



Narrabri Coal Mine Stage 1 and 2 Biodiversity Offset Strategy

Prepared for
Narrabri Coal Operations Pty Ltd

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Abbreviations

| Abbreviation | Description |
|--------------|---|
| BBAM | Biobanking Assessment Methodology |
| BOA | Biodiversity Offset Area |
| BOMP | Biodiversity Offset Management Plan |
| BOS | Biodiversity Offset Strategy |
| DECCW | NSW Department of Environment, Climate Change and Water (now OEH) |
| DEWHA | Commonwealth Department of Environment, Water, Heritage and the Arts (now DSEWPaC) |
| DNG | Derived Native Grassland |
| DoP | NSW Department of Planning (now DP&I) |
| DP&I | NSW Department of Planning and Infrastructure |
| DSEWPaC | Commonwealth Department of Sustainability, Environment, Water, Population and Communities |
| EA Report | Environmental Assessment Report |
| EEC | Endangered Ecological Community |
| ELA | Eco Logical Australia Pty Ltd |
| EPBC Act | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| NCOPL | Narrabri Coal Operations Pty Ltd |
| NPWS | National Parks and Wildlife Service (now part of DECCW) |
| OEH | NSW Office of Environment and Heritage |
| PWD | Parks and Wildlife Division (the National Park Management Division within OEH) |
| TSC Act | NSW <i>Threatened Species Conservation Act 1995</i> |

Definitions

| Definition | Description |
|----------------------|---|
| On-site Offset Area | Lots 63, 64, 65 and 67 Dp 757114 and Lots 1 and 2 Dp 811171 which are located within and adjacent to the Mine Site Boundary |
| Off-site Offset Area | That part of the 'Kenna' property shown in Figure 9 |
| Project | Narrabri Coal Stage 1 and 2 |
| Project Site | The area defined by the Mine Site Boundary |
| Proponent | Narrabri Coal Operations Pty Ltd |

Executive Summary

Narrabri Coal Operations Pty Ltd (the 'proponent') was granted approval for Stage 2 of the Narrabri Coal Mine (the 'project') on the 26th July 2010 (Department of Planning – now Department of Planning and Infrastructure (DP&I)) and 21 January 2011 (Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)).

Schedule 5, Condition 6 of PA 08_0144 requires the proponent to prepare a Biodiversity Offset Strategy (BOS) for Stages 1 and 2 of the project that offsets both the direct and indirect impacts of the project, provides a detailed assessment of the proposed offset properties and confirms the ability of the proposal to meet the 'like for like or better' and 'maintain and improve' conservation principals. The strategy is to be prepared in consultation with the Department of Environment, Climate Change and Water DECCW -now the NSW Office of Environment and Heritage (OEH)).

Condition 2 of the DSEWPaC approval requires the proponent to implement an approved version of the BOS that secures, with an appropriate legally binding conservation covenant on title, 933 hectares of the 'Kenna' property, 422 hectares at the mine site and to develop and implement an active monitoring and implementation plan for 20 years, or until the completion criteria are met, to enhance White Box Grassy Woodland, habitat for the Superb Parrot and *Bertya opposens*.

In total, Stage 1 and 2 of the project will directly impact 210.5 hectares of native vegetation, with an assumed further 201.97 ha of native vegetation impacted indirectly by subsidence (10% loss of biodiversity value to all vegetation affected by subsidence). This includes an estimated 28.9 ha of potential foraging habitat for the endangered Superb Parrot and up to 26,654 individuals of the vulnerable plant, *Bertya opposens* (**Section 2**) which will also be impacted.

A 'maintain or improve' offset calculation using the Biobanking Assessment Methodology (BBAM) has been undertaken to measure the impacts caused by the proposed mine, and the predicted improvement of the proposed offset sites. The analysis has quantified the loss of biodiversity values at the impact site, and the ability of the proposed offset areas to improve biodiversity values, and provides a 'guide' to the quantum of offset required to meet the 'maintain and improve' principal. This assessment has indicated that an offset in the order of 1,650 ha is required to offset the direct impacts and a further 1,650 ha to offset the potential indirect impacts (**Section 3**). The offset strategy has been prepared in consultation with OEH, DSEWPaC and the DP&I with meetings held in Dubbo (5 May 2011) and Sydney (25 May 2011), OEH site inspections of Kenna property (20 May 2011), as well as numerous e-mail exchanges and other consultation regarding land transfer. A Draft version of the offset strategy and associated management plans were provided to DP&I, OEH and DSEWPaC on 24 August 2012. Comments have been received by DSEWPaC and DP&I and form the basis of this revision, but no further comment has been received from OEH.

The final offset package proposed includes the protection and management of a 422 ha on-site offset, and an additional 1,243 ha off-site offset on the 'Kenna' property as shown at a regional level in **Figure 1** and **Table 1**. The on-site offset is partly within and partly adjacent to the Mine Site Boundary and contains woodland vegetation and threatened fauna habitat which will not be directly or indirectly affected by the project.

In addition to this, it is proposed to add (following the cessation of mining activity and already committed landscape management and rehabilitation activities (ELA 2011a & b) a further 1,168 ha of woodland vegetation that will be subject to subsidence impacts at the mine site as a future on-site offset to be allocated at the end of the mine life, resulting in an overall offset area of 2,833 ha (**Section 4**).

The on-site offset package for *Bertya opposens* includes the protection of nearly 380 ha of Red Ironbark – Brown Bloodwood shrubby woodland (not affected by any direct or indirect impacts of the project) and a further 297 ha of the same vegetation type occupied by *B. opposens* which is located within the 1,168 hectares affected by subsidence. The offset provides an estimated 327,094 plants (outside the area affected by surface impacts and subsidence), with an additional estimated 169,184 plants within the subsidence area (a total of approximately 500,000 plants). The conservation and management of this many individuals represents an offset ratio of between 12/18 to 1 (**Section 4.3**).

The on-site offset package for Superb Parrot foraging habitat provides a total area of 141.12 ha of preferred foraging/roosting habitat, an offset to impact ratio of 4.88:1 (**Section 4.4**).

All of the proposed offset areas are owned by the proponent ensuring that the proposed offset package can be achieved.

Separate Biodiversity Offset Management Plans (BOMP), including 20 year annual flora and fauna monitoring and reporting programs, or until the completion criteria are met, have been prepared for the on-site and off-site offset areas in accordance with the DSEWPaC approval (ELA 2013a, 2013b).

The offset package meets the calculated offset quantum required for direct impacts but not indirect impacts (1,168 ha). The improve or maintain calculations for indirect impacts resulting from subsidence are considered conservative. The success of rehabilitation and management of this area against benchmarks/completion criteria will be reported in the mine rehabilitation management plan monitoring program (ELA 2011b). If additional impacts result, the proponent will enter into further negotiations regarding any additional offset requirements. The proposed offset package meets the specific principles of offsets in NSW (and the draft Commonwealth offset principles that were in force at the time of the EPBC Act approval), particularly principles numbers 6 and 10. Key components of the offset package include:

- The vegetation at the offset sites has equal or greater conservation status to the impact site;
- The offset area is greater than the loss in biodiversity from the impact site;
- The offset areas will be secured for biodiversity outcomes in accordance with conditions of both the NSW EP&A and Commonwealth EPBC Act approvals. The appropriate mechanism for long-term security is still being negotiated and the management plans will be updated and resubmitted for approval once the preferred mechanism has been identified. These mechanisms may include transfer of land to the NSW Minister for the Environment, registration of a Conservation Agreement under s.69B of the *National Parks and Wildlife Act*, entering into a Planning Agreement under s.93F of the *Environmental Planning and Assessment Act* or similar;
- The offset area will be managed for the enhancement of biodiversity values through a commitment to prepare, fund and implement a site specific conservation management plan for 20 years, or until the completion criteria are met;
- The offset package enhances and provides a 1,590 ha strategic conservation outcome in the north-east area of the Pilliga Forest (proposed and future on-site offset areas) and provides

protection of 1,243 ha off-site, including vegetation types that are not well represented in the existing reserve system; and

- Management of surface disturbance activities in relation to Aboriginal cultural heritage values.

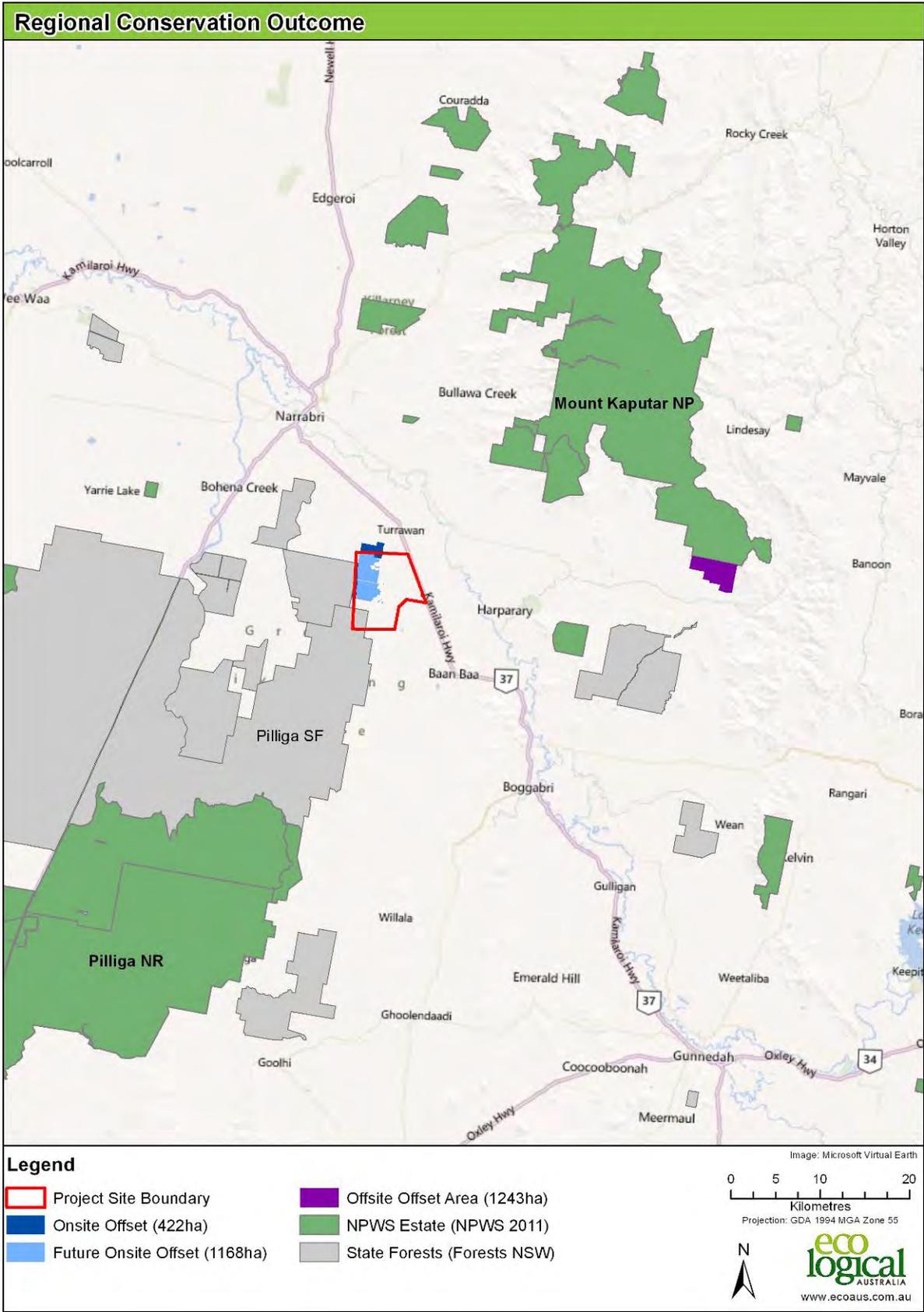


Figure 1: Project Site and regional location of offset areas.

Table 1: Summary of proposed offset package

| "Like for Like" Equivalent Offset Area Vegetation Types | Offset Location | Good | Moderate | Poor (DNG#) | Subject to Subsidence | Total Area |
|---|-----------------|---------------|---------------|---------------|-----------------------|-----------------|
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | On-site | 112.83 | 266.73 | | 1,070.28 | 1,449.84 |
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | On-site | | 17.09 | | | 17.09 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Kenna | 551.77 | 95.99 | 33.02 | | 680.78 |
| Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar bioregions | On-site | | 10.00 | | 89.49 | 99.49 |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (White Box - Yellow Box - Blakely's Red Gum EEC) | On-site | | 5.91 | | 8.63 | 14.54 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Kenna | 13.80 | 34.87 | 428.23 | | 476.90 |
| River Oak Riparian woodland of the Brigalow Belt South and Nandewar Bioregions | On-site | | 10.00 | | | 10.00 |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | Kenna | | 35.07 | | | 35.07 |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Kenna | 10.49 | | | | 10.49 |
| Heathy shrublands on rocky outcrops of the western slopes | Kenna | 18.07 | | | | 18.07 |
| Cleared land | Kenna | | | | | 20.52 |
| | | 706.96 | 475.66 | 461.25 | 1,168.40 | 2,832.79 |

DNG – Derived Native Grassland

Bertya opposens habitat.

Superb Parrot on-site foraging/roosting habitat.

1 Introduction

Whitehaven Coal Pty Ltd has commissioned Eco Logical Australia (ELA) to prepare a Biodiversity Offset Strategy (BOS) for the Narrabri Coal Mine Stage 1 and 2 (the 'project'). The project was approved by the NSW Department of Planning (under delegation to the Minister for Planning) on 26 July 2010 and by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) on 21 January 2011.

The NSW approval included two conditions, condition 6 and 7 of Schedule 5 of PA 08_0144, regarding the preparation and implementation of a BOS:

Condition 6. *The Proponent shall provide a suitable biodiversity offset strategy to compensate for the impacts of Stages 1 and 2 of the project. This offset strategy must:*

(a) be prepared in consultation with DECCW;

(b) be submitted to the Director-General for approval by 31 December 2010, or as otherwise agreed by the Director-General;

(c) provide a detailed assessment of offset proposal/s involving the two properties (agreed to by DECCW) adjoining Mt Kaputar National Park in order to:

- confirm the ability of these proposal/s to meet 'like for like or better' requirements; and

- provide information on the 'maintain or improve' conservation outcomes requirement for these proposal/s;

*(d) include and assess proposals to offset impacts to the Inland Grey Box EEC, *Bertya opposens*, and foraging habitat for the Superb Parrot;*

(e) include proposals on offsetting both direct and indirect impacts (i.e. edge effects) of the project; and

(f) determine the best overall combination of lands to provide a suitable offset.

Condition 7. *The Proponent shall make suitable arrangements to provide appropriate long-term security for the offset areas by 31 December 2011, or other date agreed by the Director-General, to the satisfaction of the Director-General.*

Condition 2 of the DSEWPaC approval requires the proponent to implement an approved version of the BOS that secures, with an appropriate legally binding conservation covenant on title, 933 hectares of the 'Kenna' property and 422 hectares at the mine site. In addition, Condition 2 also requires the proponent to clearly define the boundaries of these two areas and to develop and implement an active monitoring and implementation plan for 20 years to enhance White Box Grassy Woodland, habitat for the Superb Parrot, on the 933 hectares of the 'Kenna' property and White Box Grassy Woodland, habitat for the Superb Parrot, and Red Ironbark – Brown Bloodwood Shrubby Woodland, habitat for *Bertya opposens*, on the 422 hectares of the mine site.

This report has been prepared to meet these requirements and addresses the following matters:

- A brief summary of the direct and indirect impacts of the proposal (Section 2);
- How the ‘like for like’ and ‘improve or maintain’ offset requirements have been addressed (Section 3); and
- The proposed offset package (Section 4)
- Active monitoring and management plans for 1,243 ha offsite offset area on ‘Kenna’ and 422 ha at the mine site (Appendices 8 and 9).

Table 2 indicates where each condition of approval has been addressed.

Table 2: Compliance with conditions of approval

| EP&A ACT REQUIREMENT | EPBC ACT REQUIREMENT | SECTION ADDRESSED |
|---|--|--|
| 6. The Offset Strategy must:- | 2. the applicant must implement the approved version of the Biodiversity offset strategy | This report |
| (a) be prepared in consultation with DECCW (now OEH); | | <p>The OEH Environment Protection & Regulation Branch were consulted on 22 July 2010 to clarify their requirements.</p> <p>OEH and DP&I were sent a copy of the draft offset strategy for comment.</p> <p>Discussion have taken place with DSEWPaC on 28 July 2010 to obtain their requirements</p> <p>Meetings and subsequent communications held with OEH and DP&I on 5 and 25 May 2011.</p> <p>Consultation with Parks and Wildlife Division of OEH regarding land transfer held between May and September 2011.</p> <p>Comments from DSEWPaC April and June 2012 incorporated August 2012.</p> <p>Comments from DP&I July and September 2012 incorporated August 2012.</p> |

| EP&A ACT REQUIREMENT | EPBC ACT REQUIREMENT | SECTION ADDRESSED |
|---|---|--|
| <p>(b) be submitted to the Director-General for approval by 31 December 2010, or as otherwise agreed by the Director-General;</p> | <p>2 Must implement the approved version of the BOS by 31 December 2011</p> | <p>Draft offset strategy submitted to DP&I September 2010.</p> <p>Final offset strategy addressing NSW requirements submitted to DP&I October 2010</p> <p>Strategy submitted to DSEWPaC June 2012</p> <p>DSEWPaC provided comments on 29 June 2012</p> <p>DP&I provided with final incorporating DSEWPaC comments on 24 August 2012. Copies also forwarded to DSEWPaC and OEH.</p> <p>DP&I provided further comments on 30 August and 7 September 2012</p> <p>DSEWPaC provided further comment on 1 November 2012</p> <p>Final strategy submitted to DP&I and DSEWPaC September 2013</p> <p>Revised Final strategy submitted to DSEWPaC April 2014</p> |
| <p>(c) provide a detailed assessment of offset proposal/s involving the two properties (agreed to by DECCW) adjoining Mt Kaputar National Park in order to:</p> <ul style="list-style-type: none"> - confirm the ability of these proposal/s to meet 'like for like or better' requirements; and - provide information on the 'maintain or improve' conservation outcomes requirement for these proposal; | | <p>Appendix 5</p> <p>Section 3.1</p> <p>Section 3.2</p> |

| EP&A ACT REQUIREMENT | EPBC ACT REQUIREMENT | SECTION ADDRESSED |
|---|---|--|
| <p>(d) include and assess proposals to offset impacts to the Inland Grey Box EEC, <i>Bertya opposens</i>, and foraging habitat for the Superb Parrot;</p> | <p>2.e) develop and implement a 20 year active monitoring and management program to enhance Red Ironbark – Brown Bloodwood Shrubby Woodland which provides habitat for <i>Bertya opposens</i> and White Box grassy woodland which provides habitat for the Superb Parrot.</p> <p>2.b) develop and implement a 20 year active monitoring and management program for Kenna to enhance White Box grassy woodland which provides habitat for the Superb Parrot.</p> <p>2.c & 2.f clearly define boundaries of Kenna and 422 ha on-site property through maps, descriptions and accompanying shapefile</p> | <p>Section 4.3 and 4.4</p> <p>Appendix 8- Narrabri on-site Biodiversity Offset Management Plan (ELA 2012a)</p> <p>Appendix 9- Kenna Biodiversity Offset Management Plan (ELA 2012b)</p> <p>Site location, property boundary, vegetation, management zone maps/figures provided in ELA 2012a & b).</p> <p>Fully attributed ESRI Shapefile provided to DSEWPaC on a CD with this report.</p> |
| <p>(e) include proposals on offsetting both direct and indirect impacts (i.e. edge effects) of the project; and</p> | | <p>Section 2, Section 3 and Section 4</p> |
| <p>(f) determine the best overall combination of lands to provide a suitable offset.</p> | | <p>Section 4.1</p> |
| <p>The Proponent shall make suitable arrangements to provide appropriate long-term security for the offset areas by 31 December 2011, or other date agreed by the Director-General, to the satisfaction of the Director-General</p> | <p>2. a) Secure 933 ha on Kenna property with a legally binding conservation covenant on title.</p> <p>2. d) Secure 422 ha property as outlined in Annexure 3 (on-site offset area) with a legally binding conservation covenant on title.</p> | <p>NCOPL has received an extension to arrange for the long-term security of the offset. Once the appropriate mechanism has been identified NCOPL will update and resubmit this management plan for approval.</p> |

2 Impacts of the Narrabri Coal Mine Stage 1 and 2 Project

NSW DP&I Condition 6 of the approval requires the proponent to “include proposals on offsetting both direct and indirect impacts (i.e. edge effects) of the project”.

2.1 DIRECT AND INDIRECT IMPACTS TO ENDANGERED ECOLOGICAL COMMUNITIES AND NATIVE VEGETATION

The direct and indirect impacts to native vegetation communities, threatened flora and fauna species and their habitats resulting from the project are fully documented in the Flora and Fauna Assessment Report (EA Report) prepared by Ecotone Ecological Consultants Pty Ltd (Ecotone 2009), and additional specialised information on potential impacts to the Malleefowl and Superb Parrot provided by Cenwest Environmental Services (Cenwest 2009) and *Bertya opponens* and the Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions EEC by FloraSearch (2009).

In total, Stages 1 and 2 of the project will directly impact 210.5 ha of native vegetation from the following component parts:-

- Ventilation Fan sites – 17 ha
- Pre-drainage gas sites – 98.4 ha
- Goaf Gas Drainage sites – 74.0 ha
- Internal access roads, Power lines and Service Corridors – 18.7 ha
- Pit Top Area 2.4 ha

The flora and fauna impact reports state that whilst this is an estimate, it is based on the maximum amount of clearance required. The actual area of clearing may be significantly less than the above.

