out by SEWPAC (DEWR, 2007) and by OEH (DECC (NSW), 2008a).

Chapter 6.1 of the EIA introduces the internationally based Business and Biodiversity Offsets Programme (BBOP) indicating that the design concepts presented in that publication were also adopted in developing the proposed offset package.

The approach to designing the offset strategy therefore is described as considering a range of characteristics that covered landscape ecology principles in addition to land management optimisation. The approach to the offset strategy is also described as including consideration of the local and regional context of the project however the extent to which bioregional influences that may affect potential sites is not apparent as this factor is not raised in discussion of any of the proposed offset sites in subsequent sections of Chapter 6. Application of the NSW BioBanking Methodology (DECC 2008) would have highlighted a preference for offsets to be located within the same region (based on catchment management regions) as the proposed impact. Despite this, there is nothing in any of the documents referenced that prohibits the selection of sites in different regions from being used as offsets.

The EIA proposes an offset package comprising four elements. The eastern, western and 'shared' offset areas are all in relatively close proximity to the Maules Creek project impact site, Leard State Forest and Leard State Conservation Area, all within the Brigalow Belt South Biogeographic region. The northern offset area is located to the east of Mt Kaputar National Park and is situated in the Nandewar Biogeographic region. A cursory discussion of what is described as a 'broad indication of the types and proportion of various community types' of each proposed offset area is included in addition to noting that further baseline studies will be required as the assessment is based on 'site inspections and preliminary mapping'. Following which it is stated the intent of more detailed surveys would be (p. 6.8):

> ...to refine the vegetation maps, particularly with reference to delineating the various forms of Box Gum Woodland and Derived Grasslands (e.g. see Photographs 6.1-6.5) and to accurately differentiate between areas of high, moderate and low condition grasslands.

This approach is considered reasonable and would indicate that the offset package as proposed was only at an early stage of development and subject to further confirmation.

The proposed offset sites are also described in terms of fauna habitat with general statements of a consistent nature to those presented for the Maules Creek project area. This is accompanied by tables summarising habitats for each species across each offset site. The discussion of habitat on the eastern and western sites presumes the presence of habitat for fauna assemblages present in Leard State Forest and Leard State Conservation Area but also notes that further surveys were imminent for these properties. While it is noted that the northern offset area is described as follows (p. 6.19):

> Within the Northern Offsets, there are extensive areas of well connected forest and woodland that provide good quality habitat for a wide variety of species, potentially including species that are not found in Leard State Forest, such as the nationally endangered Spotted Tailed Quoll, Swift Parrot and Regent Honeyeater (Table 6.4). The Northern Offset Properties also contain four permanent streams, including the Horton River and the upper reaches of Maules Creek (Photograph 6.6), which are valuable resources for many faunal species. The Northern Offset properties are also located in the Barraba area, a known habitat area for Regent Honeyeater and have habitat that appears highly suitable for this species.

Similarly to the assessment of vegetation, the descriptions of fauna habitat in the offset areas suggest an early stage of assessment. This conclusion is supported by the qualitative nature of methods and the limited discussion of implementation or an attempt to target requirements of any given taxa.

Additional to Chapter 6 is information presented in Appendix J to the EIA. This summarises box gum woodland condition and habitat for the listed fauna considered in this review in relation to 16 properties that were assessed in the course of the project. With respect to box – gum woodland, three condition classes are defined including areas not included in the EPBC listing (class A), patches of more than 0.1 hectares with more than 12 species (class B) and patches of more than 2 hectares with at least 20 mature trees per hectare.

How the figures in Appendix J for box – gum woodland were derived from the methods as described is not clear. In addition to this, the condition classes do not completely correspond to the descriptions in the listing advice (TSSC 2006) and hence it is unclear how the criteria have been applied, particularly since it appears that derived grasslands have been included with the woodland form of the community in ‘class B’.

3.3 NWES (2013)

3.3.1 Overview

The submission by North West Ecological Services to the Minister for the Environment, comprises a summary report with eight appendices that provide a range of information including but not limited to the opinion of experts with respect to certain ecological matters, reports on specific issues, records of site inspections, photographs and correspondence. It is presented as a review of the EA and in particular findings of the Cumberland Ecology (2011) report. In addition to conducting a review of the ecological report included as part of the EA, the submission also details the findings of site inspections. Much of this report is written as a

commentary as opposed to a structured review and presents opinion, published facts and excerpts from the appendices.

Criticism relating to the Cumberland Ecology (2011) vegetation surveys on the impact site relate primarily to the lack of consideration of the EPBC Act listed endangered species, *Tylophora linearis* which is discussed by NWES (2013) as having been found within Leard State Forest. The majority of concerns raised by NWES (2013) focus on the mapping and condition assessments undertaken on the proposed offset sites although do note some concern about lack of 'recognition of the high habitat value per hectare of the box woodland in Leard State Forest to the EPBC listed species and community' (p.7).

3.3.2 Methods

The NEWS (2013) main report presents no discussion on methods employed in undertaking any site inspections. Despite this, there is a brief review of the application of the criteria for identification of box – gum woodland (p.8) under a discussion titled 'The EPBC Definition States'. This section of the NWES (2013) report gives an insight to the interpretation and basis for vegetation community classification as undertaken during the inspections described in the report and associated appendices. Although unreferenced in the NWES (2013) report, the criteria considered are taken from Section 2 of the listing advice for the community (TSSC 2006). A review of the interpretation and comments by NWES (2013) against the listing advice general description of the community is presented in **Table 3.1**. Also included is a comment in response as part of this review in consideration of the extent to which the interpretation is consistent with the listing advice.

Table 3.1 – Application of Box – Gum Woodland General Description by NWES (2013)

Item	Criteria (TSSC 2006)	NWES (2013) Response (p.8)	Comment in Review
1	Box-gum grassy woodland tree-cover is generally discontinuous and consists of widely-spaced trees of medium height in which the canopies are clearly separated (Yates & Hobbs 1997).	Extensive areas of Wirradale and Mt Lindsey mapped as White box – Stringybark grassy woodland have open forest canopies with canopies clearly touching	The key elements of the criteria relate to community structure and the spacing of trees. It is also noted that this is the *general* state of the community indicating that in some exceptions, canopy separation may be less than that found in typical woodland communities. This is supported by the inclusion of several forest types in Section 5 of the listing advice relating to examples of the listed community occurring in Queensland, south eastern NSW and Victoria. It should be concluded that in line with the listing advice, a clearly separated canopy is the typical form and occurs in most cases where the listed community is present. Exceptions are noted however this should also account for circumstances where post disturbance regeneration has resulted in a greater density of younger trees that may take on more of a forest form.
2	a ground layer dominated by tussock grasses	Extensive areas mapped as woodland have litter dominated ground cover	The listing advice states that 'a remnant with a significant ground layer of tussock grasses, and where the distribution of shrubs is scattered or patchy, is part of the ecological community'. Notwithstanding this, allowance should be made to account for the influences of recent climatic conditions, fire, grazing and past disturbance in modifying canopy cover and subsequently affecting the ground layer vegetation cover. Consideration should be given to factors that have influenced the apparent condition in determining whether to include an area as part of the listed community.
3	an overstorey dominated or co-dominated by White Box, Yellow Box or Blakely's Red Gum, or Grey Box in the Nandewar bioregion	Extensive areas mapped as White box woodland don't have any White box and are dominated by Stringybark or Apple box with sub dominant Yellow box or Blakely's Red gum	This requirement specifies that any one of the identified diagnostic canopy species should be the dominant species, present as a greater proportion of the total tree component to any other canopy species. Alternately, a combination of these species can also indicate presence of the community if they occur as co-dominants to each other, but must still comprise a greater proportion than other canopy trees including any of the listed associated species.
4	a sparse or patchy shrub layer	Extensive areas mapped as White box woodland have continuous shrub layers 1 – 2.5 m tall	The issue of shrubbiness is discussed at the end of Section 2 in the listing advice which notes 'a remnant with a continuous shrub layer, in which the shrub cover is greater than 30%, is considered to be a shrubby woodland and so is not part of the listed ecological community'. It is also noted that 'shrub cover should ... be assessed over the entire remnant, not just in a localised area'. The listing advice provides no conditions as to the height of shrubs however does provide a list of shrub species associated with the community.

It is apparent from **Table 3.1** that NWES (2013) have interpreted the general description of the community in a literal manner that appears to be consistent with the listing advice.

Appendix A

Appendix A considers the 'Wirradale' and 'Mt Lindesay' proposed offset properties and describes methods as including:

> Two days were spent inspecting the vegetation of the two properties...

and

> The field assesmment [sic.] targeted six areas mapped as White Box – Stringybark grassy woodland occuring [sic.] at elevations above 930 metres...

and

> The vegetation at thirty one sites was recorded according to the critical factors that determine potential CEEC. Those sites were GPS recorded...

Beyond these references there is no discussion as to how data was collected or how criteria relevant to the identification of box – gum woodland were considered. Notwithstanding this, tabulated data and comments in Table 1 of Appendix A identify a number of characteristics as having been recorded at specific locations, identified by unique number and GPS coordinates.

Discussion is included in this document correlating vegetation considered in the study to the state-wide Keith classes of vegetation. The comparison included consideration of the vegetation in Leard State Forest in comparison to that which occurs in the offset sites assessed.

NWES (2013) refer to having recorded south-eastern long-eared bat in Leard State Forest (p. 13) on 18 December 2012 however no details are provided as to what surveys were undertaken or other information to assess the limitations or potential benefits of the surveys.

Appendix B

Appendix B of the NWES (2013) report presents a series of commentaries representing the opinions of a range of people and organisations relating to a wide range of factors relevant to the EA. This Appendix provides information that is beyond the scope of this review to consider.