The indirect impacts of the project relate mainly to subsidence issues related to the longwall mining methods. Edge effects are likely to be minimal as the loss of isolated patches of remnant vegetation in cleared grazing land will not lead to additional impacts to adjacent vegetation (as by definition an isolated patch has no adjacent vegetation). In addition, the edge effects for the direct impacts in the large areas of contiguous vegetation have been factored into the estimates of loss referred to above as the “maximum area of clearance required”.

The underground mining area covers a total area of 3,243.63 ha, of which 2020.26 ha is vegetated, and 210.5 ha, or approximately 10.4%, will have direct surface impacts. These impacts will be progressively rehabilitated over an approximate 24-26 years life of operations. The areas will be progressively rehabilitated in a westerly direction for the area above the northern panels and in an easterly direction above the southern panels as the mine proceeds.

Approximately 2,020 ha of vegetation within the underground mining area will be subject to indirect impacts (subsidence) to varying degrees. The extent to which this will affect surface vegetation,

structure, floristics and fauna habitat values is difficult to quantify at this stage. The extent of impact will comprise part of the monitoring regime associated with the site over the life of the development.

DGS (2009) state that the amount of subsidence is estimated to be up to 2.17m in the east of the mine site, and 2.44m in the west of the mine site, and would be restricted to approximately 80m in each panel. Assuming that the subsidence causes a conservative 10% impact to vegetation conservation values, this would equate to an indirect impact of approximately 201.97 ha. Thus the total direct and indirect impacts of Stage 1 and 2 of the project are considered to be in the order of 412.47 ha for the purposes of meeting Schedule 5, Condition 6 (e).

The area of each vegetation type to be impacted is summarised in **Table 3** and shown in **Figure 2**.

Table 3: Area of vegetation types to be directly impacted

| Vegetation Communities as described by Ecotone 2009 | Equivalent Biometric Vegetation Types | Conservation Status | Condition | Direct Impact Area (ha) | Gross Area of vegetation subject to Subsidence | Indirect Impact Estimate (ha) |
|---|---|-----------------------|-----------|-------------------------|--|-------------------------------|
| Brown Bloodwood / Pilliga Box Woodland | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Non Threatened | Mod-Good | 178.90 | 1735.22 | 173.5 |
| Inland Grey Box / Bimble Box / Blakely's Red Gum | Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar bioregions | EEC (NSW & C'wealth)# | Moderate | 24.80 | 205.39 | 20.5 |
| Riparian Forest | River Oak Riparian woodland of the Brigalow Belt South and Nandewar Bioregions | Non Threatened | Moderate | 4.10 | 59.87 | 6 |
| Callitris Forest | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Non Threatened | Poor | 2.75 | 19.78 | 1.97 |
| Total | | | | 210.50 | 2020.26 | 201.97 |

This community was not listed as an endangered community on the EPBC Act at the time the DEWHA made its determination that the project constituted a controlled action.

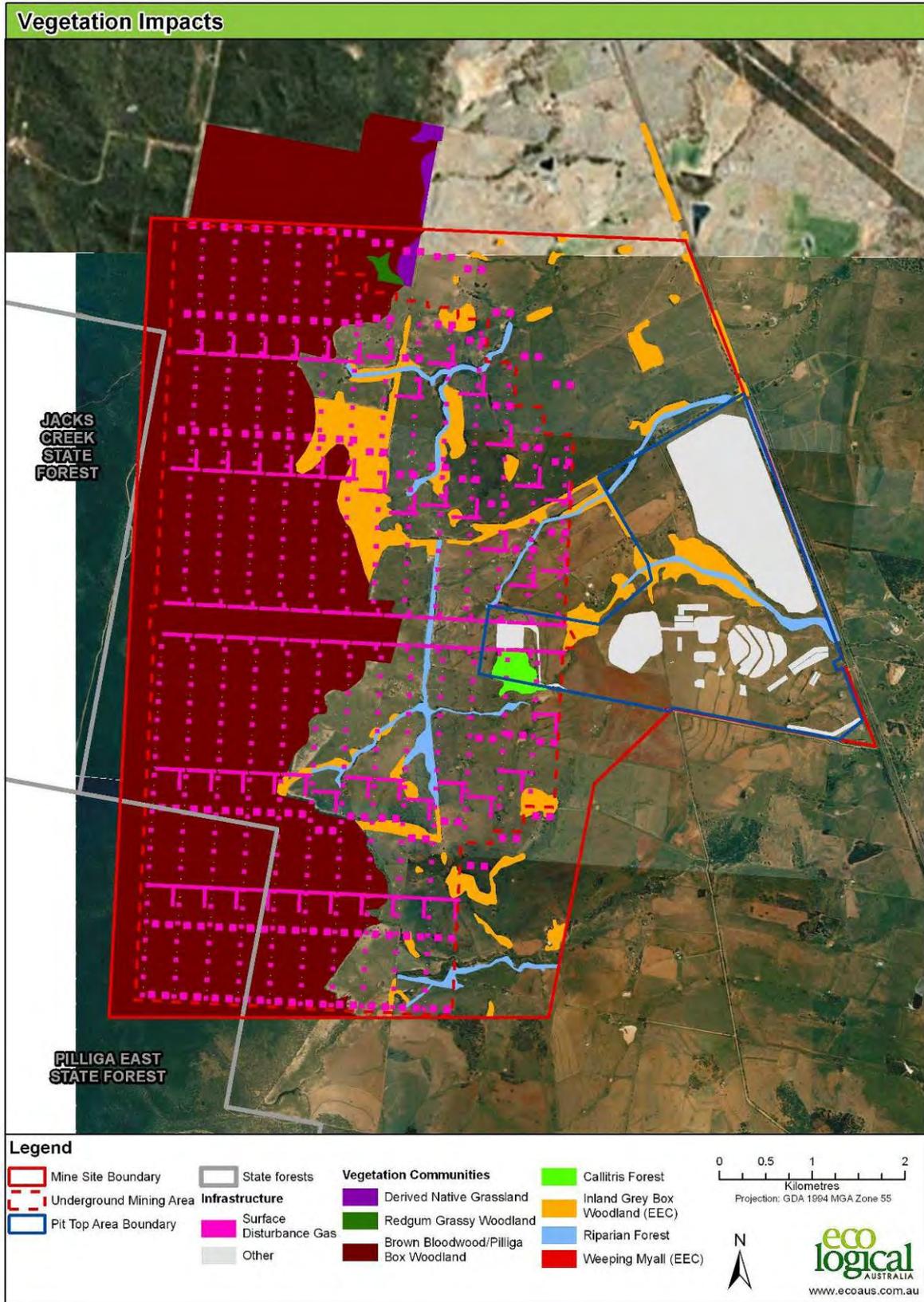


Figure 2: Project Site, impacts and vegetation communities (after Ecotone 2009)

(Note the location of proposed access tracks are not shown in the above figure. Location of pre-drainage gas sites is indicative only).

2.2 DIRECT AND INDIRECT IMPACTS TO BERTYA OPPONENS

The revised environment assessment report for the project recorded and mapped the distribution of the Coolabah Bertya (*Bertya opposens*) in the Project Site (FloraSearch 2009). The FloraSearch report states that the full extent of the distribution of *B. opposens* in the study area is not clear and that the project activities will impact on populations of the species and that this “*may include thousands of individuals*”. NPWS (2002) and the NSW Scientific Committee (2009) states that the Jacks Creek State Forest population of *B. opposens*, immediately west of the Project Site, is estimated to contain in excess of 5 million individuals, and that there are currently considered to be no threats to the Jacks Creek State Forest population.

Ecotone (2009) states that whilst individual plants may be directly impacted by clearance activities in the western parts of the project area, impacts would be minimised by targeting the Bertya in pre clearance surveys, and where possible and practical, modifying access routes and gas ventilation vents to avoid impacts to individuals or areas of high density. The report also states that impacts are likely to be minimal given the capacity of the species to germinate and grow in disturbed areas, and that it was likely that the species would quickly recolonise cleared areas undergoing rehabilitation.

The distribution of *B. opposens* across the Project Site and proposed offset site was mapped by Martin Sullivan of ELA between the 17 and 19 August 2010 (**Figure 3**) through a combination of random meander transects, spot counts and linear 50m transects. The extent of the distribution of *B. opposens* was determined through random meanders in suitable habitat, however due to the sheer size of the potential habitat (over 3000 ha), it is highly likely that other small populations of this species have not been identified or mapped, particularly where small scale disturbance has occurred.

During the site inspection most of the *B. opposens* population was observed to be flowering with both male and female plants observed (**Plates 1 and 2**). The dark green upper surfaces of the leaves were moderately glossy making the shrub conspicuous and easy to locate amongst the shrubby woodland (**Plate 3**). As identified by DECCW (2010a), disturbances such as fire and mechanical disturbance appear to trigger germination and/or suckering in *B. opposens*, and this is evidenced by the greatest density of plants observed along track edges, clearings and within the dense regrowth woodland in the proposed offset site (**Plate 4**). Density estimations range from close to 1 plant per square metre along track edges in regrowth woodland to less than 1 plant per 100 square metres in selectively cleared woodland. While significant numbers of *B. opposens* were observed in the north of the mine site and the proposed on-site offset area (Lot 63 DP 757114), it is clear from the site inspection that the greatest density of this population occurs to the west of the mine site both on private land adjoining Jacks Creek State Forest and in the State Forest itself.



Plate 1: Male flowers of the Coolabah Bertya (*Bertya opponens*)



Plate 2: Female flowers of the Coolabah Bertya (*Bertya opponens*)



Plate 3: The dark green glossy leaves of *Bertya opponens* make it conspicuous amongst the dense shrubby woodland



Plate 4: Dense *Bertya opponens* along track edges

In order to quantify the size of the population, a number of Geographic Information System calculations were made based on mapped habitat and estimated density. **Tables 4 and 5** outline the total number of *B. opponens* estimated across the Project Site and proposed offset sites, the number estimated to be impacted by the project, the total number estimated within the proposed offset areas (including areas of disturbance) and the total number estimated to occur in the proposed offset site which are unlikely to be disturbed.

In summary, of the estimated 1,066,930 plants of *B. opponens* at the Project Site, approximately 266,000, or about 25%, are within the area subject to underground disturbance (and potentially subjected to indirect impacts) and up to 26,654 of these (estimate of 10%) may be directly impacted by surface activities, depending on the degree to which areas of high density can be avoided in road and ventilation shaft micro siting (Statement of Commitment by NCOPL). The total number impacted represents approximately 2.5% of the total estimated population within the mine site boundary, and less than 0.5% of the combined estimated 6 million plants in the Jacks Creek State Forest and Project Site area.

Table 4: Estimated total number of Coolabah Bertya (*Bertya opponens*) across the Project Site including Lot 63 of DP 757114

| Area (m ²) | Density | Estimated Number |
|------------------------|---------|------------------|
| 430,618 | 0.01 | 4,306 |
| 2,742,639 | 0.04 | 109,706 |
| 24,996 | 0.08 | 2,000 |
| 44,287 | 0.3 | 13,286 |
| 1,662,833 | 0.3 | 498,850 |
| 626,832 | 0.7 | 438,782 |
| 5,532,205 | | 1,066,930 |

Table 5: Estimated number of Coolabah Bertya (*Bertya opponens*) within the disturbance area (limit of underground mining) and potentially impacted by surface activities.

| Area (m ²) | Density | Estimated Number | Number Potentially Impacted by Surface activities |
|------------------------|---------|------------------|---|
| 103,106 | 0.01 | 1,031 | 103 |
| 754,774 | 0.04 | 30,191 | 3,019 |
| 336,170 | 0.7 | 235,319 | 23,532 |
| 1,194,050 | | 266,541 | 26,654 |

The actual number that may be directly impacted cannot be determined until the route of access roads and precise location of gas ventilation fans and pre-drainage sites are known. The above numbers are based on up to 10% of the area occupied being impacted as the average surface area impact.

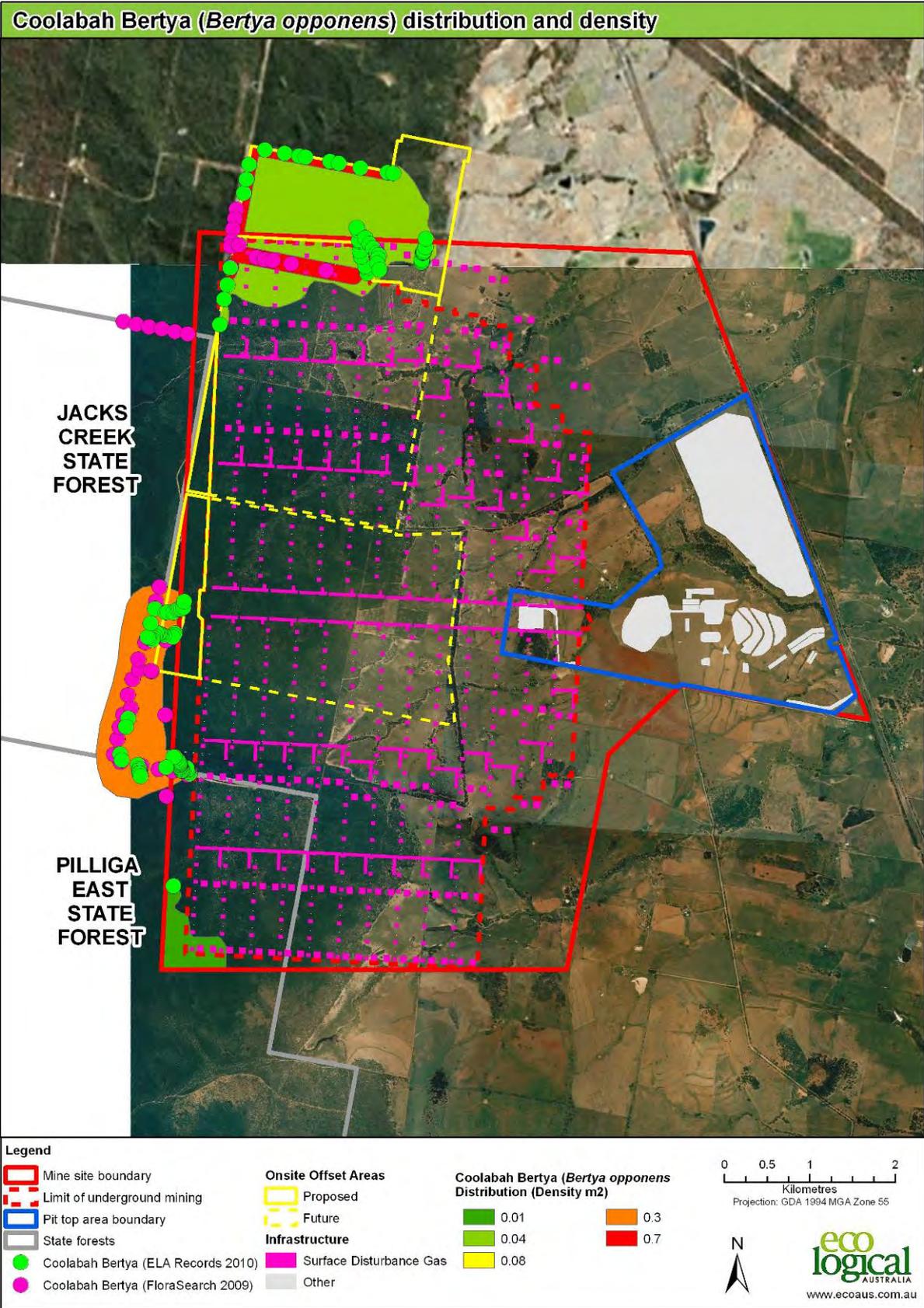


Figure 3: Distribution of *Bertya opposens* across the Project Site

2.3 DIRECT AND INDIRECT IMPACTS TO FORAGING HABITAT FOR THE SUPERB PARROT

Four Superb Parrots were observed flying overhead in January 2009 (Ecotone 2009). Additional sightings of the species were made within 10 and 20 km of the project site in 2001 (CENWEST 2009).

These records indicate that the species occasionally forages in the area outside of the breeding season and requires roosting resources in the area. Preferred roosting sites include Box-Gum woodlands, including Blakely's Red Gum, Yellow Box, Apple Box and Red Box and may include isolated paddock trees (DECCW 2010b).

A total of 28.9 ha of potentially suitable foraging/roosting habitat (i.e. 24.8 ha of Inland Grey Box being a Grassy Woodland vegetation formation and 4.1 ha of Riparian Forest, providing large trees suitable for roosting), will be impacted by the project. These areas consist largely of isolated paddock trees and small remnant patches of vegetation and riparian areas surrounded by cleared grazing land.

Schedule 5, Condition 6(d) of PA 08_0144 requires that this Biodiversity Offset Strategy include and assess proposals to offset the impacts for loss of foraging habitat for the Superb Parrot. EPBC Act approval condition 2.b and 2.e requires that the BOS includes an active monitoring and management plan to enhance White Box grassy woodland (habitat for the Superb Parrot) within the 422 ha on-site and 933 ha off-site offset areas .

Section 4.4 of this report provides a range of direct habitat protection and enhancement measures that will protect over 140 ha of suitable foraging habitat for the Superb Parrot within the Project Site and on land purchased by NCOPL as an offset area adjacent to the Project Site.

Management Plans for the active management and monitoring of these offsets areas have been prepared (ELA 2012a & b).

3 Offset Requirements to Meet ‘Like For Like’ and ‘Maintain or Improve’ Outcomes

Initial consultation has taken place with OEH in accordance with Condition 6(a), to clarify the requirements for a detailed assessment of the proposed off-site offset property and the ‘like for like’ requirements in relationship to the impact vegetation types. OEH advised that the offset strategy is to justify the use of equivalent vegetation types in accordance with OEH’s published offset principles (DECC 2008) and the assessment of the proposed offset areas is to be sufficient to identify the vegetation types, their relative condition and the threatened fauna likely to use the areas.

3.1 OFFSET PRINCIPLES

Condition 6(c) of PA 08_0144 requires that this offset strategy compensate for the impacts of Stage 1 and Stage 2 of the project and specifically that it meets ‘*like for like or better*’ requirements and provides information on the ‘*maintain and improve*’ conservation outcomes.

In this regard, both the OEH (DECC 2008) and then DEWHA (DEWR 2007) have published a list of principles that must be considered when considering offset strategies. These principles are included in Appendix 1 and 2 of this report and relevant sections discussed below. The DSEWPac finalised the EPBC Act Offset Policy in October 2012, however, as this project was approved prior to the offset policy being finalised, it does not apply to this project.

3.2 LIKE FOR LIKE OR BETTER

OEH offset principle number 10 states that offsets:-

“must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets”.

In regards to the vegetation types required to be offset for the project the offset communities listed in **Table 6** are considered to have equal or greater conservation status in relation to their legal status under the TSC and/or EPBC Acts, their percentage cleared in the Namoi CMA and the range of faunal habitat values that they provide (i.e. they meet the like for like or better criteria).

Table 6: Equivalent conservation status of proposed offset ecological communities

| Impact vegetation type | | | | Proposed offset vegetation type | | |
|---|---|-----------------------|------------------------|--|-----------------------|------------------------|
| Vegetation communities as described by ecotone 2009 | Equivalent biometric vegetation types | Conservation status | % cleared in namoi cma | Offset vegetation type (in addition to impact type) | Conservation status | % cleared in namoi cma |
| Brown Bloodwood / Pilliga Box Woodland | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Non Threatened | 35% | White Cypress Pine-Narrow leaved ironbark shrub/grass forest open forest of the western Nandewar Bioregion | Non Threatened | 55% |
| Inland Grey Box / Bimble Box / Blakely's Red Gum | Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar bioregions | EEC (NSW & C'wealth)# | 85% | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | EEC (NSW & C'wealth)# | 85% |
| Riparian Forest | River Oak Riparian woodland of the Brigalow Belt South and Nandewar Bioregions | Non Threatened | 60% | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | Non Threatened | 75% |
| Callitris Forest | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Non Threatened | 35% | White Cypress Pine-Narrow leaved ironbark shrub/grass forest open forest of the western Nandewar Bioregion | Non Threatened | 55% |

It is noted that each vegetation type impacted by the project is to be offset with the same vegetation type (on suitable unaffected lands adjacent to the mine site) or other vegetation types that have the same or higher conservation status, the same or a higher percentage cleared in the Namoi CMA and are in the same vegetation formation.

Table 7 summaries those threatened fauna species recorded in the project area (Ecotone 2009) and whether they have been predicted (BBAM and credit calculator tool), recorded (site assessment) or are likely to occur (Wildlife Atlas records within 10 km radius) at the proposed on-site and off-site offset areas. It is noted that every threatened fauna species recorded at the Project Site is known or is likely to occur at the on-site offset area and/or off-site offset area i.e. the proposed offset areas also provide 'like for like' threatened fauna habitat values as the impact area.

Table 7: Recorded and predicted threatened fauna at impact site and proposed offset sites

A 'No' in the following table indicates that the species was not recorded during site assessment. A blank cell indicates that the species has not been predicted and as targeted surveys have not been undertaken may or may not occur.

| Common Name | Scientific Name | Predicted on site | Recorded through EA process | Predicted on on-site offset | Predicted on off-site offset | Recorded on (Site Assessment) or near offset site (Atlas records within 10 km) |
|---|---------------------------------------|-------------------|-----------------------------|-----------------------------|------------------------------|--|
| Australian Bustard | <i>Ardeotis australis</i> | Yes | No | Yes | Yes | |
| Barking Owl | <i>Ninox connivens</i> | Yes | No | Yes | Yes | Yes (Atlas records) |
| Black-breasted Buzzard | <i>Hamirostra melanosternon</i> | Yes | No | | | |
| Black-chinned Honeyeater (eastern subspecies) | <i>Melithreptus gularis gularis</i> | Yes | No | Yes | Yes | |
| Black-striped Wallaby | <i>Macropus dorsalis</i> | Yes | Yes | Yes | | |
| Brown Treecreeper (eastern subspecies) | <i>Climacteris picumnus victoriae</i> | No | No | | Yes | Yes (Atlas records) |
| Bush Stone-curlew | <i>Burhinus grallarius</i> | Yes | No | Yes | Yes | |
| Delicate Mouse | <i>Pseudomys delicatulus</i> | No | Yes | Likely | | |
| Diamond Firetail | <i>Stagonopleura guttata</i> | Yes | Yes | Yes | Yes | Yes (Atlas records) |
| Eastern Pygmy-possum | <i>Cercartetus nanus</i> | Yes | Yes | Yes | Yes | |
| Five-clawed Worm-skink | <i>Anomalopus mackayi</i> | Yes | No | | | |

| Common Name | Scientific Name | Predicted on site | Recorded through EA process | Predicted on on-site offset | Predicted on off-site offset | Recorded on (Site Assessment) or near offset site (Atlas records within 10 km) |
|---|---|-------------------|-----------------------------|-----------------------------|------------------------------|--|
| Gilbert's Whistler | <i>Pachycephala inornata</i> | Yes | No | Yes | | |
| Glossy Black-cockatoo | <i>Calyptorhynchus lathami</i> | Yes | Yes | Yes | Yes | |
| Greater Long-eared Bat (south eastern form) | <i>Nyctophilus timoriensis</i> | Yes | Yes | Yes | Yes | Yes (Atlas records) |
| Grey-crowned Babbler (eastern subspecies) | <i>Pomatostomus temporalis temporalis</i> | Yes | Yes | Yes | Yes | Yes (On site) |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | Yes | No | Yes | Yes | |
| Koala | <i>Phascolarctos cinereus</i> | Yes | Yes | Yes | Yes | |
| Little Pied Bat | <i>Chalinolobus picatus</i> | Yes | Yes | Yes | Yes | |
| Malleefowl | <i>Leipoa ocellata</i> | Yes | No | Yes | | |
| Masked Owl | <i>Tyto novaehollandiae</i> | Yes | No | Yes | Yes | |
| Painted Honeyeater | <i>Grantiella picta</i> | Yes | No | Yes | Yes | |
| Pale-headed Snake | <i>Hoplocephalus bitorquatus</i> | Yes | Yes | Yes | | |
| Pilliga Mouse | <i>Pseudomys pilligaensis</i> | Yes | No | Yes | | |
| River snail | <i>Notopala sublineata</i> | Yes | No | | | |
| Speckled Warbler | <i>Pyrrholaemus sagittatus</i> | Yes | Yes | Yes | Yes | Yes (Atlas records) |
| Spotted-tailed Quoll | <i>Dasyurus maculatus</i> | Yes | No | Yes | Yes | |
| Squirrel Glider | <i>Petaurus norfolcensis</i> | Yes | No | Yes | Yes | Yes (Atlas records) |

| Common Name | Scientific Name | Predicted on site | Recorded through EA process | Predicted on on-site offset | Predicted on off-site offset | Recorded on (Site Assessment) or near offset site (Atlas records within 10 km) |
|--------------------------------|----------------------------------|-------------------|-----------------------------|-----------------------------|------------------------------|--|
| Superb Parrot | <i>Polytelis swainsonii</i> | Yes | Yes | Yes | Yes | Unlikely |
| Swift Parrot | <i>Lathamus discolor</i> | Yes | No | Yes | Yes | |
| Turquoise Parrot | <i>Neophema pulchella</i> | Yes | No | Yes | Yes | Yes (Atlas records) |
| Varied sittella | <i>Daphoenositta chrysoptera</i> | No | Yes | Likely | | Yes (Atlas records) |
| Yellow-bellied Sheath-tail-bat | <i>Saccolaimus flaviventris</i> | Yes | Yes | Yes | Yes | Yes (Atlas records) |

3.3 IMPROVE OR MAINTAIN CONSERVATION OUTCOMES

OEH offset principle number 6 states that:-

“Offsets should aim to result in a net improvement in biodiversity over time. Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site. Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation”.

Other than the Biobanking Assessment Methodology (BBAM) (DECC 2009) there is no standard framework or legislative requirement to provide an offset of a certain size, rather, the adequacy of proposed offset have traditionally been based on the biodiversity values to be impacted (type, area and condition), conservation status (endangered or not threatened community), the social and economic benefits of the proposal and the ability to secure and manage the proposed offsets.

However, OEH prefers that an assessment of the offset requirements is calculated using the BBAM to determine the ‘quantum’ of offset required, and the results are then used to inform the negotiation of suitable offset packages taking into consideration the social and economic benefits of the project, even if the area required under the Biobanking Methodology is not attained.

Accordingly, an indicative assessment of the impacts and proposed offset areas has been undertaken by ELA using data for the condition of impacted vegetation at the mine site from Ecotone (2009), rapid biometric condition plots taken across the mine site (**Table 15, Appendix 3**) and a detailed assessment of the proposed on-site and off-site offset areas completed by ELA (see **Appendices 4 and 5**).

Whilst the field survey techniques undertaken for the Stage 2 EA and this Biodiversity Offset Strategy did not comply fully with the methodology required for a full Biobanking Assessment (as the project is being assessed under Part 3A of the EP&A Act and not as a Biobanking Assessment), sufficient data was obtained from the proposed offset areas to enable robust estimates of the area of offset required under this methodology and meet the requirement to ‘provide information on the maintain or improve conservation outcome’. The results of these calculations were then used to inform the proposed offset package.

The credit reports generated by these indicative assessments have been included at **Appendix 6**. A summary of the credits required to offset the impact of the project and meet a ‘maintain and improve’ outcome (**Table 8**), and the number of credits that the proposed offset sites are able to generate, are provided in **Tables 9** and **10**.

Table 8: Offset area required for direct impacts (Pilliga Outwash CMA Sub region)

| Vegetation Type Impacted | Condition | Area Impacted (ha) | Credits Required | Credits Required/ha | Credits generated/ha (Tables 9 & 10) | Offset Area Required |
|---|-----------|--------------------|------------------|---------------------|--------------------------------------|----------------------|
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Moderate | 181.60 | 10,935 | 60.45 | 7.6 | 1,438.82 |
| Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81) | Moderate | 24.80 | 1,374 | 55.40 | 7.8 | 176.15 |
| River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) | Moderate | 4.10 | 289 | 70.49 | 7.8 | 37.05 |
| Total | | 210.50 | 12,598 | | | 1,652.02 |

The number of credits potentially able to be generated is the average of the vegetation types and condition classes across the proposed on-site and off-site offset areas (Tables 9 & 10).

The additional 1.66 ha of impact to Callitris forest (biometric equivalent Red Ironbark – Brown Bloodwood shrubby woodland) would require an additional 100 credits (1.66 ha x 60.45 credits required/ha) or an additional 13.2 ha of offset (100 credits required/7.6 credits per ha generated).

Indirect impacts as a result of subsidence, assuming an overall 10% loss to the area affected, is equivalent to a further 201.97 ha, thus approximately doubling the offset area required.

Table 9: Indicative number of credits able to be generated at proposed and potential on-site offset

| Vegetation Type Impacted | Condition# | Offset Area Available# (ha) | Credits Generated | Credits Generated/ha |
|---|--------------------------|-----------------------------|-------------------|----------------------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) | Low/Mod (Site Score 19) | 17.60 | 119.11 | 6.77 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | High (Site Score 80) | 4.50 | 41.27 | 9.17 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | High (Site Score 73) | 29.00 | 309.79 | 10.68 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | High (Site Score 84) | 1,560.00 | 10,611.25 | 6.80 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | Mod/High (Site Score 61) | 301.00 | 3,440.07 | 11.43 |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | High (Site Score 70) | 5.90 | 55.91 | 9.48 |
| Total/Average | | 1,918.00 | 14,577.40 | 7.6 |

See biometric condition scores in Appendix 3

Please note the areas in these calculations are not the same as the areas in the proposed offset package. They were used as an indication of the areas available.

Table 10: Indicative number of credits able to be generated at proposed off-site offset (Kenna Property)

| Vegetation Type Impacted | Condition | Potential Area Available (ha) | Credits Generated | Credits Generated/ha |
|---|---|-------------------------------|-------------------|----------------------|
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) | Exotic understorey | 38.10 | 377.37 | 9.90 |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) | Native understorey | 46.70 | 507.03 | 10.86 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Intact canopy - good condition | 14.50 | 95.86 | 6.61 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Derived Native Grassland - low species richness | 770.40 | 4,838.44 | 6.28 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Scattered trees with exotic understorey | 13.00 | 95.92 | 7.38 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Scattered trees with native understorey | 33.80 | 285.15 | 8.44 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Good | 619.60 | 5,440.86 | 8.78 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Derived Native Grassland - low species richness | 55.20 | 474.66 | 8.60 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Scattered trees with native understorey | 111.30 | 1,136.77 | 10.21 |

| Vegetation Type Impacted | Condition | Potential Area Available (ha) | Credits Generated | Credits Generated/ha |
|---|---|-------------------------------|-------------------|----------------------|
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Good | 10.50 | 107.24 | 10.21 |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Scattered trees with native understorey | 3.20 | 29.56 | 9.24 |
| Heathy shrublands on rocky outcrops of the western slopes | Good | 18.20 | 110.98 | 6.10 |
| Total/Average | | 1,734.50 | 13,499.84 | 7.78 |

Tables 8, 9 and 10 indicate that in order to meet a 'maintain and improve' outcome, the offset would need to be in the order of 1,650 hectares for direct impacts and a further 1,650 hectares for indirect impacts if the assumed 10% loss in site value was realised.

4 Proposed Offset Package

The offset package proposed for the Narrabri Stage 1 and 2 project includes the protection and conservation management of 422 ha of an on-site offset containing unaffected woodland vegetation and threatened fauna habitat adjacent to the mine site (**Figure 5**) and 1,243 ha on an off-site offset area (the 'Kenna' property) which has recently been purchased by NCOPL (**Figure 9**).

The on-site offset area includes areas within and adjacent to the Mine Site Boundary. A 30m edge effect buffer has been added to the area subject to underground mining and not included in the area calculation for the unaffected woodland areas. The on-site offset area forms part of Lot 63 DP 757114 and the western parts of Lots 64, 65 and 67 DP 757114, Lot 1 & Lot 2 DP 81171 and parts of Lots 83 & 84 Dp757124.

In addition to this, it is proposed to add, following the cessation of mining activity and rehabilitation, a further 1,168 ha of woodland vegetation (the vegetated part of the above lots which are 1,368 ha in area) that will be subject to subsidence impacts at the mine site. This area is referred to as the 'future' offset, and will result in an overall offset area of approximately 2,833 ha (**Table 11** and Figures 4, 5, 6, 8 and 9).

The proposed offset package meets the specific principles of offsets in NSW (and the draft Commonwealth offset principles), particularly principles numbers 6 and 10. Key components of the offset package include:

- The vegetation at the offset sites has equal or greater conservation status to the impact site;
- The offset area is greater than the loss in biodiversity from the impact site;
- The offset areas will be secured on title for biodiversity outcomes in accordance with conditions of both the EP&A and EPBC Act approvals. The appropriate mechanism for long-term security is still being negotiated and the management plans will be updated and resubmitted for approval once the preferred mechanism has been identified. These mechanisms may include transfer of land to the NSW Minister for the Environment, registration of a Conservation Agreement under s.69B of the *National Parks and Wildlife Act*, entering into a Planning Agreement under s.93F of the *Environmental Planning and Assessment Act* or similar;
- The offset area will be managed for the enhancement of biodiversity values through a commitment to prepare, fund and implement site specific conservation management plans for 20 years (ELA 2013a and b), or until the completion criteria are met; and
- The offset package enhances and provides strategic conservation outcomes in the north-east area of the Pilliga Forest (on-site offset) and provides protection to vegetation types not well represented in the existing reserve system (grassy woodland vegetation at Kenna adjacent to Mount Kaputar National Park).

In summary, the offset package compensates for the direct (210.5 ha) and estimated indirect (201.97 ha) impacts of the project on a 'like for like' basis, and the improvements in conservation values in the proposed offset areas (through the cessation of current grazing and implementation of conservation management practices) will lead to an 'improve and maintain' conservation outcome.

The offset package, not including areas subject to mine subsidence, provides an offset to impact ratio of 4.03:1, which increases to 6.87:1 when the area affected by mine subsidence is included. It is acknowledged that the biodiversity values of the area subject to mine subsidence will be affected, at least in the short term, hence the 10% loss in value used to assess the area of indirect impacts (**Section 2**).

It is considered that the 1,168 ha of vegetation subject to mine subsidence will retain significant biodiversity values during and post mining activity (24-26 years), which will be progressively rehabilitated (Ecotone 2009, ELA 2011 a & b) and provide long term protection of these vegetation types and fauna habitats in a consolidated 1,590 ha offset area in the north-east area of the Pilliga Forest (Figure 4).

Observations of the natural regeneration of past disturbances at the mine site including clearing for agriculture and forestry operations and impacts associated with exploration and piezometer installation (see Plates 5 and 6) suggests that the Red Ironbark – Brown Bloodwood vegetation recovers well from disturbance. It is likely to respond better with targeted rehabilitation activity as proposed by NCOPL.

4.1 ON-SITE OFFSET AREA FOR IMPACTS TO NATIVE VEGETATION

The combination of on-site and off-site offsets is required to meet the 'like for like' requirements of the condition of approval (as offsets for *Bertya opposens* cannot be found outside of the Jacks Creek State Forest area).

The combination of on-site and off-site offsets also leads to a more direct 'like for like' conservation outcome through the provision of a minimum 1:1 ratio of unaffected vegetation types which are the same vegetation types and condition as those being impacted at the mine site (Red Ironbark – Brown Bloodwood and Inland Grey Box), plus an additional or complementary 1,168 ha of vegetation that will be subject to subsidence and includes up to approximately 210.5 ha of post disturbance rehabilitation that provides a long term consolidated conservation area of 1,590 ha.

Whilst both the OEH and DP&I have previously commented that the area affected by underground mining would not be considered as part of the offset package due to the amount of disturbance this area would be subject to, it is noted that the disturbance only directly impacts up to 10.4% of this area and the disturbance will not be all at the same time (i.e. the actual amount of disturbance at any point in time will only be a small fraction of the total due to the progressive nature of the longwall activity and will also be progressively rehabilitated). In combination with the Statement of Commitments by NCOPL to implement a weed and feral animal control program in this area, avoid and minimise where possible and practical any direct impacts to mature trees in the area during siting of access roads, ventilation fan and gas drainage sites, and the likely success of the rehabilitation of disturbed areas, the area will provide a valuable long term conservation area, which combined with the 422 ha of undisturbed on-site offset area, will provide a consolidated long term conservation area of over 1,590 ha in the north-east sector of the Pilliga Forest (Figure 4). It is also noted that the NSW Minister for the Environment has recently (June 2010) entered into a Biobanking Agreement with a private landholder in south-west Sydney which has been used to provide an offset for the Sydney Growth Centres urban expansion impacts to endangered ecological communities and that this Biobank site is subject to approved underground (longwall) mining indirect impacts.

Further, the ability to secure this on-site conservation outcome is readily achievable as NCOPL already owns all of the land proposed as the on-site offset area (**Figure 7**). A preliminary assessment of the conservation values of the on-site offset area were assessed by ELA as part of preparing this offset strategy and a report is included at **Appendix 4**. Further baseline studies as part of the implementation

of the annual flora and fauna monitoring program were completed in November 2012 (Parsons Brinkerhoff 2013).

Table 11: Proposed offset areas and vegetation types

Vegetation types included in Superb Parrot offset component. Vegetation types providing habitat for *Bertya opponens*.

| Impact Area Vegetation Types (Ecotone 2009) | Direct Impacts (Surface Impacts) | Indirect Impacts (10% of vegetation affected by subsidence) | "Like for Like" Equivalent Offset Area Vegetation Types | Offset Location | Good | Moderate | Poor (DNG) | Subject to Subsidence | Total Area |
|---|----------------------------------|---|---|-----------------|---------------|---------------|---------------|-----------------------|-----------------|
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 181.6 | 173.5 | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | On-site | 112.83 | 266.73 | | 1,070.28 | 1,449.84 |
| | | | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | On-site | | 17.09 | | | 17.09 |
| | | | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Kenna | 551.77 | 95.99 | 33.02 | | 680.78 |
| Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar bioregions | 24.8 | 20.5 | Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar bioregions | On-site | | 10.00 | | 89.49 | 99.49 |
| | | | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (White Box - Yellow Box - Blakely's Red Gum EEC) | On-site | | 5.91 | | 8.63 | 14.54 |
| | | | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Kenna | 13.80 | 34.87 | 428.23 | | 476.90 |
| River Oak Riparian woodland of the Brigalow Belt South and Nandewar Bioregions | 4.1 | 6 | River Oak Riparian woodland of the Brigalow Belt South and Nandewar Bioregions | On-site | | 10.00 | | | 10.00 |
| | | | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | Kenna | | 35.07 | | | 35.07 |
| | | | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Kenna | 10.49 | | | | 10.49 |
| | | | Heathy shrublands on rocky outcrops of the western slopes | Kenna | 18.07 | | | | 18.07 |
| | | | Cleared land | Kenna | | | | | 20.52 |
| | 210.5 | 200 | | | 706.96 | 475.66 | 461.25 | 1,168.40 | 2,832.79 |