Appendix C

Appendix C presents information gathered in field inspections of the eastern and western offset properties and presents numerous photographs accompanied by brief statements on the apparent vegetation depicted. The appendix responds to information presented in the 'Maules Creek Biodiversity Offset Management Plan', a source document not part of this review. Regardless, there is no discussion as to methods applied in conducting the inspections.

Appendix D

Appendix D presents information relevant to the 'Kelso' proposed offset property in a similar format to the preceding Appendix C. There is no discussion as to methods applied in conducting the inspections.

Appendix E

Appendix E presents a discussion on research into the impact of noise on fauna and also includes the opinion of selected experts in fauna survey and assessment. This discussion also includes reference to potential implications for use of the area by the fauna species subject to this review.

Tabulated data is also presented describing the timing, location, climatic conditions and comments for each entry relating to sound recordings made in Leard State Forest in early January 2013. There is no context provided to this data, equipment used or information on how it has been applied with the exception of a brief, unreferenced comment under Chapter 2.0 (p.23) of the NWES (2013) main report in discussion of noise pollution.

Appendix F

Appendix F discusses the impacts of artificial light on forest ecosystems and includes a literature review and comments from selected experts. Impacts to the threatened fauna subject to this review are raised followed by a collection of unstructured and selected statements from a number of references in relation to lighting impacts on fauna.

There are no field studies apparently associated with this appendix and accordingly, no methods presented.

Appendix G

Appendix G is a review of the Boggabri Coal offset proposal and a field assessment of offsets east of Leard State Forest. This document is beyond the scope of the current review.

3.3.3 Results

Despite the lack of explicit methods, from the information presented in appendices of brief site inspections, a general appreciation of the extant vegetation would have been possible. Since the listing advice (TSSC 2006) or the policy statement and associated flow chart (DEH 2006) do not prescribe a survey methodology, brief site inspections should be sufficient to give a general indication of the presence of the listed community based on dominant species and structure, but would not be suitable for providing a description of community floristics, species richness and relative quality, or the community's condition in accordance with Section 4 of the listing advice.

The report by NWES (2013) provides a sound basis for identification of box – gum woodland however results would be considered anecdotal given the lack of detail relating to methods. As suggested in the report and also by Cumberland Ecology (2011), detailed surveys of the offset sites are required to verify the presence of box – gum woodland, its condition in addition to the presence and quality of habitat for the listed threatened species. From the report, it appears that the same level of investigation undertaken for the offset sites was not invested into the Maules Creek project area and no comparison can be drawn between the findings of the EA and those of NWES (2013). In this regard, the NWES (2013) report cannot assess adequacy of the quantity of proposed offsets in relation to the impact, however presents sufficient information to comment on the accuracy of the box – gum woodland identification within the offset areas with respect to the listing advice.

The bat survey reported by NWES (2013) correlates vegetation communities in which the species was recorded within Leard State Forest with the species' presence and predicts

which areas are preferred habitats. Despite this, there is little or no empirical evidence in the report to support the conclusions.

3.4 Greenloaning Biostudies (2013)

Greenloaning Biostudies (GB 2013) 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 project. The review was required as part of the Commonwealth approval conditions, which also determined the scope of the review. The report incorporated new information that was not available to the EIA and also refers to the submission by NWES (2013) in discussing certain aspects of the findings.

3.4.1 Approach to Assessment

Chapter 2.1 of the report summarises the key elements of the work that were undertaken, this is further expanded upon in the subsequent chapters describing the detail of each component. With reference to the scope of the current review, only those elements relevant to the methods employed are discussed further however the overall approach is logical, clear and transparent.

Central to the issue of box-gum woodland and habitat for the listed fauna, is the approach taken to identification of the listed community and other assessment as described in Chapter 2.3.1 of the report. This is considered in the following sections.

Box – Gum Woodland

The listing advice (TSSC 2006) is cited in the report and extracts are reproduced summarising the appearance of the community. The report confirms that the community can exist in the absence of the tree component as derived grassland before entering a discussion on the issue of canopy species dominance. Through a series of statements generally reflecting the language used in the listing advice, it is concluded in the report (p. 2.4) that:

> ...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.

This is an interpretation consistent with the listing advice and is also consistent with the understanding of NWES (2011). The report continues to summarise the listing advice and is generally consistent, despite what is assumed to be a typographic error in relation to the altitudinal range (p. 2.4). The report also does not acknowledge that in the Nandewar bioregion, grey box (*Eucalyptus microcarpa* or *E. moluccana*) is also considered a diagnostic canopy species. This latter point is relevant to consider given that the proposed northern offset is within the Nandewar bioregion.

Fauna Habitat

A brief outline of the key features of habitat for the three species of concern to this review are also summarised and provide a reference for identification of suitable features during field surveys.

3.4.2 Methods

Preliminary site inspections and desktop reviews were undertaken of a range of datasets including among others, information presented in Cumberland Ecology (2011) plot data, topographic maps and aerial photography available on Google Earth. These desktop

analyses were intended to provide an initial understanding of the extent to which the EIA represented vegetation on the ground. This was followed by more extensive field survey.

In addition to desktop methods, GB (2013) describe several methods used in the field for review of vegetation including:

> 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).