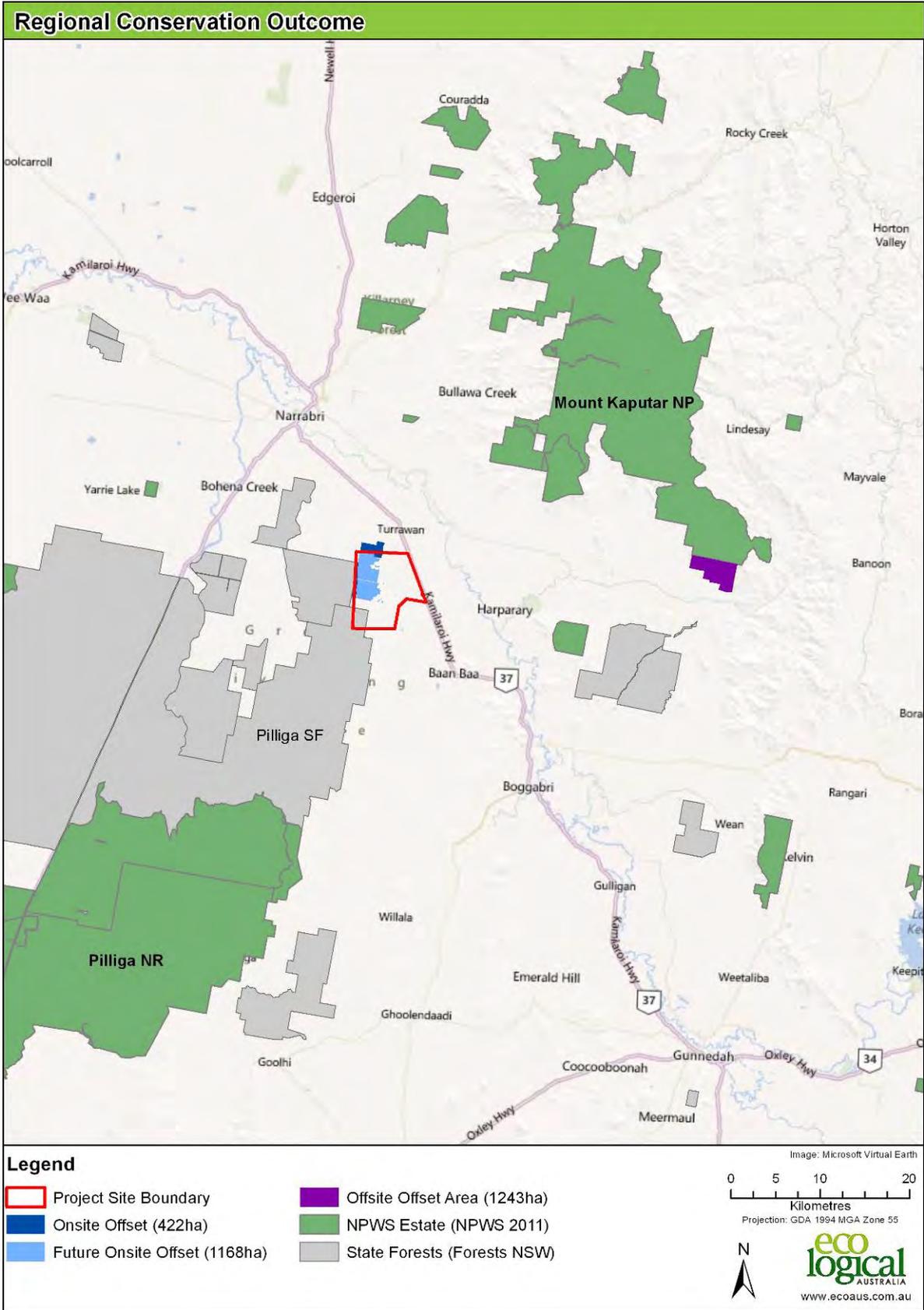


Figure 4: Regional location of proposed offset sites

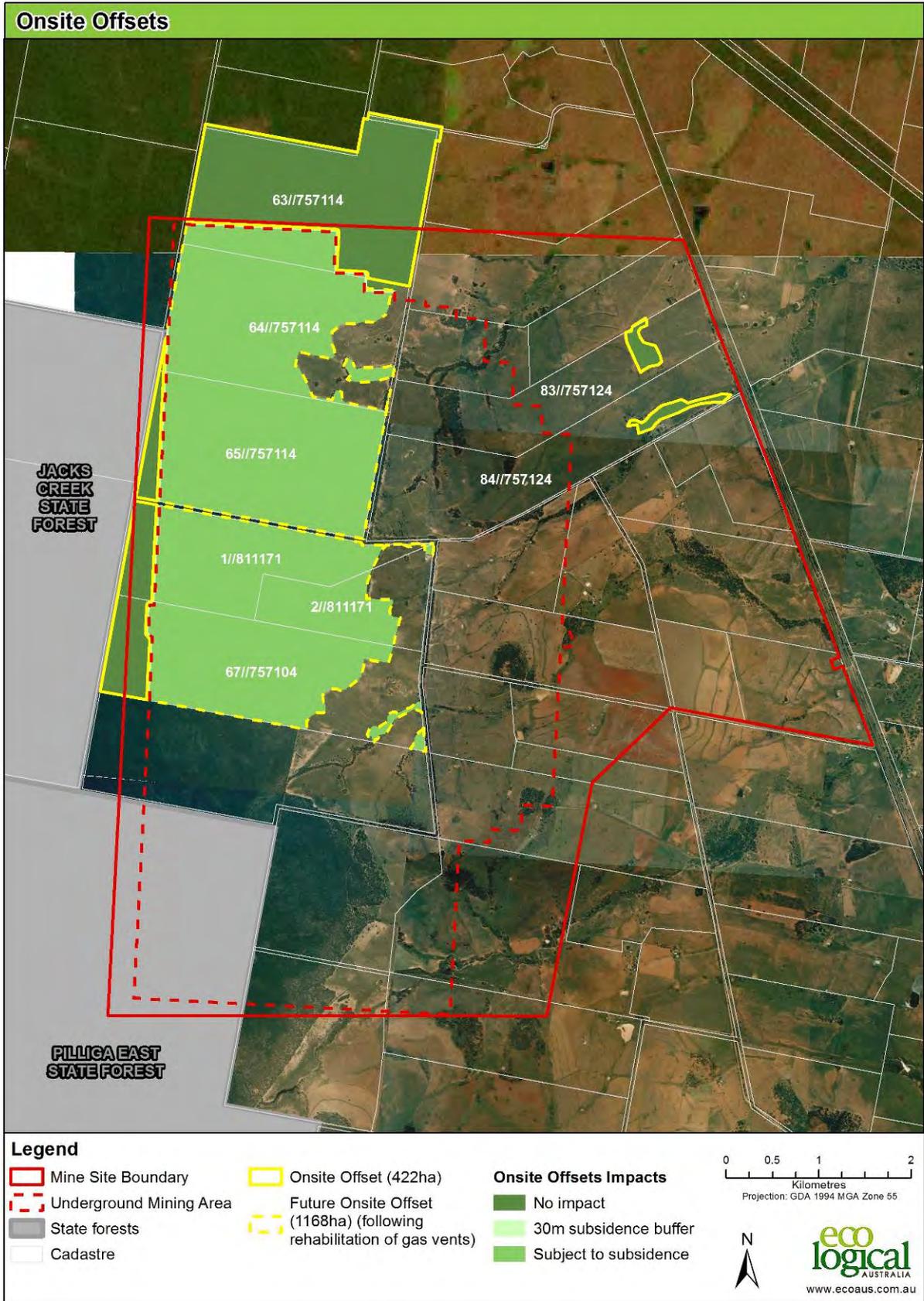


Figure 5: Area of on-site offset affected and not affected by mining activity (including a 30m buffer)

1,368 ha is the area of Lots owned by Narrabri Coal, of which 1,168 ha are vegetated.

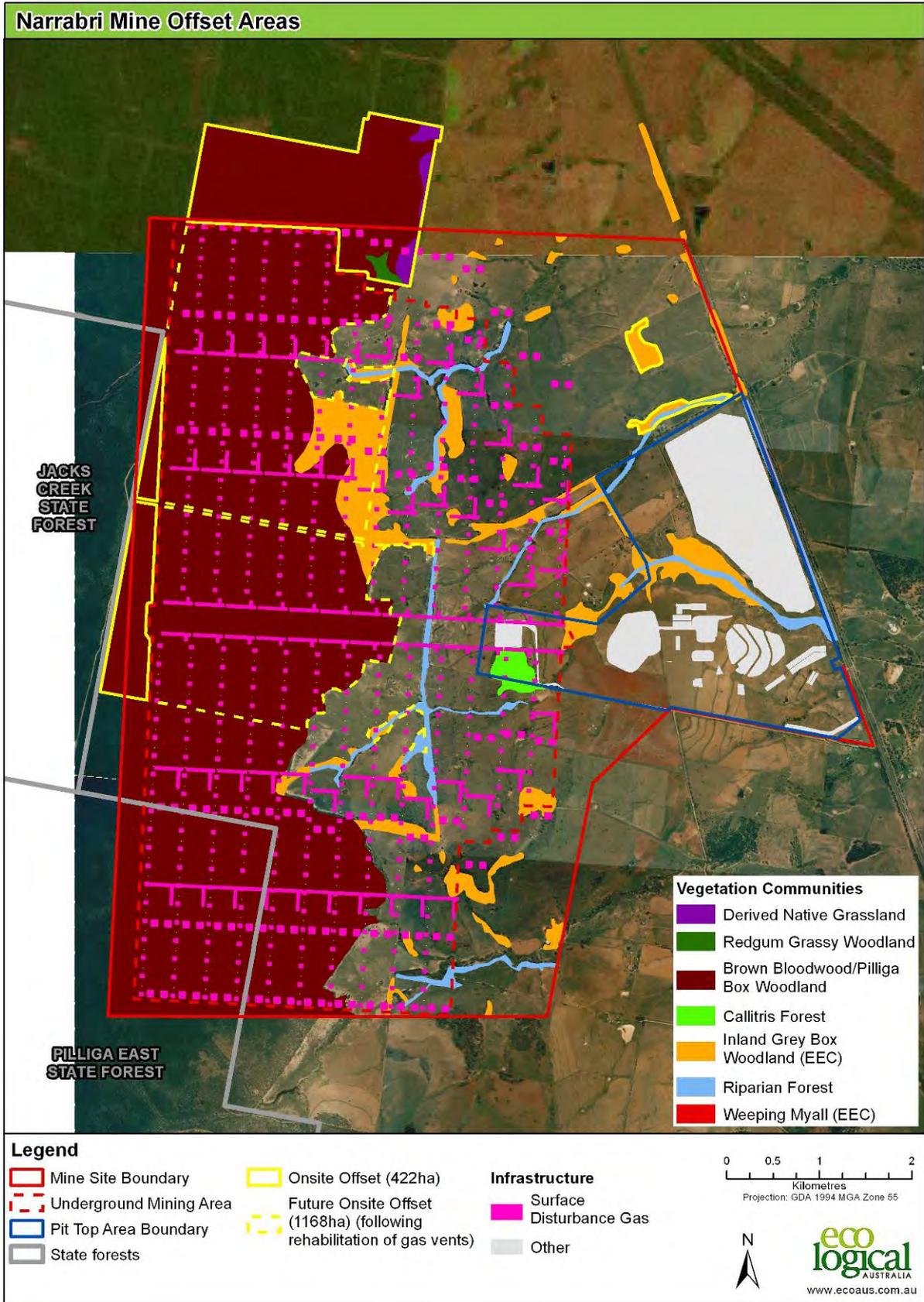


Figure 6: Proposed and future on-site offset areas

1,368 ha is the area of Lots owned by Narrabri Coal, of which 1,168 ha are vegetated

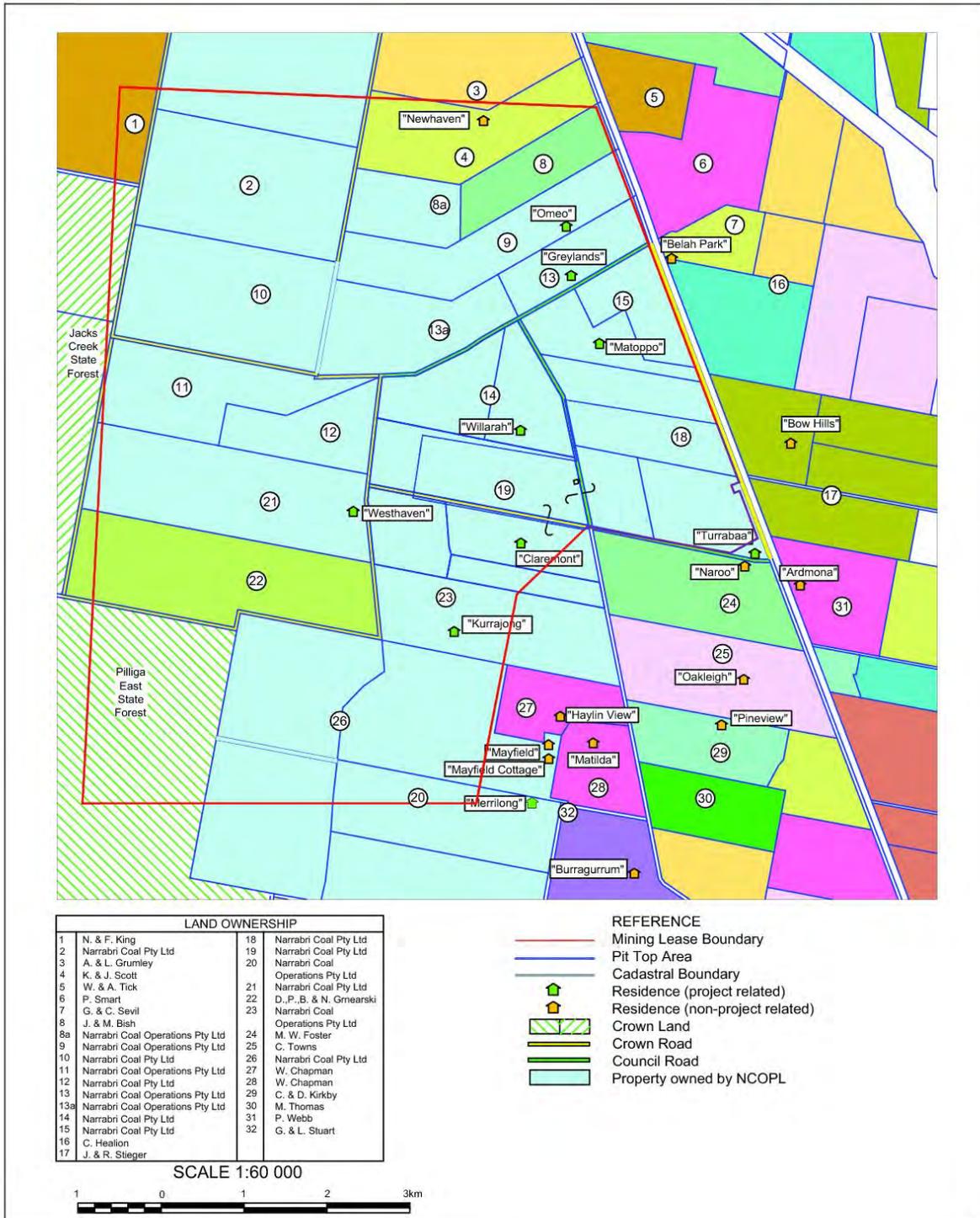


Figure 7: Land owned by Narrabri Coal Operations Pty Ltd at the Mine Site

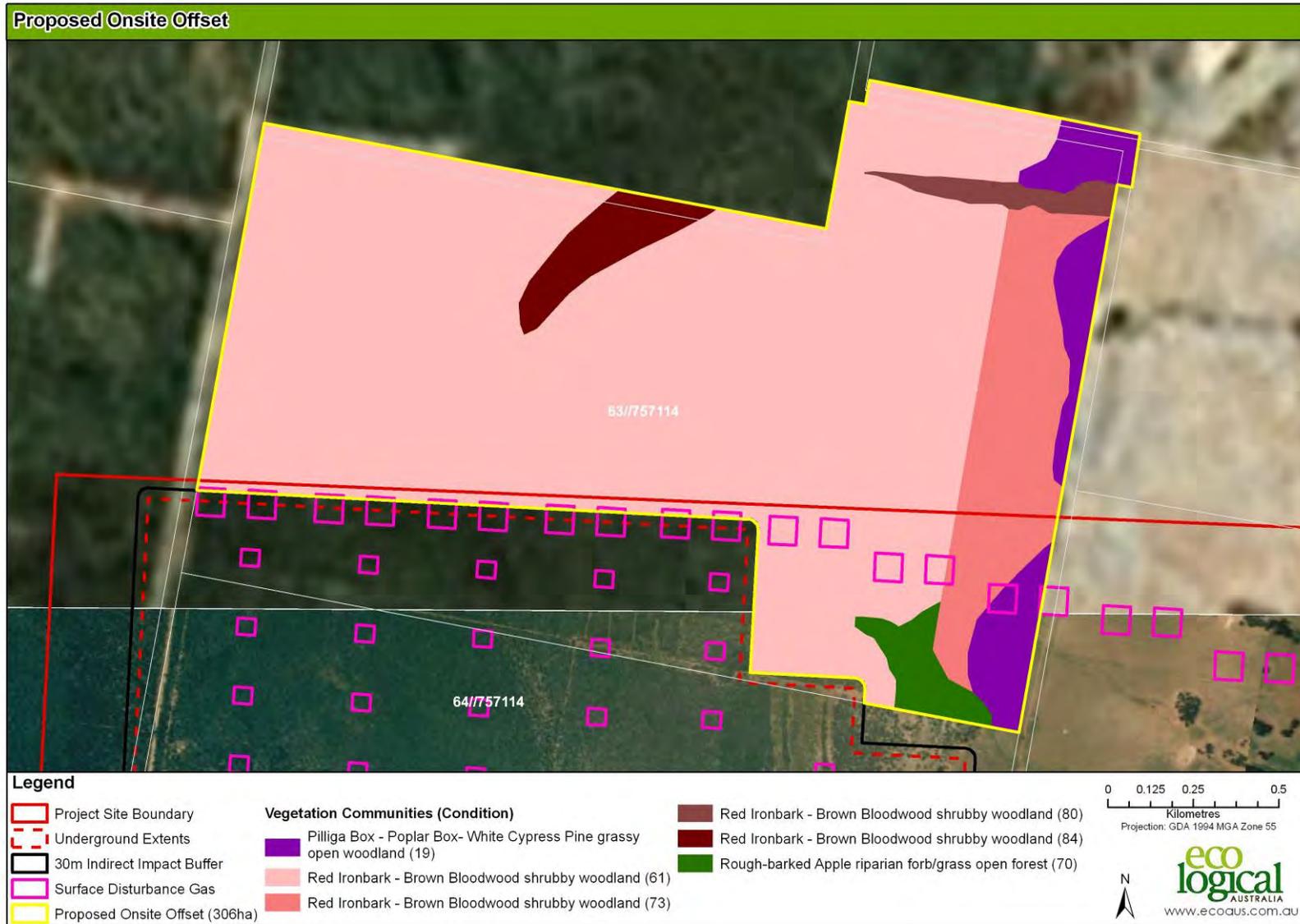


Figure 8: Lot 63 Dp 757114 vegetation and condition

4.2 OFF-SITE OFFSET AREA FOR IMPACTS TO NATIVE VEGETATION

In addition to the on-site offset areas, the proposed offset package includes an additional 1,243 ha area within a 1,840 ha property adjacent to Mount Kaputar National Park. The property, referred to as 'Kenna' will provide an off-site offset and has been purchased by NCOPL to further meet the 'like for like' and 'improve or maintain' requirements of Condition 6(c). This area includes 476.9 ha of White Box grassy woodland (37.7 ha as intact remnants and 428.2 ha as modified Derived Native Grassland (DNG) and approximately 680 ha of White Cypress Pine – Narrow-leaved Ironbark open forest (**Figure 9** and **Table 12**).

This off-site offset will enhance the on-site offset package by providing additional equivalent conservation status vegetation to offset the impacts to 24.9 ha of Inland Grey Box, and additional area to offset the indirect impacts to the Red Ironbark – Brown Bloodwood community.

A preliminary conservation values assessment of this property, consistent with discussions held with OEH regarding the scope of the assessment, was undertaken by ELA as part of preparing this offset strategy and is included at **Appendix 5**. This assessment included identifying and mapping the biometric vegetation types and relative condition across the entire property (**Figure 11** and Table 18 in **Appendix 5**). Further baseline studies as part of the implementation of the annual flora and fauna monitoring program were completed in November 2012 (Parsons Brinkerhoff 2013).

The study mapped some 831 ha of White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, all of which meets the moderate-good condition (as defined by the BBAM) of the listed EEC White Box – Yellow Box – Blakely's Red Gum Woodland (TSC Act) and White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland (EPBC Act) (i.e. greater than 50% of the ground cover consists of native species although due to past agricultural practices, much of this is in a highly modified state, has a low number of species and largely exists as a DNG). This vegetation community has been determined to be of equivalent conservation and biodiversity value to the Inland Grey Box vegetation type being impacted by the project (**Table 6**).

Large areas have at various stages been cultivated and pasture improved (clover added), but the predominance of native grasses (5-8 species per 0.04 ha plot) has persisted, there are scattered canopy species (White Box) and in places remnant patches of woodland, totalling approximately 50 ha, are in good condition with higher species richness (> 20 native species per 0.04 ha plot). Natural regeneration of the canopy is occurring.

Under appropriate conservation management, including the removal of grazing, active weed and feral animal control, and where necessary, assisted regeneration, the area of woodland (canopy and shrub cover) will significantly increase in the short to medium term and species richness can be enhanced over the long term through targeted weed control and species enrichment plantings. This 'improvement' to the biodiversity values of the "Kenna" property assists the project in meeting an 'improve or maintain' outcome (as defined in the Native Vegetation Act Regulations and the BBAM (DECC (2009))).

In the short to medium term, an actively regenerating canopy and shrub layer will provide significant extra foraging resources for a suite of threatened woodland birds and microchiropteran bats that have been recorded either on site or in the adjacent Mount Kaputar National Park. In the longer term habitat for hollow dependant threatened mammals, birds and reptile species will be created as trees mature and form hollows and fallen timber accumulates providing nesting and roosting locations. Parsons Brinkerhoff (2013) recorded 13 TSC Act listed threatened fauna species in the offset area in November 2012 including five birds (Speckled Warbler, Grey-crowned Babbler, Turquoise Parrot, Brown Treecreeper and Little Lorikeet), 2 non-flying mammals (Koala and Squirrel Glider) and six bats (Grey-headed Flying Fox, Eastern Bent-wing Bat, Eastern Falsistrelle, Yellow-bellied Sheath-tail Bat, Large-

eared Pied Bat and Eastern Cave Bat). Three of these species (Koala, Grey-headed Flying Fox and Large-eared Pied Bat are also listed on the EPBC Act.

In addition to the grassy woodland areas, the “Kenna” property also contains some 786 ha of White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest (a vegetation community determined to be of equivalent conservation and biodiversity value to the Red Ironbark-Brown Bloodwood vegetation type being impacted by the project (**Table 6**), which although parts have been subject to past timber operations (fence posts, sleepers and firewood), is in moderate to good condition, with hollow trees, fallen logs and a low incidence/cover of weeds.

Consultations with OEH have resulted in an in principal agreement to accept transfer of 520 ha of the proposed offset as an addition to the Mount Kaputar National Park (**Figure 10** and **Appendix 7**).

Narrabri Coal Operation Pty Ltd will enter into negotiations with OEH to progress the transfer of this area and address the conditions identified in the OEH letter dated 8 September 2011 (**Appendix 7**). The remaining area, 723 ha, will have an appropriate security mechanism applied in consultation with the relevant agencies, a conservation management plan prepared (ELA 2012b) and implemented (see **Section 5**) and when appropriate, and subject to agreement with the OEH, may be progressively transferred to OEH as an addition to Mount Kaputar National Park. If land transfers do not occur, the offset area will still be subject to in perpetuity protection on title and be the responsibility of Narrabri Coal to ensure appropriate management.

Table 12: Area and condition of vegetation types for the proposed offset area within the Kenna Property

| Biometric Vegetation Community | Condition | | | | | Total |
|---|---------------|---|---|---------------|--------------|-----------------|
| | Good | Scattered trees with exotic understorey | Scattered trees with native understorey | DNG (Poor) | Cleared | |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | 13.80 | 10.97 | 23.90 | 428.23 | | 476.91 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | 551.77 | | 95.99 | 33.02 | | 680.78 |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | 10.49 | | | | | 10.49 |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | | 21.13 | 13.94 | | | 35.06 |
| Heathy shrublands on rocky outcrops of the western slopes | 18.07 | | | | | 18.07 |
| Cleared | | | | | 20.52 | 20.52 |
| Total | 594.13 | 32.10 | 133.83 | 461.26 | 20.52 | 1,241.83 |

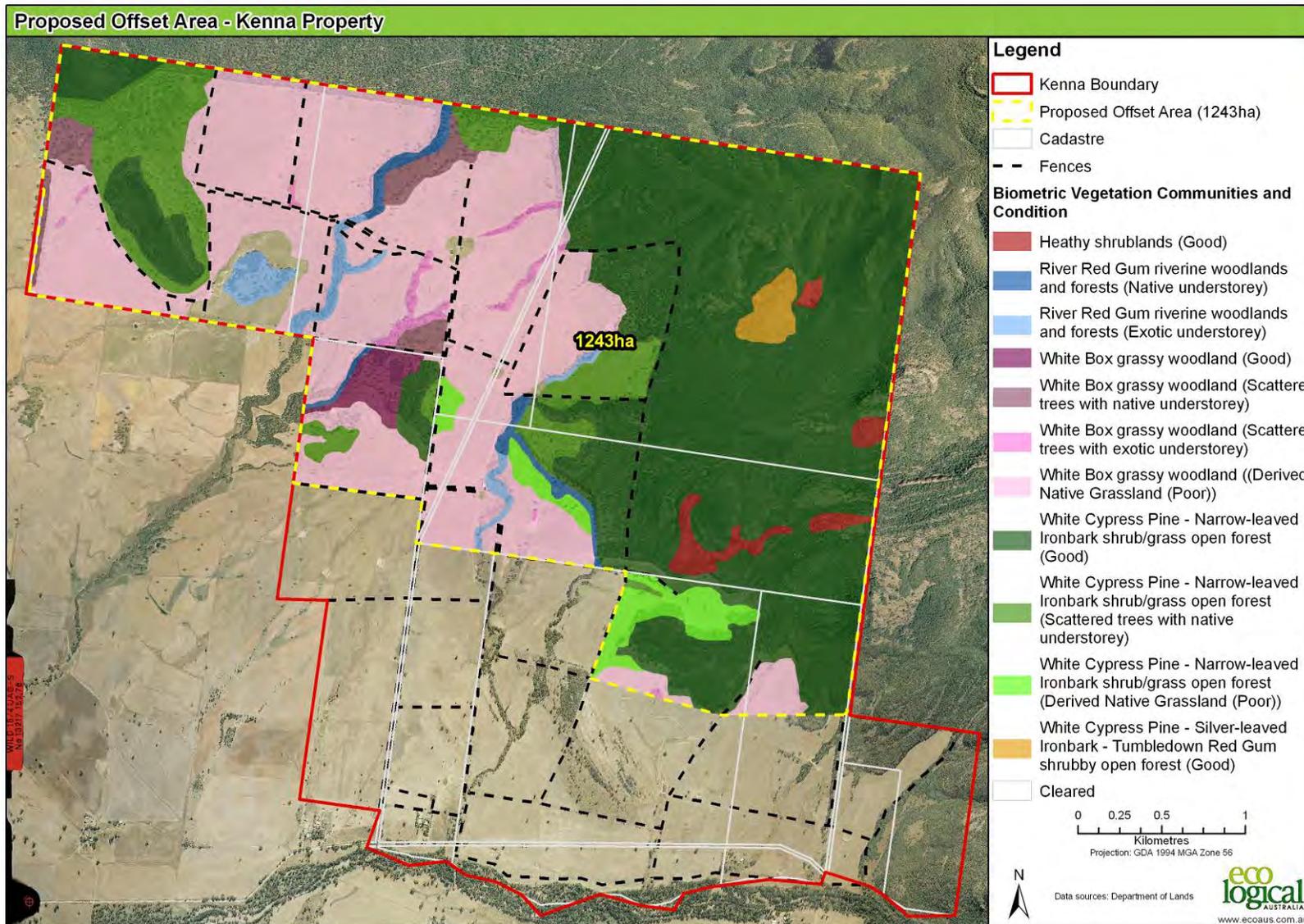


Figure 9: Proposed off-site offset area within the Kenna property.

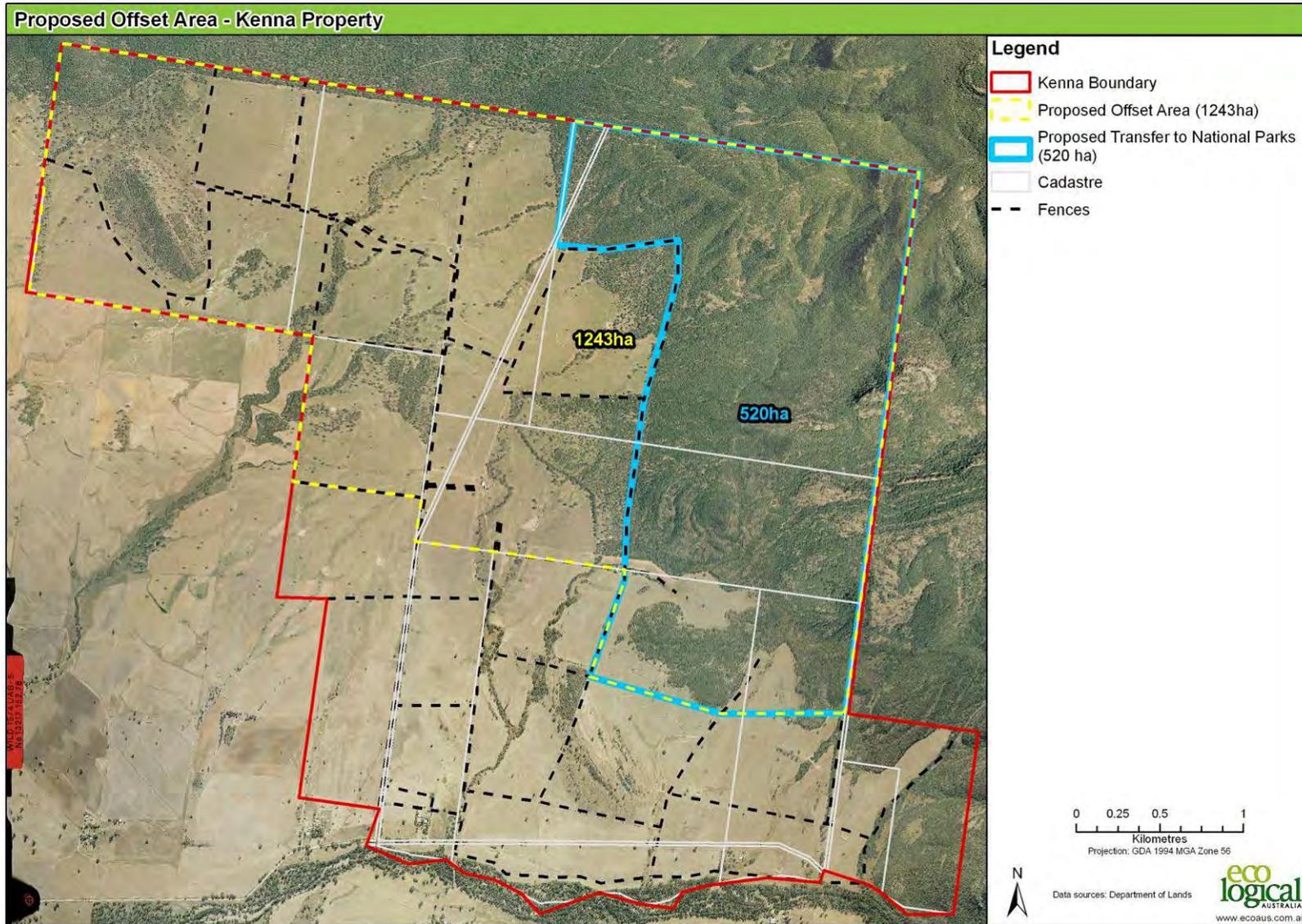


Figure 10: Areas of Kenna property that the DECCW has indicated would make suitable land transfers

4.3 ON-SITE OFFSET FOR IMPACTS TO BERTYA OPPONENS

The on-site offset package for *Bertya opposens* includes the protection of nearly 380 ha of Red Ironbark – Brown Bloodwood shrubby woodland (not affected by any direct or indirect impacts of the project) and a further 297 ha of the same vegetation community occupied by *B. opposens* which is located within the 1,168 hectares affected by subsidence. The offset provides an estimated 327,094 plants (outside the area affected by surface impacts and subsidence), with an additional estimated 169,184 plants within the subsidence area (a total of approximately 500,000 plants) (**Figures 3 and 5**).

The proposed on-site offset areas have in the order of 12 times the number of Coolabah *Bertya* that are estimated to be directly impacted by surface activities (26,654 see **Table 5**) or 18 times the number directly affected if the number of plants potentially indirectly affected by subsidence at the proposed offset site are included. As discussed in **Section 2**, the indirect impacts of subsidence at the mine site to populations of *B. opposens* are likely to be negligible given the expected extent of subsidence.

As this species appears to respond well following disturbance, there is potential that the population of *B. opposens* at the mine site may actually increase following extraction activities. This would depend both on the level of disturbance and clearing and regeneration methods used. Several areas (including firebreaks and piezometer sites) were observed to be regenerating vigorously with both native woodland and *B. opposens* as part of this assessment (**Plates 5 and 6**).

Table 13: Estimated number of *Bertya opposens* within the proposed on-site offset areas

Lot 63 of DP 757114

| Area (m ²) | Density | Total Estimated Number | Number outside subsidence area | Number within subsidence area |
|------------------------|---------|------------------------|--------------------------------|-------------------------------|
| 515,004 | 0.70 | 360,503 | 203,463 | 157,039 |
| 2,291,175 | 0.04 | 91,647 | 79,502 | 12,145 |
| 2,806,179 | | 452,150 | 282,965 | 169,184 |

Lots 65 of DP 757114

| Area (m ²) | Density | Number outside subsidence area |
|------------------------|---------|--------------------------------|
| 24,996 | 0.08 | 2,000 |
| 140,430 | 0.30 | 42,129 |
| 165,426 | | 44,129 |

Lot 64 of DP 757114

| Area (m ²) | Density | Number within subsidence area |
|------------------------|---------|-------------------------------|
| 111,828 | 0.70 | 78,280 |
| 451,149 | 0.04 | 18,046 |
| 562,977 | | 96,325 |



Plate 5: Regeneration occurring at a piezometer site



Plate 6: Dense Coolabah Bertya regrowth in a disturbed area

4.4 ON-SITE OFFSET MEASURES FOR IMPACTS TO SUPERB PARROT

The offset package proposes to protect 43 ha of preferred Superb Parrot foraging habitat, including Inland Grey Box, Blakely's Red Gum, Pilliga Box – Poplar Box and River Oak Riparian woodland in areas within the Project Site that will not be directly or indirectly affected by the project (surface impacts or mine subsidence).

The 43 hectares also includes 5.91 ha of Blakely's Red Gum grassy woodland and 17.09 ha of Pilliga Box-Poplar Box regenerating woodland. Both of these areas are within Lot 63 of DP 757114 and are not currently subject to any grazing activity. These areas form part of the 422 ha of Red Ironbark - Brown Bloodwood shrubby woodland that forms the main part of the on-site offset (**Figures 5 and 6**).

In addition to these areas, a further mapped area of 89.49 ha of Inland Grey Box and 8.63 ha of Blakely's Red Gum woodland, which will be subject to some surface impacts and mine subsidence, will be available in the long term as part of a consolidated 1,570 ha on-site offset area. Whilst this area will be subject to some surface disturbance and mine subsidence, the impacts on the habitat value to Superb Parrots is estimated to be negligible as large trees (which are well spaced in the offset area) will be avoided wherever possible and practical during the micro-siting of gas ventilation vents and access roads and the area will be progressively rehabilitated as the longwall mining proceeds. Further, only a small part of the area subject to surface impacts will be affected at any one point in time. This will provide a total area of preferred foraging/roosting habitat for Superb Parrots of 141.12 ha, or an offset to impact ratio of 4.88:1 (highlighted areas in **Table 11**).

The almost 48 ha of remnant White Box grassy woodland, 428 ha of White Box DNG and 35 ha of River Red Gum riverine forest on the "Kenna" property (**Table 12**), that form part of the overall offset package, whilst suitable for Superb Parrot foraging and roosting, are considered to be outside the non-breeding range of the species (Peter Christie, OEH, pers. comm.) and have therefore not been counted as part of the offset for this species.

5 Proposed Offset Area Management

5.1 PROTECTION OF OFFSET AREAS

The offset part of the “Kenna” property and the on-site offset will be secured for biodiversity outcomes in perpetuity in accordance with conditions of both the EP&A and EPBC Act approvals. The appropriate mechanism for long-term security is still being negotiated and the management plans will be updated and resubmitted for approval once the preferred mechanism has been identified. These mechanisms may include transfer of land to the NSW Minister for the Environment, registration of a Conservation Agreement under s.69B of the *National Parks and Wildlife Act*, entering into a Planning Agreement under s.93F of the *Environmental Planning and Assessment Act* or similar.

The Parks and Wildlife Division (PWD) of the OEH have provided in principle agreement to the transfer of 520 ha of the proposed offset area on “Kenna” to the NSW Minister for the Environment as an addition to Mount Kaputar National Park (indicated in **Figure 10**). This in principle agreement is subject to a number of conditions (**Appendix 7**). Ongoing negotiations will take place with the PWD to reach agreement on management funds required and other land transfer costs prior to commencing the land transfer process.

Whilst some parts of the offset area (both on and off-site) may currently not be considered suitable for transfer, these areas will be reviewed at appropriate intervals following recovery/enhancement to woodland values and may progressively be transferred in the future, subject to the OEH's agreement.

All land not transferred to the National Parks estate will remain the responsibility of NCOPL to manage in accordance with the Biodiversity Offset Management Plan (BOMP) (ELA 2013b).

5.2 PREPARATION OF OFFSET AREA MANAGEMENT PLANS

Biodiversity Offset Management Plans (BOMP) (ELA 2013a & b) have been prepared for the on-site and off-site offset areas to guide the management of those parts of the properties identified as offset areas to improve and maintain the biodiversity values (**Appendices 8 & 9**).

The range of management actions include, but not necessarily limited to, the following:-

- Removal of grazing – the property is currently grazed by cattle which are preventing the regeneration of woodland canopy species. Grazing will be progressively excluded from the offset area to promote the natural regeneration of woodland canopy species. Should natural regeneration not occur, a program of tree planting will be implemented and prioritised to linking remnant patches of woodland vegetation types. Planting densities have been determined to achieve a typical canopy cover for White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions, typically an average of around 50 trees per ha;
- Feral animal control - rabbits, feral goats and feral pigs have been identified as being present on the properties and impeding the regeneration of woodland and other vegetation types. A vertebrate pest management program will be implemented to reduce the numbers of these feral animals. The program will achieve greater landscape benefits if implemented in conjunction with neighbours, including the NPWS. Consultation will take place with the NPWS and other neighbours to coordinate control programs to achieve the most cost effective conservation benefits;

- Weed control – a range of environmental and noxious weeds, generally in low abundance or concentrated in particular areas, have been recorded on the “Kenna” and mine site properties. A weed control program will be implemented to reduce the incidence and spread of weed species, including the reduction in exotic clover cover;
- Removal of internal fencing – the “Kenna” property is currently managed as a grazing enterprise and is divided into a number of grazing paddocks. Internal fences within the offset area will be progressively removed to provide free movements of mobile fauna species across the site. The identified offset area at the mine site will be fenced to exclude grazing activity from adjacent lease areas. Temporary fencing will be maintained around areas subject to planting activities;
- Collection of firewood and cutting of fence posts will be prohibited from within the offset area to allow an accumulation of fauna habitat features over time;
- Implementation of an ecological fire regime; and
- Management of surface disturbance activities at both the on-site and off-site offset areas for sites/items of Aboriginal cultural significance.

The implementation of the management plans will be funded for a period of 20 years, or until the completion criteria are met, following approval of the Biodiversity Offset Strategy.

At the completion of the initial 20 year management program, long term management arrangements (which may include transfer of further lands to NPWS) will be investigated. It is noted that the security mechanism referred to in **Section 5.1** will be in perpetuity. These investigations will also include the long term management and ownership of the rehabilitated areas subject to gas extraction and subsidence.

5.3 FLORA AND FAUNA MONITORING PROGRAM

An annual monitoring program for revegetation success, condition of the conserved remnant and utilisation by key indicator species is proposed for a 20 year period post approval, or until the completion criteria are met. The monitoring program would be based on the collection of a detailed baseline flora and fauna inventory, (using the assessment in **Appendices 4 & 5** as a base), mapping progressive changes in tree and shrub regeneration and changes in ground cover richness at intervals. Full details of the monitoring program are included in the BOMPs (ELA 2013a & b – **Appendices 8 & 9**).

The first year baseline studies were completed in November 2012 (Parsons Brinkerhoff (2013)).

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Appendix 1: NSW Offsetting Principles

These offset principles are from the OEH website (30/5/2010):

1. Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

2. All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

3. Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

4. Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

5. Offsets must be underpinned by sound ecological principles.

They must:

- include the consideration of structure, function and compositional elements of biodiversity, including threatened species
- enhance biodiversity at a range of scales
- consider the conservation status of ecological communities
- ensure the long-term viability and functionality of biodiversity.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

7. Offsets must be enduring & they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

8. Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

9. Offsets must be quantifiable & the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- the area of impact
- the types of ecological communities and habitat/species affected
- connectivity with other areas of habitat/corridors
- the condition of habitat
- the conservation status and/or scarcity/rarity of ecological communities
- management actions
- level of security afforded to the offset site.
- the best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:
 - they protect land with high conservation significance
 - management actions have greater benefits for biodiversity
 - the offset areas are not isolated or fragmented
 - the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).
- management actions must be deliverable and enforceable.

10. Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

11. Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

12. Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Appendix 2: Draft Commonwealth Offsetting Principles

Commonwealth (DEWR 2007) as relevant at the time of project approval.

While the Commonwealth do not have a formal methodology for calculating offset requirements, there are draft policies in place that provide the principles deemed appropriate when offsetting the impact of vegetation clearance (DEWR 2007). The Australian Government's position is summarised as follows.

1. Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

This policy identifies two kinds of biodiversity offset, 'direct offsets' including such measures as long-term protection of existing habitat, and 'indirect offsets' for such measures as implementing recovery plan actions or contributions to relevant research.

The proposed LOM Project BOS has been designed to meet the nominated principles and goals of both the NSW and Commonwealth jurisdictions.

Appendix 3: Biometric Condition Assessment – Mine Site

VEGETATION CONDITION ASSESSMENT IMPACT AREAS

Rapid Assessment Plots (20 m x 20 m) were undertaken in as many patches of mapped vegetation across the mine site as practicable to determine the biometric site condition scores against benchmarks for each vegetation types and inform the 'maintain or improve' assessment. A total of 20 rapid assessment plots were completed across the mine site and offset site in order to adequately assess the condition of the vegetation. Within each plot, the native species richness; native and exotic species cover; hollow bearing trees; over-storey regeneration; and length of fallen logs were assessed. Native cover in each structural layer was visually estimated.

Plot data was categorised into BioMetric vegetation types according to the Vegetation Types Database (DECCW 2009a) and then compared against the Vegetation Type Benchmarks (DECCW 2009b) to develop an accurate and repeatable condition score for each plot. The plot data for each site attribute was compared against the relevant benchmark for the vegetation type utilising the BioMetric tool. The final score for each rapid assessment plot (out of a maximum 100 points) was then assigned a condition rating (low = 0 to 16, low-moderate = 17 to 33, moderate = 34 to 50, moderate-high = 51 to 67, high = 68 to 84, very high = 85 to 100). (Tables 14 and 15).

The condition of patches across the site was variable, ranging from low in the derived native grasslands in the northern offset site to very high in the central western portion of the site in selectively logged woodland. Patches which scored high (scores >68) generally had all structural layers present, moderate species diversity, low exotic cover and some fauna habitat features such as hollows or logs.