Subsequent description of the data collected under each method provides a clear understanding of the nature of information that was generated through these surveys. The surveys were conducted on the Maules Creek project area in addition to proposed offset sites however there is no indication of any stratification process in site selection. This is assumed to be a function of the report's objective in testing the findings of Cumberland Ecology (2011).

3.4.3 Results and Assessment

The results and assessment in the report are supported by summarised data presented in several appendices relating to the occurrence of box – gum woodland and fauna habitat values. The level of information provided correlates with the detail discussed in the methodology section.

Box – Gum Woodland

Discussion of the results describes a number of variations from the results of the surveys conducted by Cumberland Ecology (2011) but also largely support the original findings. Changes to the vegetation community classification both within the Maules Creek project area and the northern offset are proposed with an accompanying additional offset to replace vegetation considered to be inconsistent with the listing of box – gum woodland. Reference is also made to the Namoi Catchment Management Area biometric vegetation types for regional comparisons.

Despite this, there appears to be a broad interpretation of the issue of dominance and co-dominance in the canopy in addition to the extent to which forest communities should be accepted as part of the listed box – gum woodland (p. 3.7). Without field data to review it is not possible to identify whether there are any inconsistencies in the way these aspects of the listing advice have been applied. However, an area mapped as the box – gum woodland community should be dominated by the diagnostic canopy species and principally of a woodland form, or likely to have met this criterion if now in the derived woodland form. In addition to other criteria determining patch size, lower strata composition and cover as well as ground layer composition and floristics, this is the intent of the description in Section 2 of the listing advice (TSSC 2006).

While the listing advice allows for co-dominance by identified associated species, the circumstances where this occurs should be the exception and not the rule as indicated by the use of the term 'occasionally co-dominant'. This allows for variations to the composition of the canopy as a result of localised effects. Similarly, consideration of the crown separation and community structure should recognise that the forest form is typically not part of the listed box – gum woodland community; it is the exception as opposed to the rule as indicated by the term 'generally'.

While the methodology described in the report is unambiguous and based on a correct interpretation of the listing advice, the latitude given in application of the methodology, allowing for the inclusion of otherwise marginally compliant communities in the definition of what comprises box – gum woodland is not clear. The principle issue here is whether communities that are regularly co-dominated by the associated species are being included in the mapped extent of box – gum woodland. In such circumstances, these vegetation communities would not be consistent with the listing advice that establishes co-dominance by species other than the diagnostic canopy species is generally not indicative of the listed community. Although allowance needs to be made for localised variation in dominance, where the non diagnostic species form a consistently co-dominant component of the canopy, this represents another vegetation community that cannot be included in the box – gum woodland definition.

Similarly, while the conditions determining the extent of a 'patch' are correctly summarised, the extent to which this has been applied is also not clear, particularly where derived grassland variants of the community are determined to be consistent with the listing advice or otherwise.

The report also responds to the issues raised by NWES (2013) with regard to box – gum woodland identification identifying the reasons for inclusion of certain areas and explaining inclusion of areas as mapped by Cumberland Ecology (2011). As summarised, the primary reasons for differences as explained by GB (2013) are the result of (p. 3.7):

- 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.

Although the report includes an earlier discussion of how the listing advice was interpreted in undertaking the work, how the criteria above have been applied is not clear, particularly in relation to the second, third and fourth items. As previously noted, there is concern about the extent to which the community is defined as being present when diagnostic species are consistently co-dominant. Equally, circumstances where the presence of 'regeneration' has been used as the deciding factor in identifying the listed community are not clarified, nor are the criteria used for determining the original species composition in the canopy to conclude that the diagnostic species were previously dominant.

These points in addition to the extent to which a broad interpretation of the listing advice has been applied are the likely cause of differences of opinion, or at least in interpretation of the listing advice between the various reports considered in this review. Points of difference between the four reports comprising the scope of this review are summarised in **Section 4**.

Threatened Fauna

The habitat assessments for threatened fauna present a detailed discussion of habitat values and generally reflect the nature of information collected. Given the greater level of detail presented in the GB (2013) report as compared to the Cumberland Ecology (2011) report with regard to fauna habitat, the results should be considered as likely to be more reliable and descriptive of habitat characteristics, at least for those variables recorded.

Notwithstanding this, the assessments of significance should give due consideration to the role that stepping-stone habitats play in providing connectivity in fragmented landscapes. Methods for assessing impacts of the proposal, temporally and spatially as a result of the Maules Creek project are reliant on other habitat in the Leard State Conservation Area and surrounding lands remaining in situ and also being suitable. This includes a number of assumptions regarding habitat suitability and quality that are not supported by empirical evidence with the exception of what is discussed in relation to the proposed offset sites.

For species whose movement relies on landscape connectivity on a regional scale, a corresponding scale for analysis to support the assessment must also be undertaken.