Table 14: BioMetric vegetation types present across the mine site

| BioMetric Vegetation Type | Equivalent RVC | Disturbance History | BioMetric Site Value Scores | Average BioMetric Score | Condition Range |
|---|----------------|---|--|-------------------------|-----------------------|
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | RVC 33 | Selectively logged / under-scrubbed | 74, 84 | 79 (High) | High |
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) | RVC 32 | Selectively logged woodland to isolated and degraded paddock remnants | 48, 51, 61, 65, 69, 70, 77, 79, 81, 83, 85 | 69 (High) | Moderate to Very High |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | RVC 20 | Under-scrubbed/thinned | 69, 70, 72 | 70 (High) | High |

Table 15: Rapid assessment plot data

| Plot | Ecotone (2009) Vegetation Community | BioMetric Vegetation Type | Number of native plant species | Native over-storey cover (%) | Native mid-storey cover (%) | Native ground cover (hits/50 points) – Grasses | Native ground cover (hits/50 points) – shrubs | Native ground cover (hits/50 points) – other | Exotic plant cover | Number of trees with hollows | Over-storey regeneration | Total length fallen logs >10cm width (m) | BioMetric Score | Relative Condition |
|------|--------------------------------------|--|--------------------------------|------------------------------|-----------------------------|--|---|--|--------------------|------------------------------|--------------------------|--|-----------------|--------------------|
| 1 | Not mapped | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 10 | 0 | 0 | 88 | 0 | 4 | 16 | 0 | 1 | 0 | 19 | Low-Mod |
| 2 | Outside assessment area | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 20 | 20 | 40 | 5 | 5 | 10 | 0 | 1 | 1 | 10 | 61 | Mod-High |
| 3 | Outside assessment area | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 15 | 20 | 20 | 10 | 10 | 0 | 0 | 2.5 | 1 | 50 | 80 | High |
| 4 | Outside assessment area | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 25 | 20 | 10 | 40 | 5 | 2 | 5 | 1.5 | 1 | 30 | 73 | High |
| 5 | Brown Bloodwood/Pilliga Box Woodland | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 30 | 25 | 40 | 5 | 20 | 10 | 0 | 3 | 1 | 50 | 84 | High |
| 6 | Brown Bloodwood/Pilliga Box Woodland | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | 20 | 30 | 20 | 7 | 5 | 5 | 0 | 6 | 1 | 30 | 70 | High |
| 7 | Inland Grey Box Woodland (EEC) | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | 20 | 25 | 20 | 10 | 0 | 15 | 5 | 2 | 1 | 50 | 69 | High |
| 8 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 25 | 15 | 10 | 40 | 1 | 3 | 10 | 2 | 1 | 20 | 79 | High |
| 9 | Riparian Forest | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 25 | 25 | 15 | 10 | 2 | 2 | 20 | 3 | 1 | 25 | 81 | High |
| 10 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 20 | 20 | 2 | 35 | 1 | 3 | 2 | 2 | 1 | 5 | 65 | Mod-High |
| 11 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 20 | 20 | 8 | 30 | 0 | 3 | 10 | 2 | 1 | 5 | 70 | High |
| 12 | Inland Grey Box Woodland | Red Ironbark - Brown Bloodwood | 20 | 20 | 20 | 5 | 3 | 2 | 1 | 1 | 1 | 30 | 74 | High |

| Plot | Ecotone (2009) Vegetation Community | BioMetric Vegetation Type | Number of native plant species | Native over-storey cover (%) | Native mid-storey cover (%) | Native ground cover (hits/50 points) – Grasses | Native ground cover (hits/50 points) – shrubs | Native ground cover (hits/50 points) – other | Exotic plant cover | Number of trees with hollows | Over-storey regeneration | Total length fallen logs >10cm width (m) | BioMetric Score | Relative Condition |
|------|--------------------------------------|---|--------------------------------|------------------------------|-----------------------------|--|---|--|--------------------|------------------------------|--------------------------|--|-----------------|--------------------|
| | (EEC) | shrubby woodland of the Brigalow Belt South Bioregion | | | | | | | | | | | | |
| 13 | Brown Bloodwood/Pilliga Box Woodland | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 25 | 25 | 33 | 10 | 2 | 2 | 0 | 2 | 1 | 50 | 83 | High |
| 14 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 25 | 25 | 7 | 40 | 1 | 2 | 1 | 4 | 1 | 50 | 85 | Very High |
| 15 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 25 | 30 | 30 | 40 | 5 | 2 | 0 | 1 | 1 | 50 | 77 | High |
| 16 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 15 | 35 | 1 | 20 | 2 | 2 | 15 | 0 | 1 | 50 | 51 | Mod-High |
| 17 | Riparian Forest | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 20 | 20 | 20 | 40 | 2 | 3 | 0 | 0 | 1 | 50 | 61 | Mod-High |
| 18 | Inland Grey Box Woodland (EEC) | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 17 | 40 | 20 | 20 | 1 | 1 | 1 | 0 | 1 | 0 | 48 | Mod |
| 19 | Inland Grey Box Woodland (EEC) | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | 20 | 50 | 2 | 50 | 0 | 5 | 5 | 2 | 1 | 24 | 72 | High |
| 20 | Callitris Forest | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams | 20 | 50 | 2 | 50 | 0 | 5 | 5 | 2 | 1 | 24 | 69 | High |

Appendix 4: Conservation Values Assessment of Lot 63 DP 757114

Conducted by Martin Sullivan, Eco Logical Australia, 17th-19th August 2010.

Vegetation Communities

A total of three BioMetric vegetation types were recorded across the proposed offset site in a range of condition states from derived native grasslands, advanced regeneration to selectively logged remnants. The vast majority of the offset site had been clear-felled approximately 20-30 years ago, consisting predominantly of moderately dense advanced regrowth. Mature remnant trees occur along minor drainage lines in the north and south of the offset site as well as in a relatively large rectangular patch in the east of the proposed offset area. Small patches of derived native grassland occur along the eastern boundary where the soils are likely to be of greater fertility. The major vegetation type at the offset site has been identified as Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion.

The three vegetation types present within the study area include:

- Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion;
- Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88); and
- Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion.

The vegetation types were divided into broad condition categories based on the structure, age and disturbance history of the vegetation. The following disturbance categories were assigned:

- All native strata present with evidence of under-scrubbing/thinning;
- Dense regrowth; and
- Derived native grassland with canopy and shrub layers removed.

The Namoi CMA has mapped the study area and this mapping was ground-truthed as part of the assessment. The CMA mapping is in accordance with the Regional Vegetation Community (RVC) classifications. In some cases, more than one BioMetric vegetation type has been incorporated into the one RVC. Table 16 lists each vegetation type recorded across the study area in accordance with the condition and the associated RVC. A description of each vegetation type and condition is included below.

Table 16: Vegetation types present across Lot 63 DP 757114

| BioMetric Vegetation Type | Equivalent RVC | Condition Categories |
|---|----------------|---|
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | RVC 33 | Dense regrowth and under-scrubbed/thinned |
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) | RVC 32 | Derived Native Grassland |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | RVC 20 | Underscrubbed / thinned |

Rapid biometric vegetation condition assessment plots (20 m x 20 m) were undertaken in each vegetation type and condition to assess native species richness; native and exotic species cover; hollow bearing trees; over-storey regeneration; and length of fallen logs. Native cover in each structural layer was visually estimated. Many of the mature remnant trees along the drainage lines were observed to be utilised by native birds such as Cockatoos and Galahs.

Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion

This vegetation type dominated the proposed offset site on the infertile and often rocky, shallow sandy soils. It ranged in condition from under-scrubbed/thinned woodland along drainage lines and across the east of the site to dense regrowth across the western portion of the site. This vegetation type is equivalent to RVC 33 *Ironbark shrubby woodlands of the Pilliga area, Brigalow Belt South*.

The canopy was dominated by Red Ironbark (*E. fibrosa*) with Brown Bloodwood (*Corymbia trachyphloia* ssp. *amphistomatica*) forming an occasional component. Scattered within the woodland were various other eucalypt species including Blakely's Red Gum (*E. blakelyi*) and mallee forms of Dwyer's Red Gum (*E. dwyeri*). Along the eastern transitional boundary of this vegetation type, Pilliga Box (*Eucalyptus pilligaensis*) and White Box (*E. albens*) were observed. Common midstorey species included White Cypress Pine (*Callitris glaucophylla*), Motherumbah (*Acacia cheelii*), Burrow's Wattle (*Acacia burrowii*), *Philotheca ciliata* and *Boronia* spp. The state and federally listed vulnerable shrub species Coolabah *Bertya* (*Bertya opposens*) was common in this community, particularly in previously disturbed areas such as the dense regrowth woodland and along tracks. Along the north-eastern drainage line, this community includes species such as Belah (*Casuarina cristata*) and Deane's Wattle (*Acacia deanei*).

The groundlayer was sparse to absent in the west of the site amongst the dense regrowth and was grassy in the east of the site including a diverse range of herbs and forbs.

Groundlayer species included *Aristida* spp., Brown's Lovegrass (*Eragrostis brownii*), Mulga Fern (*Cheilanthes sieberi*), Ivy-leaved Goodenia (*Goodenia hederacea*), Honey Myrtle (*Homoranthus flavescens*) and Flax-lily (*Dianella revoluta*)

Total Native Species: 20 - 25

Condition:

Despite occurring across a range of condition states, this community is considered to be in good condition overall with few exotic species being recorded. BioMetric site value scores (out of a maximum of 100) for this community ranged from 61 in the dense regrowth, to 84 along the drainage line in the north of the offset site (Table 15).

Fauna habitat features:

This area supports a dense shrub layer that is likely to be used by small birds for shelter. Areas with remnant hollow bearing trees are likely to support larger avifauna and bats. The diversity of flowering shrubs is also likely to provide significant fauna foraging resources. A medium sized farm dam is located in the north-eastern corner of the offset site and is likely to provide additional foraging and roosting habitat for a range of fauna species.



Plate 7: Dense regrowth

Management Issues:

Current conservation management of the proposed offset site is limited with both feral pigs and goats observed during the site inspection with pig damage frequently being observed throughout the offset site, particularly in the dense regrowth areas. No formal grazing of the offset site has occurred since the property was acquired by Narrabri Coal. The entire offset site is currently fenced to exclude grazing from adjacent lands with gated access points from the north-east, south-east and north-west. While the entire offset is currently fenced, the condition of the fencing is variable with many posts likely to require replacement within 5-10 years.



Plate 8: Current state of fencing at the proposed offset site



Plate 9: Remnant trees along an ephemeral drainage line with evidence of under-scrubbing/thinning



Plate 10: Large hollow in a Red Ironbark along the ephemeral drainage line



Plate 11: Scattered remnant trees with evidence of under-scrubbing/thinning and grazing



Plate 12: North-eastern drainage line

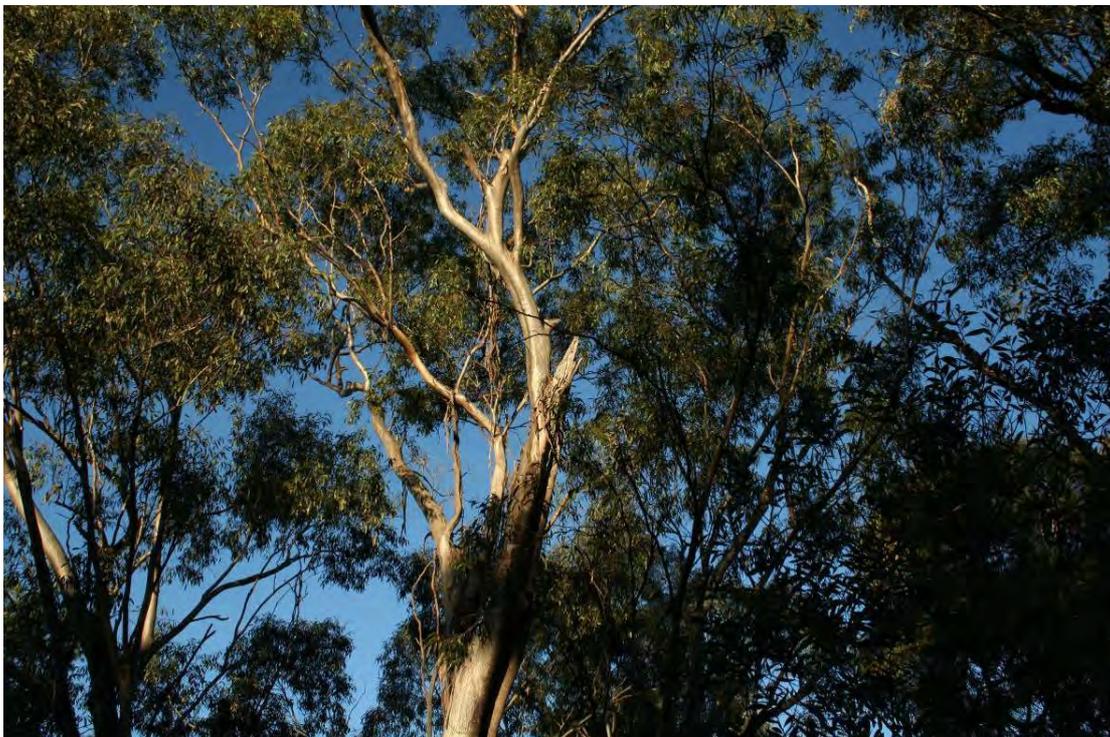


Plate 13: Hollow bearing Pilliga Box in the northern drainage line

Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland on alluvial loams

This vegetation type would have previously occurred along the eastern boundary of the offset site on slightly more fertile sandy soils. This vegetation community now only exists as derived native grassland which has had the canopy, midstorey and shrub layers removed. This vegetation type is equivalent to RVC 32 *Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams, Darling Riverine Plains and Brigalow Belt South*.

Groundlayer species included Red Grass (*Bothriochloa decipiens*), Barbed Wire Grass (*Cymbopogon refractus*), Mulga Fern (*Cheilanthes sieberi*), Western Rat-tail Grass (*Sporobolus creber*) and *Aristida* spp.

Commonly observed weeds included Perennial Ryegrass (*Lolium perenne*) and Burr Medic (*Medicago* sp.).

Total Native Species: 10

Condition:

As this community has undergone major structural modification and is relatively species poor, it is considered to be in low condition overall. Derived native grasslands have however been identified as being of conservation significance given the amount of clearing which has been undertaken in grassy woodlands. The BioMetric site value score (out of a maximum of 100) for this community was 19 (Table 15).

Fauna habitat features:

The habitat value of this vegetation type is limited with some small birds such as Songlarks and Quails likely to seek shelter in the tall grass. This area would also be utilised by reptiles and birds of prey for foraging on small mammals such as the House Mouse (*Mus musculus*) that are likely to use this vegetation.

Management Issues:

Regeneration of both the shrub and canopy layers was observed to be occurring, particularly along the edges of the adjoining woodland. White Cypress Pine has the potential to vigorously regenerate and dominate areas such as this.



Plate 14: Derived native grasslands



Plate 15: Tree and shrub regeneration in the derived native grasslands

Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion

This vegetation type occurred in a small patch in the south-east of the offset site on a relatively flat ephemeral drainage line. This vegetation type had been under-scrubbed/thinned and would have previously been grazed. This vegetation type is equivalent to RVC 20 *Rough-barked Apple - Blakely's Red Gum riparian grassy woodlands, Brigalow Belt South and Nandewar* and forms part of the listed NSW EEC White Box Yellow Box Blakely's Red Gum Woodland.

The canopy was dominated by Blakely's Red Gum (*Eucalyptus blakelyi*) and Rough-barked Apple (*Angophora floribunda*). White Cypress Pine (*Callitris glaucophylla*) occurred as a common midstorey component with occasional Kurrajong (*Brachychiton populneus*). Shrubs were virtually absent from this vegetation type.

The groundlayer was grassy and included a diverse range of herbs and forbs.

Groundlayer species included *Aristida* spp., Barbed Wire Grass (*Cymbopogon refractus*), Flax-lily (*Dianella revoluta*) and Kidney Weed (*Dichondra repens*).

Total Native Species: 20

Condition:

Despite having been under-scrubbed/thinned and grazed, this community is considered to be in good condition overall with few exotic species being recorded. The BioMetric site value score (out of a maximum of 100) for this community was 70 (Table 15).

Fauna habitat features:

This area supports a number of remnant hollow bearing trees which are likely to support larger avifauna and bats.

Management Issues:

Goats were sighted grazing in the adjoining vegetation type and are likely to utilise this vegetation type from time to time. Vigorous White Cypress Pine regrowth is occurring in some areas.



Plate 16: Rough-barked apple riparian forb/grass open forest of the Nandewar Bioregion



Plate 17: Large hollow bearing Blakely's Red Gum

Appendix 5: Conservation Values Assessment of “Kenna” Property

Conducted by Tammy Haslehurst and Daniel Magdi, Eco Logical Australia, 1-11 August 2010 and Tammy Haslehurst, Melissa Head and Martin Sullivan, 17-20 August 2010.

Vegetation Communities

The Namoi CMA has mapped the study area at a landscape scale (ELA 2009). The CMA mapping was ground-truthed as part of the assessment. The CMA mapping uses Regional Vegetation Community (RVC) classifications, whilst DECCW's preferred vegetation classification is the Biometric vegetation types database (DECCW 2010b). In some cases, more than one biometric vegetation type has been incorporated into the one RVC. Table 17 lists each vegetation type recorded across the study area in accordance with the condition and the associated RVC.

A total of five biometric vegetation types were recorded and mapped across the Kenna property although they were of varying condition. The site has a long history of logging and agricultural use and as such all areas have suffered some level of past disturbance. The most intact stands of vegetation occur on the western portion of the property and along Maules Creek on the southern boundary. Smaller stands of moderate – good condition vegetation are also present in the central and north–western portions of the site. The majority of the site is comprised of derived native grasslands derived primarily from one of two vegetation types, White Box grassy woodland or White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest.

The five vegetation types mapped within the study area are (Figure 11):

- White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions;
- White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion;
- White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions;
- River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions; and
- Heathy shrublands on rocky outcrops of the western slopes

The vegetation types were broken into four condition categories in accordance with the following:

- All native strata present – good condition;
- Scattered characteristic native trees and native groundlayer (> 50 % native) – scattered trees (native);
- Scattered characteristic native trees and exotic groundlayer (> 50 % exotic) – scattered trees (exotic);

- Derived grassland – native (Poor or highly modified); and
- Cleared land - areas without a native canopy and with > 50 % of the ground cover consisting of exotic species were mapped as cleared land consistent with the Native Vegetation Act and Biobanking Methodology.

The area of each vegetation type mapped is shown in Table 18.

Quadrats (20 m x 20 m) were undertaken in most vegetation types and conditions to assess the species richness. The total number native species recorded within each plot has been noted for each vegetation type and is included in Table 19.

Hollow-bearing trees that were encountered were also recorded and their location is shown on Figure 8. Although this is not a comprehensive assessment of all hollow bearing trees on the property. The majority of the hollows were small to medium in size likely to be used by birds and bats with few large hollows suitable for use by owls. Many of the larger hollows were seen to already be being utilised by Cockatoos or Galahs. A number of nests were also present within scattered trees throughout the study area.

Table 17: Vegetation types present across the study area

| Biometric Vegetation Type | Equivalent RVC | Condition Category |
|---|-------------------------------|---|
| Heathy shrublands on rocky outcrops of the western slopes | RVC 62 | Good |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | RVC 72 | Native understorey |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | RVC 72 & RVC 73 | Exotic understorey |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | RVC 28 Derived from RVC 18 | Derived BGW (Poor Condition highly modified) |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | RVC 18 | Scattered trees with exotic understorey |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | RVC 18 | Scattered trees with native understorey |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | RVC 18 | Good |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | RVC 59 | Scattered trees native understorey |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | RVC 59 | Good |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | RVC 59 | Highly degraded |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | RVC 44 | Good |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | RVC 44 | Scattered trees with native understorey |

Table 18: Area and condition of biometric vegetation types on Kenna

| Off-site Offset Vegetation Types | Condition | Area (ha) | Proportion (%) |
|---|--|-----------------|----------------|
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Good (Intact canopy and ground cover) | 14.52 | 0.84% |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Scattered trees with native understorey | 33.75 | 1.95% |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Scattered paddock trees with exotic understorey | 12.96 | 0.75% |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | Derived Native Grassland (poor species richness) | 770.36 | 44.42% |
| Sub-total | | 831.59 | 47.95% |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Good | 619.60 | 35.73% |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Scattered trees with native understorey | 111.25 | 6.41% |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | Derived Native Grassland (poor species richness) | 55.18 | 3.18% |
| Sub-total | | 786.03 | 45.32% |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Good | 10.49 | 0.60% |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | Scattered trees with native understorey | 3.19 | 0.18% |
| Sub-total | | 13.68 | 0.79% |
| Heathy shrublands on rocky outcrops of the western slopes | Good | 18.24 | 1.05% |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | Exotic understorey | 38.09 | 2.20% |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions | Native understorey | 46.65 | 2.69% |
| Total | | 1,734.28 | 100.00% |
| Cleared land (no canopy and <50% native ground cover) | | 105.25 | |

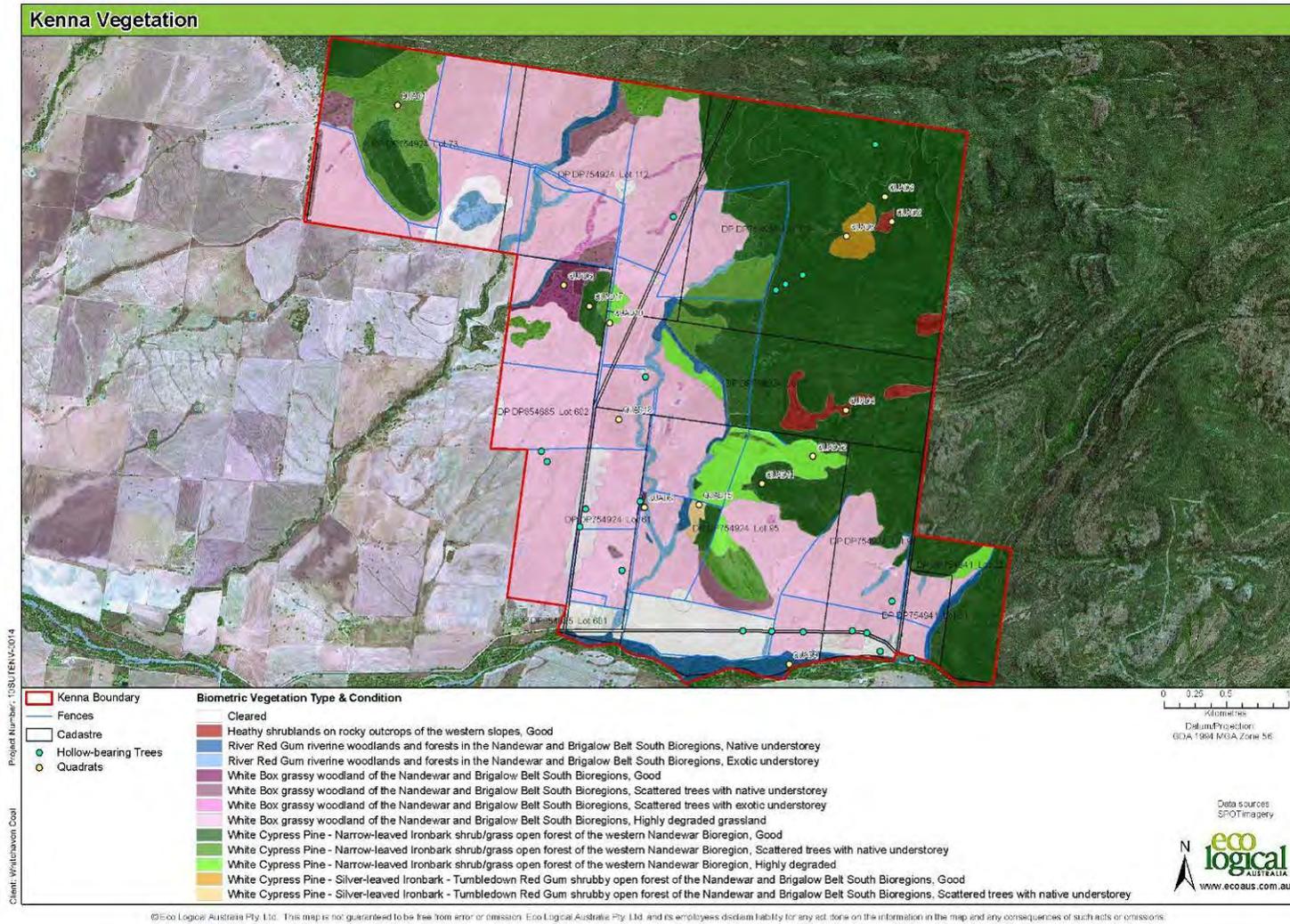


Figure 11: Mapped biometric vegetation types of Kenna

White Box Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions

White Box Grassy Woodland is the dominant vegetation type across the study area although the majority has been cleared and is now present as derived grassland with the occasional White Box (*Eucalyptus albens*) scattered throughout. The vegetation is characteristic of two RVCs; RVC 18 (White Box grassy woodland, Brigalow Belt South and Nandewar) and RVC 28 (Derived grasslands, Brigalow Belt South and Nandewar). The most intact stand is present in the centre of the site (Lot 602). Although all areas have undergone past disturbance and are currently grazed, the species diversity in this area is greater than in the areas of derived grassland with a number of herbs and forbs also present and a characteristic canopy.