3.5 Hewlett Hunter (2014)

The Hewlett Hunter (2014) report prepared by Dr John Hunter presents what is described as a preliminary overview of assessment of the 'Wirradale' and 'Mt Lindesay' offset sites undertaken by North West Ecological Services in early January of 2013. It is understood the NWES study cited in this report is the document that forms Appendix A to the NWES (2013) report considered in **Section 3.3** of this review. The report also considers an investigation conducted by The Envirofactor (cited as Hawes, 2013) which included investigation of a further 13 sites in addition to the 30 considered by NWES.

3.5.1 Methods

The field methodology of Hewlett Hunter (2013) is described as consisting of (p. 2) meandering transects, with a total of 80 'rapid data points' placed approximately every 300 metres. In addition to photographs taken from the cardinal points of the compass, data collected at each point included (p. 3):

> ...at least the three dominant flora species in each definable stratum; if that many occurred. These species were scored individually for their percentage cover and the total cover of each stratum was also recorded.

The findings of this study were combined with the data from the NWES and Envirofactor studies to produce 125 data points throughout the areas assessed in order to compare to mapping by Cumberland Ecology (2011). It is also noted that the three studies that inform the report should be regarded as preliminary and do not provide full floristic information on the areas considered.

This report does not consider fauna habitat.

3.5.2 Results

The approach taken in this report to interpretation of the criteria for identification of box – gum woodland is not explicitly described; however Appendix C includes a copy of the identification flowchart from DEH (2006) and selected text which appears to be derived from the listing advice (TSSC 2006).

Hewlett Hunter (2013) report a very low level of correlation with the mapping by Cumberland Ecology (2013) particularly in relation to the identification of box – gum woodland as listed. The primary issues raised by Hewlett Hunter (2014) with regard to identification of the community by Cumberland Ecology (2011) include:

- Canopy species dominance; and
- Extent of shrubs in the understorey.

While the approach of Hewlett Hunter (2014) allows for identification of the community and a general prediction of potential distribution of box – gum woodland, the inspections described provide insufficient information to allow for a quantitative assessment of quality and extent.

4.0 Summarised Assessment

The review undertaken of the documents considered the Commonwealth listing advice (TSSC 2006), the EPBC Act Policy Statement 3.5 (DEH 2006), the species list accompanying DEH (2006) and the advice on hybrids in the listed community (TSSC 2011). At no point in the review was the issue of hybrids raised, accordingly there is no further comment in relation to that reference. However, the following points summarise findings and key considerations relating to the scope of work. These are elaborated further in the summary **Tables 4.1** and **4.2**.

Hansen Bailey (2011)

- Reproduces findings presented in Cumberland Ecology (2011).

Cumberland Ecology (2011)

- Used NSW State guidelines recommended for undertaking ecological surveys (DECC 2004):
  - Limited or absent detail concerning implementation and data collected;
  - Applied to Maules Creek project area only and not the proposed offset sites;
  - Other less detailed, preliminary surveys undertaken on offset areas.
- Used policy statement (DEH 2006) for identification of box – gum woodland:
  - Limitations in the interpretation potentially resulting in under or over estimation of the extent of the community;
  - Uncertainty regarding application of criteria due to lack of reference to listing advice.
- Implemented a predominantly qualitative method for habitat assessment however with selected quantitative components (e.g. tree hollow and koala habitat assessment):
  - Limited or absent detail for both impact and offset sites.
- Primary source for Hansen Bailey (2011) with regard to ecological matters relevant to the Maules Creek Coal Project.

North West Ecological Services (2013)

- Use of listing advice for identification of box – gum woodland:
  - Describe limitations in Cumberland Ecology (2011) mapping with respect to offset areas described as being box – gum woodland with reference to listing advice criteria;
  - Literal interpretation of listing advice.
- High-level site inspection methods with little detail on site selection, conducted as spot-check of Cumberland Ecology vegetation community mapping on offset sites only;
- Observational assessment of habitat values only.

Greenloaning Biostudies (2013)

- Detailed description of field survey methods, designed for the purpose of reviewing findings of Cumberland Ecology (2011):
  - Considered Maules Creek project area and offset areas equally in application of methods;
  - Quantitative methods applied for vegetation and habitat assessment surveys.
- Refers to listing advice for identification of box – gum woodland and provides a detailed discussion explaining interpretation:
  - Broad interpretation of aspects of the listing advice likely to result in the inclusion or omission of areas in a manner that is not consistent with the box – gum woodland community definition;
  - Responds to NWES (2013) submission comments regarding the apparent inconsistency in mapping in the EIA and extant vegetation.
- Generally supports vegetation mapping by Cumberland Ecology (2011) with only limited discrepancies reported in the Maules Creek project area. These discrepancies were not considered to have increased the extent of box – gum woodland as originally mapped however suggests the opposite (Section 3.3.1, p. 3.5);
- Identifies limitations with Cumberland Ecology (2011) vegetation mapping of proposed offset sites in particular with eastern and northern offset areas:
  - Proposes additional properties for inclusion in the offset package to compensate for box – gum woodland in lieu of areas found to not be consistent with the interpretation of box – gum woodland adopted for the report.
- Structured and quantified fauna habitat assessments on the Maules Creek project area and proposed offset sites.