All strata present – good condition

This community was present within Lot 602 and was dominated by native species in all strata. The canopy was dominated by *Eucalyptus albens* and *Callitris glaucophylla*. *Eucalyptus crebra* was also scattered throughout. A small number of areas occur within this community where the regrowth *Callitris glaucophylla* is denser but the vegetation community is the same in terms of species composition and disturbance levels and consequently has been included in the good condition category.

Small tree species within this community and scattered throughout grassland areas derived from this community included *Geijera parviflora* and *Brachychiton populneus*. *Pimelea neo-anglica* is also present within this community.

The groundlayer is dominated by native grasses including *Bothriochloa decipiens*, *Austrostipa scabra*, Paddock Lovegrass (*Eragrostis leptostachya*), *Aristida* sp., *Sporobolus creber*, Windmill Grass (*Chloris truncata*) and *Austrodanthonia* sp.. A variety of herbs and forbs are also present and include Common Everlasting (*Chrysocephalum apiculatum*), *Wurmbea dioica*, *Vittadina cuneata*, Bears-ear (*Cymbonotus lawsonianus*) and *Oxalis perennans*.

Total Native Species: 27

Condition:

This community is dominated by native species although weed invasion is present in the groundlayer covering about 10 % of the plot. Exotic species include Haresfoot Clover (*Trifolium arvense*), *Trifolium* sp. and an exotic *Eragrostis* cultivar species.

Fauna habitat features:

This vegetation type is likely to provide habitat for a variety of fauna given the presence of hollow-bearing trees and woody debris. Species likely to utilise this community include birds, mammals, bats, and reptiles. This vegetation joins a larger stand of Narrow-leaved Ironbark Woodland to the east and the vegetated drainage line to the west and therefore forms part of one of the larger stands of consolidated vegetation across the disturbed parts of the site.

Management Issues:

Management issues in this area include grazing management and weed management.



Plate 18: Intact Grassy White Box Woodland Community

Scattered characteristic native trees and native groundlayer (> 50 % native) – scattered trees (native)

This community is situated immediately north of Lot 602 and forms part of the larger stand of vegetation in this area. The canopy is the same as the good condition vegetation with a slightly less diverse groundlayer.

Common groundlayer species include *Bothriochloa decipiens*, Paddock Lovegrass (*Eragrostis leptostachya*), *Aristida* sp., Barbed Wire Grass (*Cymbopogon refractus*) and *Sporobolus creber*.

Total Native Species: Estimated to be slightly lower than the good condition vegetation. This area has less herbs and forbs and contains species characteristic of the derived grassland areas.

Condition:

This community is dominated by native species although weed invasion is present in the groundlayer. Exotic species include *Trifolium* sp. and *Medicago* sp.

Fauna habitat features:

This vegetation type is likely to provide habitat for a variety of fauna given the presence of hollow-bearing trees and some woody debris. Species likely to utilise this community include birds, mammals, bats, and reptiles. This vegetation joins a larger stand of Box Gum Woodland and Narrow-leaved Ironbark Woodland to the south and forms part of one of the larger stands of consolidated vegetation across the disturbed parts of the site.

Management Issues:

Management issues in this area include grazing management and weed management.

Scattered characteristic native trees and exotic groundlayer (> 50 % exotic) – scattered trees (exotic)

This community is present primarily near fencelines, gates and access tracks across the site. Scattered *Eucalyptus albens* and *Callitris glaucophylla* are present with an exotic understorey dominated by *Trifolium* spp., *Medicago* sp. and in some areas *Bromus* sp. .

Total Native Species: N/A

Condition:

This community is dominated by exotic species in the understorey and is present in very small stands throughout areas of derived Box Gum Woodland. Areas around fencelines, access gates and access tracks primarily support this vegetation type.

Fauna habitat features:

Hollow-bearing trees were recorded within this vegetation type along the central access road given the presence of large *Eucalyptus albens* and provide potential habitat for a variety of birds and bats. Hollow-bearing stags were also present. The hollows are likely to be a suitable size for woodland birds, bats and small nocturnal birds (e.g. Nightjars). The scattered trees also provide nesting habitat for non hollow-dependant birds. The habitat value of this community is otherwise limited.



Plate 19: Scattered White Box canopy with exotic ground cover

Management Issues:

Management issues in this area include weed management, rehabilitation of native species and grazing.

Derived Native Grassland – native, poor condition – highly modified

Extensive areas of grassland derived from Box Gum Grassy Woodland are present throughout the study area. The occasional *Eucalyptus albens*, *Callitris glaucophylla*, *Eucalyptus crebra*, *Geijera parviflora*, *Acacia* sp. and *Brachychiton populneus* are present but this community is primarily a grassland.

The groundlayer at the time of assessment (August 2010) was a mixture of native and exotic species of almost equal proportions (plot – 60 % native, 40 % exotic). Native grasses present include *Bothriochloa decipiens*, *Austrostipa* spp., Paddock Lovegrass (*Eragrostis leptostachya*), *Aristida* sp., *Sporobolus creber*, Windmill Grass (*Chloris truncata*) and *Cymbopogon refractus*.

Trifolium repens and *Medicago* sp. have been sown throughout the grassland areas with Shepherd's Purse (*Capsella bursa-pastoris*) and other Brassicaceae species scattered throughout.

Total Native Species: Maximum approximately 6

Condition:

This community meets the biometric condition of moderate-good and was marginally dominated by native species at the time of assessment. It is a highly modified example of what was once a Box Gum Woodland and currently supports limited ecological value. Under appropriate conservation management (removal of grazing, weed and feral animal control, and if necessary, supplementary planting of canopy and shrub species) its ecological values can be significantly improved.

Fauna habitat features:

The habitat value of this community is currently limited with some small birds such as Songlarks and Quails likely to seek shelter in the tall grass. This area would also be utilised by reptiles and birds of prey for foraging on small mammals such as the House Mouse (*Mus musculus*) that are likely to use this vegetation. The scattered paddock trees present provide nesting habitat for a variety of birds with a number of nests sighted in scattered trees across the site. A small number of trees (primarily *Eucalyptus albens*) also support hollows suitable for use by bats and birds.

The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) was recorded within this community in the south east of the site although no nests were recorded in this area.

Management Issues:

Management issues in this area include grazing management, weed management, native species rehabilitation. The presence of rabbits was noted in this area. A warren was recorded in the south of the site under a wood pile within a cleared area.



Plate 20: Derived Native Grassland (Box Gum Woodland)

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest was the dominant vegetation type across the eastern part of the study area. This community was present on the rises and rocky hills / escarpments. All areas had undergone past logging and consequently some areas supported dense *Callitris glaucophylla* regrowth. This community occurs in both a shrubby and grassy form and in the east of the site is present as a mosaic of the two forms. This vegetation community is characteristic of RVC 59 (White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion).

Three condition types were assigned to this community; a near intact category with all strata present, scattered trees with a native understorey and a derived grassland dominated by native species.

All strata present - good

This community dominates the east of the site on the steep slopes. A smaller stand is also present in the north western corner of the site. The dominant canopy species include *Callitris glaucophylla*, *Eucalyptus crebra*. *Eucalyptus albens* is also present in this community within the central portion of the large stand of vegetation in the east of the site on the lower slopes and *Eucalyptus dealbata* is also present in some parts of this community. A large number of old stumps from previously clearing present throughout this community. Red Ash (*Alphitonia excelsa*) is also present on the north-western parts of this community.

In the shrubby form of this vegetation community Sticky Wallaby Bush (*Beyeria viscosa*) is dominant in most areas with Sticky Daisy-Bush (*Olearia elliptica*) also common throughout. Other less common shrubs include Native Olive (*Notelaea microcarpa*), Motherumbah (*A. cheelii*), Cough Bush (*Cassinia quinquefaria*) (common in the north eastern part of this community), Urn Heath (*Melichrus urceolatus*), *A. triptera x cheelii*, *Pimelea neo-anglica* is also present within this community.

In the grassy form of this community the groundlayer is dominated by native grasses and there are large areas of bare ground, rock and litter. Although in less abundance, similar grass species are present in the shrubby form of this community. The groundlayer is dominated by native species including *Austrostipa scabra*, *Eragrostis spp.*, *Aristida ramosa*, *Enneapogon sp.*, *Cymbopogon refractus*, *Austrodanthonia sp.*, *Panicum effusum*, *Desmodium brachypodum*, *Cheilanthes sieberi*, *Dichondra repens*, *Gonocarpus elatus*, *Fimbristylis dichotoma* and *Dianella revoluta*.

Total Native Species: 23

Condition:

This community is dominated by native species with little weed invasion. *Opuntia stricta* is scattered within this community and should be treated to prevent further spread. This community has been heavily logged in the past and is currently grazed by feral goats.

Fauna habitat features:

This vegetation type is likely to provide habitat for a variety of fauna given the presence of hollow-bearing trees, woody debris, rocky outcrops, shrubby and grassy formations and abundant leaf litter. Species likely to utilise this community include birds, mammals, bats, and reptiles. This vegetation forms the majority of the extensive consolidated stand of vegetation in the east of the site.



Plate 21: Intact White Cypress Pine – Narrow-leaved Ironbark

Management Issues:

Management issues in this area include management of feral goats and minor weed removal.

Scattered characteristic native trees and native groundlayer (> 50 % native) – scattered trees (native)

This community is present in the north west of the site and is a grassy form of this community. A very small area is also present in the south west of the site on a rock hill and this area supports a diversity of native species.

The dominant canopy species include *Callitris glaucophylla* and *Eucalyptus crebra*. A large number of old stumps from previously clearing are present throughout this community and the groundlayer supports tall native grasses including *Eragrostis* spp., *Aristida* spp., *Cymbopogon refractus*, *Sporobolus creber*, *Panicum effusum* and *Digitaria* sp.. Herbs and forbs are present in the *Wurmbea dioica*, *Geranium* sp., *Vittadinia cuneata*, *Daucus glochidiatus* and *Crassula* sp. The groundlayer has been sown with *Medicago* sp. and *Trifolium glomeratum* and supports a small number of other weed species.

Total Native Species: 19

Condition:

This community is dominated by native species with little weed invasion. *Opuntia stricta* is scattered within this community and should be treated to prevent further spread. This community has been heavily logged in the past and is currently grazed by cattle.

Fauna habitat features:

This vegetation type is likely to provide habitat for a variety of bird species. Given the presence of Ironbark trees, hollows are limited. The grassy groundlayer provides potential habitat for small mammals, reptiles and shelter for some small birds (e.g. Songlark). The rocky features are also likely to provide suitable habitat for reptiles.



Plate 22: Scattered Trees White Cypress Pine Narrow-leaved Ironbark

Management Issues:

Management issues in this area include grazing and weed management.

Derived native Grassland – native, poor condition -highly modified

A very small area of this community is present in the centre on a hilltop in a paddock adjacent to an area of regrowth Narrow-leaved Ironbark Woodland. Larger areas are present in the south-east of the site. Whilst a mixture of native and exotic species are present, the distribution of these is patchy with native species having a marginally higher cover across the vegetation type.

Common native species recorded include *Bothriochloa decipiens*, *Wurmbea dioica*, *Austrostipa scabra*, *Eragrostis leptostachya*, *Aristida* sp., *Sporobolus creber*, *Crassula* sp., *Cymbopogon refractus* and *Cheilanthes sieberi*.

The exotic cover is predominantly *Trifolium repens* and *Medicago* sp. with *Cotula australis*, Dandelion (*Taraxacum officinale*) and a number of other species scattered throughout.

Total Native Species: 21

Condition:

This community is marginally dominated by native species and therefore is considered a highly degraded example of grassland derived from Narrow-leaved Ironbark Woodland.

Fauna habitat features:

Habitat values of this community are limited. The rocky areas would provide potential habitat for reptiles and the grassy areas particularly in the east of the site would provide habitat for small birds, reptiles and ground-dwelling mammals.



Plate 23: Derived Native Grassland White Cypress Pine Narrow-leaved Ironbark

Management Issues:

Management issues in this area include grazing management, weed management, native species rehabilitation.

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest is patchily distributed throughout areas of White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest primarily in the east of the site. This community was present on the rises and slopes / rocky hills. All areas had undergone past logging. This community supported a shrubby understorey. This vegetation community is characteristic of RVC 44 (White Box - Pine - Silver-leaved Ironbark shrubby open forests, Brigalow Belt South and Nandewar).

Two condition types were assigned to this community; a near intact category with all strata present and scattered trees with a native understorey.

All strata present - good

This community is present on the steep slopes in the east of the site. The dominant canopy species include *Callitris glaucophylla* and *Eucalyptus melanophloia*. *Eucalyptus dealbata* is also present in some parts of this community. A large number of old stumps from previous clearing are present throughout this community.

Sticky Wallaby Bush (*Beyeria viscosa*) is the dominant shrub species within this community. Other shrubs include *Acacia* spp. and *Indigofera adesmiifolia*. The groundlayer is dominated by native species and there are large areas of bare ground, rock and litter (up to 85 %). Native species present in the groundlayer include *Austrostipa scabra*, *Eragrostis* spp., *Aristida ramosa*, *Aristida* sp., *Enneapogon* sp., *Cymbopogon refractus*, *Desmodium brachypodum*, *Cheilanthes distans*, *Dichondra* sp., *Lomandra filiformis* and *Stackhousia* sp.. The orchid species *Pterostylis* sp. was also recorded within this community.

Total Native Species: 19

Condition:

This community is dominated by native species with little weed invasion. This community has been heavily logged in the past and is currently grazed by feral goats.

Management Issues:

Management issues in this area include management of feral goats and minor weed removal.

Fauna habitat features:

This vegetation type is likely to provide habitat for a variety of fauna given the presence of hollow-bearing trees, woody debris, rocky outcrops, a shrubby understorey and abundant leaf litter. Species likely to utilise this community include birds, mammals, bats, and reptiles. This vegetation forms part of the most extensive consolidated stand of vegetation in the east of the site.



Plate 24: White Cypress Pine / Silver-leaved ironbark (good condition)

Scattered characteristic native trees and native groundlayer (> 50 % native) – scattered trees (native)

This community is present on the lower slopes in the centre of the site. The dominant canopy species include *Callitris glaucophylla* and *Eucalyptus melanophloia* with *Eucalyptus dealbata* also scattered throughout. A large number of old stumps from previous clearing are present throughout this community.

The proportion of native to exotic species in this community are similar. The groundlayer supports native grasses such as *Aristida* sp., *Bothriochloa decipiens*, *Cymbopogon refractus*, *Eragrostis* sp. and *Panicum effusum* with limited herb and forb diversity.

Exotic species present include *Trifolium arvense*, *Medicago* sp., *Hypochaeris radicata*, *Opuntia stricta* and *Cotula australis*.

Total Native Species: 14

Condition:

This community has been previously logged and exotic species sown into the groundlayer. The understorey supports limited native diversity and is considered highly degraded.

Management Issues:

Management issues in this area include weed and grazing management.

Fauna habitat features:

The scattered trees are likely to provide nesting habitat for woodland birds and bats may forage throughout the area. The grassy groundlayer provides habitat for birds, mammals and reptiles.



Plate 25: White Cypress Pine / Silver-leaved ironbark (moderate condition)

River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions

This vegetation type was present in two forms throughout the study area. Along Maules Creek the vegetation was an alluvial woodland characteristic of RVC 73 (River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar) with a tall, denser canopy. Along the smaller drainage lines across the site, the vegetation was highly disturbed and more characteristic of RVC 72 (Bracteate Honey Myrtle riparian shrubland, Brigalow Belt South) with a dense small tree layer and scattered Eucalypts.

Scattered characteristic native trees and native groundlayer (> 50 % native) – scattered trees (native)

Canopy species present in this area include River Red Gum (*Eucalyptus camaldulensis*), River Oak (*Casuarina cunninghamiana* and Rough-barked Apple (*Angophora floribunda*). The small tree / shrub layer was dominated by *Acacia* sp. and *Melaleuca bracteata* with Kurrajong (*Brachychiton populneus*) also present.

The groundlayer was a mixture of native and exotic species dominated by Slender Bamboo Grass (*Austrostipa verticillata*) and the exotic species Mouse-ear Chickweed (*Cerastium glomeratum*). Other groundcover species present include Weeping Grass (*Microlaena stipoides*) and *Dichondra repens*. Dense infestations of Moth Vine (*Araujia sericifera*) are also present in this area.

Total Native Species: 15

Condition: This community supports all strata although it is heavily invaded by exotic species in the understorey including groundcovers, herbs and vines. Common weed species include *Cerastium glomeratum*, *Hypochaeris radicata*, *Sida rhombifolia*, *Medicago* sp. and *Bidens pilosa*.

Fauna habitat features:

This area supports a number of hollow-bearing trees and stags and provides habitat for a variety of birds, bats, reptiles and amphibians. The riparian zone along Maules Creek is likely to be used for movement by a variety of fauna species given the fragmented nature of much of the areas outside the riparian corridor.

Management Issues:

Weed invasion and management of feral animals such as rabbits are likely to be key management issues for this area.



Plate 26: River Red Gum riverine woodlands (native understory)

Scattered characteristic native trees and exotic groundlayer (> 50 % exotic) – scattered trees (exotic)

Canopy species present in this area include *Eucalyptus dealbata* and Blakely's Red Gum (*Eucalyptus blakelyi*). The small tree / shrub layer was dominated by *Melaleuca bracteata* with Wilga (*Geijera parviflora*) and Swamp Oak (*Casuarina glauca*) also present. *Callitris glaucophylla* is also present in some areas.

The groundlayer was a mixture of native and exotic species dominated by *Aristida* sp. and the exotic species *Medicago* sp. Other groundcover species present include *Austrostipa verticillata*, *Bothriochloa decipiens*, *Sporobolus creber*, *Cotula australis*, *Oxalis* sp. and *Rumex brownii*.

Total Native Species: 15

Condition:

This community is dominated by exotic species and is grazed and has been under-scrubbed.

Fauna habitat features:

This area supports a dense shrub layer that is likely to be used by small birds for shelter. The watercourses also provide habitat for reptiles, ground-dwelling mammals and amphibians and foraging habitat for bats. A number of hollow-bearing trees are present along the drainage lines primarily in areas where Red Gum and White Box are present in the central parts of the site.

Management Issues:

Management issues in this area include grazing management / exclusion and weed management. Riparian areas are narrow and degraded and would benefit from rehabilitation



Plate 27: River Red Gum riverine woodlands (exotic understory)

Heathy shrublands on rocky outcrops of the western slopes

This vegetation type was present on the rocky outcrops above a waterfall amongst areas of White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest and White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest. It had a shrubland structure with emergent small trees. This community is equivalent to RVC 62 (Shrublands of rocky areas, Brigalow Belt South, Nandewar and western New England Tablelands).

Scattered Tumbledown Red Gum (*Eucalyptus dealbata*) and White Cypress Pine (*Callitris glaucophylla*) were present with the *Eucalyptus dealbata* exhibiting a mallee-like form. A dense stand of *Micromyrtus sessilis* with the occasional *Cryptandra propinqua* and *Pimelea neo-anglica* were present in the shrub strata. The groundlayer supported large areas of mosses and lichens and a diversity of groundcover species including herbs, forbs and grasses sparsely spread across the rocks.

Groundlayer species included Barbed Wire Grass (*Cymbopogon refractus*), *Aristida* sp., *Austrostipa* sp., Mulga Fern (*Cheilanthes sieberi*), Raspwort (*Gonocarpus elatus*), *Geranium* sp., Kidney Weed (*Dichondra repens*), Rough Bedstraw (*Galium gaudichaudii*), Early Nancy (*Wurmbea dioica*), *Crassula* sp., *Pterostylis* sp., *Enneapogon* sp. and Snowgrass (*Poa sieberiana*).