Hewlett Hunter (2014)

- Methods used are described with data tables in an appendix identifying the range of characteristics recorded. Methodology provides detail on limited aspects of the community and is described as being preliminary;
- Identification refers to the criteria described by the listing advice (TSSC 2006);
- Reaches conclusions consistent with NWES (2013):
  - Describe limitations in Cumberland Ecology (2011) mapping with respect to offset areas described as being box – gum woodland with reference to listing advice criteria;
  - Literal interpretation of listing advice.
- Does not assess Maules Creek project area;
- Does not assess fauna habitat.

The scope of this review in part, was to consider each of the sources and their ability to identify and accurately predict the quantity and condition class of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands ecological community

(as per the EPBC Act listing). Following the summary of key findings above, the following **Table 4.1** presents a response to each of the criteria comprising the scope.

The other component of the scope for this review was to consider each of the sources and their ability to identify and accurately predict the quality and quantity of habitat for the Regent Honeyeater, Swift Parrot and South-eastern Long-eared Bat. **Table 4.2** presents a response to these aspects.

In these comparison tables it is reasonably assumed that all surveyors involved in their respective surveys are competent and have the ability to accurately identify diagnostic flora associated with box – gum woodland and in the assessment of habitat for fauna.

Table 4.1 - Comparative Assessment of Box – Gum Woodland

Source	Ability to identify	Ability to accurately predict quantity and condition
Hansen Bailey (2011)	This report presents a summary of Cumberland Ecology (2011) and does not undertake further assessment in order to identify the extent of the community. The ability of this report to identify and accurately predict the quantity and condition of box – gum woodland is directly related to the performance of Cumberland Ecology (2011) in this regard.	
Cumberland Ecology (2011)	This report states that the results published by PB (2010) were incorporated into the assessment, however there is no discussion as to the level of acceptance or any inconsistencies despite vegetation mapping between the two projects not aligning. This report does not use the listing advice for identification of the listed community, relying instead on the policy advice document (DEH 2006) which is prepared as a guide for land owners and not a technical guide for practitioners. Despite this, the report cites methods that should result in the collection of information that would allow for identification of the listed community. This however is limited by the interpretation of identification guidelines. For those aspects of the interpretation which are clarified in the report, it is possible that areas of derived grassland and other lower quality examples of the community are not identified or included in the extent of the 'patch'. Other elements of the interpretation such as canopy dominance of diagnostic and associated species, extent of shrubbiness and proportion of perennial cover are not explicitly discussed and accordingly, objective comment in regard to these aspects is not possible. There is a reasonable likelihood that the interpretation adopted in this report would have led to an under or over estimation of the presence of box – gum woodland on the project area and offset sites.	Cumberland Ecology (2011) describes different methods for assessing vegetation communities on the project site as opposed to the proposed offset sites[5]. Accordingly, subject to the ability to identify the listed community, given the methods applied on the Maules Creek project area, the ability to accurately predict the quantity and condition of box – gum woodland should have been high. The lower level of survey effort applied to offset sites would be accompanied by a correspondingly lower ability to accurately predict quantity and condition of box – gum woodland. This again would have been affected by the ability to identify the community in the first instance. High resolution satellite imagery of the project area would also have allowed for visual prediction of vegetation communities within the project area in a desktop exercise that could be verified in field survey. The ability to accurately predict the quantity of the listed community on the offset sites would have been limited to some extent by the quality of imagery, which is unknown as this is not specified in the report. Similarly, the preliminary nature of the methods employed on the offset sites would not have permitted a high level of accuracy in prediction of the quantity and condition of the listed community. This is highlighted by the report in noting that more detailed surveys are required.
North West Ecological Services (2013)	This report uses a literal interpretation of the listing advice. While methods employed were not detailed, a concise understanding of the characteristics of the listed community	The preliminary nature of the site inspections would have only given a cursory understanding of the extent of the listed community. This is similarly the case for its ability to predict

[5] It is understood that the Biodiversity Offset Management Plan (BOMP) as referred to by Greenloaning Biostudies (2013) includes details of methods employed in gathering additional data to support the proposed management actions. Despite this the BOMP is beyond the scope of this review and hence is not considered.

Source	Ability to identify	Ability to accurately predict quantity and condition
	combined with the methods applied would have enhanced ability to identify the listed community.	condition of the community which would be based on subjective observations.
Greenloaning Biostudies (2013)	This report implements survey methods that target identification of box – gum woodland on both the Maules Creek project area and the proposed offset sites and accordingly the ability to collect data to enable identification of the community is high. Reference to the listing advice also enhances ability to identify the community however broad interpretation of the listing advice may have resulted in identification of areas that under a more literal interpretation of the listing advice would not have been included or alternatively excluded. Depending on the circumstances in different locations where the interpretation was applied, this may have led to an under or over estimation of the community's extent.	Data collected for this report included a range of factors that would have allowed for a relatively detailed assessment of condition. While desktop reviews of a range of data sets also included review of aerial photography, the resolution of imagery available through Google Earth for this location is sufficiently detailed to allow recognition of broad scale patterns in the vegetation in addition to an understanding of topography. Subject to the interpretation of identification guidelines, this report should have a reasonably high ability to also accurately predict the quantity of box – gum woodland in the project area and offset sites.
Hewlett Hunter (2014)	Similarly to NWES (2013), this report adopts a literal interpretation of the listed community through reference to the listing advice (TSSC 2066), although also considers the flowchart presented in DEH (2006). Survey methods were designed to be rapid and were designed to produce a preliminary assessment of the presence of the listed community. This approach would have the ability to identify presence of box – gum woodland.	As for the NWES (2013) report, given the preliminary nature of the site inspections this would have only given a cursory understanding of the extent of the listed community. This is similarly the case for its ability to predict condition of the community which would be based on subjective observations.

Table 4.2- Comparative Assessment of Threatened Fauna Habitat Assessments

Source	Ability to identify habitat	Ability to accurately predict quality and quantity of habitat
Hansen Bailey (2011)	This report presents a summary of Cumberland Ecology (2011) and does not undertake further assessment in order to identify the extent of the community. The ability of this report to identify and accurately predict the quality and quantity of habitat for regent honeyeater, swift parrot and south-eastern long-eared bat is directly related to the performance of Cumberland Ecology (2011) in this regard.	
Cumberland Ecology (2011)	This report described habitat assessments based on findings of vegetation surveys and a quantitative assessment of tree	As with the information gathered for identification of habitat, the report included approaches to assessment including desktop

Source	Ability to identify habitat	Ability to accurately predict quality and quantity of habitat
	hollows across the Maules Creek project area. This would have provided sufficient information to identify habitat suitable for south-eastern long-eared bat. In addition to this, positive identification of the species during 2008 fauna surveys would have allowed for a correlation of vegetation surveys results with the characteristics of locations where the species was recorded. Habitat assessment for regent honeyeater and swift parrot also relied on the findings of vegetation surveys in addition to qualitative records of observations made while traversing the project area. The report also references literature providing a general description of the habitat requirements and life-cycle of these species. Given this, sufficient information was gathered to enable a reliable identification of generally suitable habitat.	assessment of aerial imagery, field verification of vegetation condition and floristics that would have provided the author with sufficient information to accurately predict the quality and quantity of habitat for all species within the project area. This was also supported by field surveys targeting bats and birds. These surveys would have provided information on species assemblage and guilds that may be used in consideration of other species that may occur but were not detected during surveys. Despite this, the preliminary nature of assessments undertaken on the proposed offset sites is likely to have limited the accuracy of this to some extent for these sites. The lack of fauna surveys or any quantitative assessment of habitat characteristics would not have allowed for a similar level of accuracy as could have been achieved on the project area.
North West Ecological Services (2013)	NWES (2013) focus on the offset sites and do not assess habitat on the project area. Despite this, the report includes records of consultations with expert zoologists with specialisations in micro-bats and ornithology. This combined with the site inspections of offset site would have provided sufficient information to accurately identify potentially suitable habitat for the species considered.	The report relies primarily on the findings of vegetation surveys of the offset sites and advice from the various experts consulted. Predictions of habitat quality and quantity are limited to generalised discussions concerning what was observed and subsequently implied about habitat extent and suitability. This report has a low ability to accurately predict the quality and quantity of habitat on the offset sites given the relatively subjective nature of the discussion.
Greenloaning Biostudies (2013)	This report included structured, quantitative surveys of the Maules Creek project area and offset sites, collecting a range of data relating to various habitat attributes. This information in addition to the literature review and vegetation survey data collected would have provided data of a consistent quality and allow an accurate identification of potentially suitable habitat for all species considered.	Accurate prediction of the quantity and quality of habitat relies heavily on the results of vegetation surveys combined with the habitat assessments. Given the information available to this assessment, ability to accurately predict habitat quality and quantity for all species should have been relatively high.
Hewlett Hunter (2014)	This report considers vegetation communities only and does not consider fauna habitat.	

5.0 Conclusions

Review of the reports provided to Umwelt resulted in two general positions being established. The Cumberland Ecology (2011) and Greenloaning Biostudies (2013) reports generally concur about the extent and quality of habitat for threatened fauna and the distribution of box – gum woodland. Despite this, some amendments to mapping were recommended by the latter study (refer to Appendix F in that report). These studies considered there to be extensive areas of habitat for all matters of NES considered by the current review both within the project area and within the offset sites.

Contradicting these studies, the North West Ecological Services (2013) and Hewlett Hunter (2014) reports which focus primarily on the proposed offsets conclude a much reduced area of box – gum woodland in addition to areas that would be suitable to the threatened fauna.

In terms of the methods of assessment, a major point of difference between the reports related to the identification of box – gum woodland and interpretation of the criteria set out by the listing advice (TSSC 2006). The literal interpretations of NWES (2013) and Hewlett Hunter (2014) resulted in substantially fewer areas being considered box – gum woodland and hence also habitat for regent honeyeater and swift parrot. Points of difference for the potential of offset sites to meet habitat requirements of south-eastern long-eared bats were primarily the function of altitudinal limits to distribution cited by NWES (2013) as supported by various expert opinions in addition to limitations in habitat quality for other aspects of the species' life cycle, such as hollow availability within the offset areas.

Each report presents information that would allow for a reasonable assessment of the listed matters relevant to the level of detail collected. Notwithstanding omissions, inconsistencies and limitations to reporting comprehensiveness, some of which are identified by this review, on the assumption that the authors of the respective reports are competent ecologists, there is no reason to doubt the accuracy of the findings as described. The apparent accuracy issues relate to differing interpretations of the box – gum woodland listing advice and thresholds for significance in undertaking assessment of impacts.

Resolution of the approach to identification of box – gum woodland would resolve the majority of points of difference between the reports. While allowance should be made for stochastic events and localised or temporal disturbances, interpretation of the listing advice should closely follow the intent of the language used. This would ensure that areas considered to be box – gum woodland are generally of a woodland form dominated by the diagnostic species, but occasionally with other associated species being co-dominant.

In order to verify the manner in which the listing advice has been interpreted, data representing key aspects of the community's identification should be provided in ecological assessments. This should include data representing the proportion of each canopy tree species at points or plots assessed in addition to other metrics corresponding to the listing advice (TSSC 2006) and the box – gum woodland species list (DEH 2006).

In summary, the identification of box – gum woodland must follow the listing advice (TSSC 2006), as supported by the policy (DEH 2006), and not the reverse. Persons preparing reports that seek to implement these documents for the identification of listed communities should stipulate how potentially ambiguous criteria have been addressed including the presentation of quantitative data describing community floristics, structure and vegetative cover within each stratum. This would ensure transparent reporting of the approach to assessment and enable a clear understanding of the influence of co-dominant species and other key criteria can be understood by a third party. This is important both for assessment purposes and also in permitting others to replicate field surveys and analysis where necessary. This level of detail or transparency is not apparent in any of the reports reviewed.

6.0 References

Cumberland Ecology (2011) *Maules Creek Coal Project Ecological Assessment*, prepared by David Robertson for Hansen Bailey (July 2011)

DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)*, Department of Environment and Conservation (NSW) (November 2004), accessed online (17-3-2014) http://www.environment.nsw.gov.au/surveys/BiodiversitySurveyGuidelinesDraft.htm

DECC (2008) *BioBanking Assessment Methodology*, NSW Department of Environment and Climate Change, Sydney (July 2008), accessed online (17-3-2014) http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm

DECCW (2010) *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney (May 2011) accessed online (17-3-2014) http://www.environment.gov.au/resource/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national

DEH (2006) *EPBC Act policy statement 3.5: White box – yellow box – Blakely's red gum grassy woodlands and derived native grasslands*, Department of the Environment and Heritage, accessed online (17-3-2014) http://www.environment.gov.au/resource/white-box-yellow-box-blakelys-red-gum-grassy-woodlands-and-derived-native-grasslands

DEWHA (2010a) *Survey Guidelines for Australia's Threatened Birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*, accessed online (17-3-2014) http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-birds-guidelines-detecting-birds-listed-threatened

DEWHA (2010b) *Survey Guidelines for Australia's Threatened bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*, accessed online (17-3-2014) http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-bats-guidelines-detecting-bats-listed-threatened

Greenloaning Biostudies Pty Ltd (2013) *Independent Peer Review of Offsets for the Maules Creek Mine Project – EPBC 2010/5566*, prepared by Alison Martin for Whitehaven Coal Pty Ltd (December 2013)

Hansen Bailey (2011) *Maules Creek Coal Project Environmental Assessment*, prepared by James Bailey for Aston Coal 2 Pty Limited (July 2011)

Hewlett Hunter Pty Ltd (2014) *Preliminary Overview of Independent Assessments of Wirradale & Mt Lindesay Offset Mapping: Updated amended version with additional survey sites*, prepared by Dr John T. Hunter for North West Ecological Services (March 2014)

NWES (2013) *Submission to Tony Burke re the EPBC assessment of Maules Creek and Boggabri Coal mine developments*, prepared by North West Ecological Services on behalf of the Maules Creek Community Council and the Northern Inland Council for the Environment (January 2013)

PB (2010) *Continuation of Boggabri Coal Mine- Biodiversity Impact Assessment*. Parsons Brinckerhoff Australia Pty Ltd, Newcastle.

TSSC (2006) *Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, listing advice prepared by the Threatened Species Scientific Committee, accessed online (17-3-2014) http://www.environment.gov.au/node/14495

TSSC (2011) *Advice on the presence of hybrids in listed ecological communities*, accessed online (17-3-2014) http://www.environment.gov.au/resource/advice-presence-hybrids-listed-ecological-communities

Canberra

PO Box 6135
56 Bluebell Street
O'Connor ACT 2602

Ph. 02 6262 9484

www.umwelt.com.au