Total Native Species: 29

Condition:

This community is in good condition with the majority of species recorded being native. Prickly Pear (*Opuntia* sp.) was recorded within this community in low numbers as was *Hypochoeris radicata*.

Fauna habitat features:

This area supports a dense shrublayer that is likely to be used by small birds for shelter. The rocky outcrop and pools associated with the waterfall are likely to provide habitat for reptiles and amphibians.

Management Issues:

Goats were sighted grazing in this area at the time of the survey and there is a small amount of weed invasion.



Plate 28: Heathy Shrublands on rocky outcrops

Table 19: Plants species recorded on Kenna property, 17th-20th August 2010

| Family | Scientific Name | Common Name | Vegetation Type | | | | |
|-----------------|----------------------------------|---------------------|---|---|--|---|---|
| | | | Heathy shrublands on rocky outcrops of the western slopes | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Native dominant) | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Adiantaceae | <i>Cheilanthes distans</i> | Bristly Cloak Fern | x | | | | x |
| Adiantaceae | <i>Cheilanthes sieberi</i> | Mulga Fern | x | x | x | x | |
| Anacardiaceae | <i>Schinus areira</i> * | Pepper Tree | | | x | | |
| Anthericaceae | <i>Arthropodium sp.</i> | | x | | x | | x |
| Apiaceae | <i>Daucus glochidiatus</i> | Native Carrot | x | x | x | x | x |
| Asphodelaceae | <i>Bulbine sp.</i> | | x | | | | |
| Asteraceae | <i>Calotis sp.</i> | | | | | x | |
| Asteraceae | <i>Cassinia sp.</i> | | x | | | x | |
| Asteraceae | <i>Cotula australis</i> | Common Cotula | | | x | x | x |
| Asteraceae | <i>Chrysocephalum apiculatum</i> | Common Everlasting | | x | x | | |
| Asteraceae | <i>Cymbonotus lawsonianus</i> | Bears-ear | | | | | |
| Asteraceae | <i>Hypochaeris radicata</i> * | Catsear | x | x | | | |
| Asteraceae | <i>Sigesbeckia australiensis</i> | | x | | x | | |
| Asteraceae | <i>Vittadinia cuneata</i> | Fuzzweed | | | | x | |
| Boraginaceae | <i>Echium plantagineum</i> * | Paterson's Curse | | x | x | | |
| Brassicaceae | <i>Capsella bursa-pastoris</i> * | Shepherd's Purse | | | | | |
| Brassicaceae* | | | | x | | | |
| Cactaceae | <i>Opuntia stricta</i> * | Common Prickly Pear | x | | x | x | |
| Campanulaceae | <i>Wahlenbergia sp.</i> | | x | | | | |
| Caryophyllaceae | <i>Cerastium glomeratum</i> * | Mouse-ear Chickweed | | x | | | |
| Casuarinaceae | <i>Casuarina cunninghamiana</i> | River Oak | | x | | | |
| Casuarinaceae | <i>Casuarina cristata</i> | Belah | | | x | | |
| Chenopodiaceae | <i>Einadia nutans</i> | Climbing Saltbush | | x | x | x | |
| Colchicaceae | <i>Wurmbea dioica</i> | Early Nancy | x | | | x | |
| Colchicaceae | <i>Wurmbea sp. 2 (purple)</i> | | x | | | x | |

| Family | Scientific Name | Common Name | Vegetation Type | | | | |
|----------------------------|----------------------------------|-----------------------|---|---|--|---|---|
| | | | Heathy shrublands on rocky outcrops of the western slopes | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Native dominant) | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Convolvulaceae | <i>Dichondra repens</i> | Kidney Weed | | x | x | x | x |
| Crassulaceae | <i>Crassula sp.</i> | | x | | | x | x |
| Cupressaceae | <i>Callitris glaucophylla</i> | White Cypress Pine | x | x | x | x | x |
| Cyperaceae | <i>Fimbristylis dichotoma</i> | Common Fringe-sedge | x | | | x | |
| Droseraceae | <i>Drosera sp.</i> | | x | | | | |
| Ericaceae - Styphelioideae | <i>Melichrus urceolatus</i> | Urn-heath | | | | x | |
| Euphorbiaceae | <i>Beyeria viscosa</i> | Pinkwood | | | | x | |
| Fabaceae - Faboideae | <i>Desmodium brachypodum</i> | Large Tick-trefoil | x | | | | |
| Fabaceae - Faboideae | <i>Desmodium brachypodum</i> | Large Tick-trefoil | | | | x | x |
| Fabaceae - Faboideae | <i>Glycine sp.</i> | | | | | x | |
| Fabaceae - Faboideae | <i>Hovea sp.</i> | | | x | | | |
| Fabaceae - Faboideae | <i>Indigofera adesmiifolia</i> | Tick Indigo | x | | | | x |
| Fabaceae - Faboideae | <i>Medicago sp.*</i> | | | x | | x | |
| Fabaceae - Faboideae | <i>Trifolium arvense*</i> | Haresfoot Clover | | | x | | |
| Fabaceae - Faboideae | <i>Trifolium sp.*</i> | | | | | x | x |
| Fabaceae - Mimosoideae | <i>Acacia cheelli x triptera</i> | | x | | | x | |
| Fabaceae - Mimosoideae | <i>Acacia sp.</i> | | x | | | x | x |
| Fabaceae - Mimosoideae | <i>Acacia cheelli</i> | | | | | x | |
| Geraniaceae | <i>Geranium sp.</i> | | x | | x | x | |
| Haloragaceae | <i>Gonocarpus elatus</i> | | | | | x | |
| Lamiaceae | <i>Lamium amplexicaule*</i> | | | | x | x | |
| Lomandraceae | <i>Lomandra sp.</i> | | x | | x | x | x |
| Malvaceae | <i>Malva parviflora*</i> | Small-flowered Mallow | | x | | | x |
| Malvaceae | <i>Sida sp.</i> | | | | x | | |
| Myrtaceae | <i>Angophora floribunda</i> | Rough-barked Apple | | x | | | |

| Family | Scientific Name | Common Name | Vegetation Type | | | | |
|----------------|---------------------------------|------------------------|---|---|--|---|---|
| | | | Heathy shrublands on rocky outcrops of the western slopes | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Native dominant) | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Myrtaceae | <i>Eucalyptus albens</i> | White Box | | | x | | |
| Myrtaceae | <i>Eucalyptus blakelyi</i> | Blakely's Red Gum | | x | | | |
| Myrtaceae | <i>Eucalyptus crebra</i> | Narrow-leaved Ironbark | | x | | x | |
| Myrtaceae | <i>Eucalyptus camaldulensis</i> | River Gum | | x | | | |
| Myrtaceae | <i>Eucalyptus dealbata</i> | Tumbledown Red Gum | x | | x | x | x |
| Myrtaceae | <i>Eucalyptus melanophloia</i> | Silver-leaved Ironbark | | | | | x |
| Myrtaceae | <i>Melaleuca bracteata</i> | Black Tea-tree | | x | x | | |
| Myrtaceae | <i>Micromyrtus sessilis</i> | | x | | | | |
| Oleaceae | <i>Notelaea microcarpa</i> | Native Olive | | x | | | |
| Orchidaceae | <i>Pterostylis sp.</i> | | x | x | x | | x |
| Oxalidaceae | <i>Oxalis perennans</i> | | | | x | x | x |
| Phormiaceae | <i>Dianella sp.</i> | | | | | x | |
| Plantaginaceae | <i>Veronica sp.</i> | | | | | x | |
| Poaceae | <i>Aristida sp.</i> | | x | | | x | x |
| Poaceae | <i>Aristida sp.</i> | | | x | x | | x |
| Poaceae | <i>Austrodanthonia sp.</i> | | | | x | x | |
| Poaceae | <i>Austrostipa sp.</i> | | x | x | x | x | x |
| Poaceae | <i>Austrostipa scabra</i> | | | | x | x | x |
| Poaceae | <i>Austrostipa verticillata</i> | Slender Bamboo Grass | | x | x | x | |
| Poaceae | <i>Bothriochloa decipiens</i> | | | | x | x | x |
| Poaceae | <i>Bromus sp.*</i> | | | x | x | | |
| Poaceae | <i>Chloris truncata</i> | | | x | x | x | |
| Poaceae | <i>Cymbopogon refractus</i> | Barbed Wire Grass | x | x | x | x | x |
| Poaceae | <i>Digitaria sp.*</i> | | | | x | x | |
| Poaceae | <i>Enneapogon sp.</i> | | | | x | x | x |

| Family | Scientific Name | Common Name | Vegetation Type | | | | |
|-----------------------------|-------------------------------------|-------------------|---|---|--|---|---|
| | | | Heathy shrublands on rocky outcrops of the western slopes | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Native dominant) | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Poaceae | <i>Eragrostis sp.</i> | | x | | x | | |
| Poaceae | <i>Eragrostis cultivar (exotic)</i> | | | | x | | x |
| Poaceae | <i>Eragrostis leptostachya</i> | Paddock Lovegrass | | | x | | |
| Poaceae | <i>Eragrostis sp. 1 (native)</i> | | | | | x | x |
| Poaceae | <i>Eragrostis sp. 2 (native)</i> | | | | | x | |
| Poaceae | <i>Hordeum sp.</i> | | | | x | | |
| Poaceae | <i>Lolium sp.</i> | | | | | | x |
| Poaceae | <i>Microlaena stipoides</i> | Weeping Grass | x | x | | | |
| Poaceae | <i>Panicum sp.</i> | | | x | x | x | |
| Poaceae | <i>Poa sieberiana</i> | Snowgrass | x | | | | |
| Poaceae | <i>Sporobolus creber</i> | | | x | x | x | x |
| Poaceae | <i>Themeda australis</i> | Kangaroo Grass | | | x | | |
| Polygonaceae | <i>Rumex sp.</i> | | | | x | | |
| Rhamnaceae | <i>Alphitonia excelsa</i> | Red Ash | x | | | | |
| Rhamnaceae | <i>Cryptandra sp.</i> | | | | x | x | |
| Rhamnaceae | <i>Cryptandra propinqua</i> | | x | | x | | |
| Rhamnaceae | <i>Pomaderris sp.</i> | | | | | | x |
| Rubiaceae | <i>Galium gaudichaudii</i> | Rough Bedstraw | x | | | | |
| Rutaceae | <i>Geijera parviflora</i> | Wilga | | | x | | |
| Stackhousiaceae | <i>Stackhousia sp.</i> | | | | | | x |
| Sterculiaceae | <i>Brachychiton populneus</i> | Kurrajong | | x | x | | |
| Thymelaeaceae | <i>Pimelea neo-anglica</i> | | x | | x | x | |
| Xanthorrhoeaceae | <i>Xanthorrhoea sp.</i> | | | | | | |
| Total Native Species | | | 33 | 25 | 39 | 43 | 27 |
| Total Exotic Species | | | 2 | 6 | 8 | 5 | 3 |

Appendix 6: Indicative Credit Reports for Direct Impacts and Proposed Offset Areas

Note the areas in these credit reports are the total areas available on the various properties and are not the same as presented in the proposed offset package. They do however, provide a robust 'indication' of the loss of biodiversity values at the impact site and the potential of the vegetation types and condition scores to 'guide' and informed basis for consideration of 'improve or maintain" at the proposed offset sites.

The credit reports are presented in order:-

1. Impact assessment at Project site
2. Credits generate at on-site offset site
3. Credits generated at off-site offset site.

BioBanking

Biodiversity Banking and Offsets Scheme

Biobanking Credit Report

This report identifies the number and type of credits required at a **DEVELOPMENT SITE**.

Date of report: 31/08/2010 Time: 19:46 Tool Version: 1.1

Development Details

Proposal ID: 0034/2010/D000

Development Name: Pilliga Outwash Impact

Development Location:

Development Address:

CMA: Namoi

Proponent Name:

Proponent Address:

Proponent Phone:

Assessor Name:

Assessor Address:

Assessor Phone:

Assessor Accreditation Number: 0034

The following information is required to be submitted with this BioBanking Statement (where ticked)

Local reference data is required for the following vegetation zones

An Expert Report for the following species

The minimum number of plots were not entered for the following vegetation zones

Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81)

Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion

River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)



Improving or maintaining biodiversity values

An application for a red flag determination is required for the following red flag areas:

| Red Flag | Reason |
|---|--------------------------------------|
| Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81) | Vegetation type being > 70% cleared; |

The application for a red flag determination should address the criteria set out in section 2.3 of the Biobanking Assessment Methodology. A BioBanking Statement cannot be issued unless the determination is approved.



Ecosystem Credits

| Vegetation Type | Area (ha) | Credits Required | Red Flag |
|---|-----------|------------------|----------|
| Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81) [NA146] | 24.8 | 1,374 | Yes |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion [NA189] | 180.9 | 10,935 | No |
| River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) [NA191] | 4.1 | 289 | No |

Credit Profiles

Group: 1 Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81)

Ecosystem credits: 1,374 credits

Total area of vegetation(s): 24.8 ha

| 1. Surrounding vegetation cover | 2. Patch size, including low condition |
|--|--|
| <p>Description: Minimum surrounding vegetation cover in which the credits must be obtained.</p> <p>Minimum percent cover: 10%</p> | <p>Description: Minimum area of contiguous vegetation in which credits must be obtained.</p> <p>Minimum area: 25 ha</p> |

| 3. CMA subregion & vegetation types |
|--|
| Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types: |

Namoi

| CMA Sub-Region(s) | Veg Type(s) |
|---------------------------|---|
| Liverpool Plains (Part A) | Inland Grey Box tall grassy woodland on clay soils in the Brigalow Belt South and Nandewar Bioregions (Benson 81) (NA146) |
| Liverpool Plains (Part B) | |
| Pilliga (Part A) | |
| Pilliga Outwash | |
| | |

Group: 2 Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion

Ecosystem credits: 10,935 credits

Total area of vegetation(s): 180.9 ha



| 1. Surrounding vegetation cover | 2. Patch size, including low condition |
|---|--|
| Description: Minimum surrounding vegetation cover in which the credits must be obtained. Minimum percent cover: 10% | Description: Minimum area of contiguous vegetation in which credits must be obtained. Minimum area: 100 ha |

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Namoi

CMA Sub-Region(s)

Pilliga (Part A)

Pilliga Outwash

Veg Type(s)

Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189)

Group: 3 River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)

Ecosystem credits: 289 credits

Total area of vegetation(s): 4.1 ha

| 1. Surrounding vegetation cover | 2. Patch size, including low condition |
|---|---|
| Description: Minimum surrounding vegetation cover in which the credits must be obtained. Minimum percent cover: 10% | Description: Minimum area of contiguous vegetation in which credits must be obtained. Minimum area: 25 ha |

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

Border Rivers/Gwydir

CMA Sub-Region(s)

Eastern Nandewars (Part B)

Tingha Plateau

Veg Type(s)

River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (BR196)



Central West

CMA Sub-Region(s)

Bogan-Macquarie
Canbelego Downs
Castlereagh-Barwon
Lower Slopes
Nymagee-Rankins Springs
Pilliga
Upper Slopes

Veg Type(s)

River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (CW184)

Namoi

CMA Sub-Region(s)

Liverpool Plains (Part A)
Liverpool Plains (Part B)
Northern Basalts
Pilliga (Part A)
Pilliga (Part B)
Pilliga Outwash

Veg Type(s)

River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) (NA191)

River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193)

Species Credits



BioBanking

Biodiversity Banking and Offsets Scheme

Biobanking Agreement Credit Report

This report identifies the number and type of credits that may be created at a BIOBANK SITE.

Date of report: 23/09/2010 Time: 08:14 Tool Version: 1.1

Property Details

Proposal ID: 0034/0000/B000
Biobank Name: Biobank site- Pilliga Outwash
Biobank Location:
Biobank Address:

CMA: Namoi

Landholder Name:
Landholder Address:
Landholder Phone:

Assessor Name:
Assessor Address:
Assessor Phone:
Assessor Accreditation Number:

The following information is required to be submitted with this BioBanking Agreement (where ticked)

- All or part of the biobank site is covered by a covenant, has received govt funding or is crown land
- Expert Report for the following species:
- Justification for request of additional increase in site value score with management for the following vegetation zones:
- The minimum number of plots were not entered for the following vegetation zones
 - Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88)
 - Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion
 - Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion
 - Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion
 - Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion
 - Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion

Department of Environment & Climate Change NSW



Ecosystem Credits

| Vegetation Type | Area (ha) | Credits created |
|---|-----------|-----------------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) | 17.6 | 119 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 4.5 | 41 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 29 | 310 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 1560 | 10,611 |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion | 301 | 3,440 |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion | 5.9 | 56 |

Credit Profile

Group 1 : Ecosystem credits: 119 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 17.6 ha

Group 2 : Ecosystem credits: 41 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 4.5 ha

Group 3 : Ecosystem credits: 310 credits

p



| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 29 ha

Grou 4 : Ecosystem credits: 10611 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 1560 ha

Grou 5 : Ecosystem credits: 3440 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 301 ha

Grou 6 : Ecosystem credits: 56 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Pilliga Outwash (776) |
| Vegetation type | Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 5.9 ha



Species Credits

Additional Management Actions

The following management actions are required at the property. These actions are in addition to the standard management actions required at the property

Cat and/or Fox control

| | |
|---|---------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) (NA179) | 17.6 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 4.5 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 29 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 301 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 1560 ha |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197) | 5.9 ha |

Control feral pigs

| | |
|---|---------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) (NA179) | 17.6 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 4.5 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 29 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 301 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 1560 ha |

Exclude miscellaneous feral species

| | |
|---|---------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) (NA179) | 17.6 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 4.5 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 29 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 301 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 1560 ha |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197) | 5.9 ha |

Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)

| | |
|---|---------|
| Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) (NA179) | 17.6 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 4.5 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 29 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 301 ha |
| Red Ironbark - Brown Bloodwood shrubby woodland of the Brigalow Belt South Bioregion (NA189) | 1560 ha |
| Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion (NA197) | 5.9 ha |

BioBanking

Biodiversity Banking and Offsets Scheme

Biobanking Agreement Credit Report

This report identifies the number and type of credits that may be created at a BIOBANK SITE.

Date of report: 23/09/2010 Time: 08:15 Tool Version: 1.1

Property Details

Proposal ID: 0034/1111/B111
Biobank Name: Biobank Site- Liverpool Plains Part B
Biobank Location:
Biobank Address:

CMA: Namoi

Landholder Name:
Landholder Address:
Landholder Phone:

Assessor Name:
Assessor Address:
Assessor Phone:
Assessor Accreditation Number:

The following information is required to be submitted with this BioBanking Agreement (where ticked)

- All or part of the biobank site is covered by a covenant, has received govt funding or is crown land
- Expert Report for the following species:
- Justification for request of additional increase in site value score with management for the following vegetation zones:
- The minimum number of plots were not entered for the following vegetation zones
 - Heathy shrublands on rocky outcrops of the western slopes
 - River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)
 - River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78)
 - White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
 - White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
 - White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions
 - White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions

Department of Environment & Climate Change NSW



White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion

White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions

White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions



Ecosystem Credits

| Vegetation Type | Area (ha) | Credits created |
|---|-----------|-----------------|
| Heathy shrublands on rocky outcrops of the western slopes | 18.2 | 111 |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) | 38.1 | 377 |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) | 46.7 | 507 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | 14.5 | 96 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | 770.4 | 4,838 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | 13 | 96 |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions | 33.8 | 285 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | 619.6 | 5,441 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | 55.2 | 475 |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion | 111.3 | 1,137 |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | 10.5 | 107 |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions | 3.2 | 30 |

Credit Profile

Group 1 : Ecosystem credits: 111 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | Heathy shrublands on rocky outcrops of the western slopes |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 18.2 ha

Group 2 : Ecosystem credits: 377 credits

p



| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 38.1 ha

Grou 3 : Ecosystem credits: 507 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 46.7 ha

Grou 4 : Ecosystem credits: 96 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 14.5 ha

Grou 5 : Ecosystem credits: 4838 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 770.4 ha

Grou 6 : Ecosystem credits: 96 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |



Total area of Vegetation zone(s) included in this group: 13 ha

Grou 7 : Ecosystem credits: 285 credits

p

| | |
|--|--|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 33.8 ha

Grou 8 : Ecosystem credits: 5441 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 619.6 ha

Grou 9 : Ecosystem credits: 475 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 55.2 ha

Grou 10 : Ecosystem credits: 1137 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 111.3 ha

Grou 11 : Ecosystem credits: 107 credits

p



| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 10.5 ha

Group 12 : Ecosystem credits: 30 credits

p

| | |
|--|---|
| CMA | Namoi |
| CMA Sub-region | Liverpool Plains (Part B) (871) |
| Vegetation type | White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions |
| Surrounding vegetation cover class | 31-70% |
| Patch size, including low condition | >100 ha |

Total area of Vegetation zone(s) included in this group: 3.2 ha



Species Credits

Additional Management Actions

The following management actions are required at the property. These actions are in addition to the standard management actions required at the property

Cat and/or Fox control

| | |
|---|----------|
| Heathy shrublands on rocky outcrops of the western slopes (NA145) | 18.2 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 38.1 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 46.7 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 13 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 14.5 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 33.8 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 770.4 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 55.2 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 111.3 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 619.6 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 3.2 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 10.5 ha |

Control feral pigs

| | |
|---|---------|
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 38.1 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 46.7 ha |



Exclude miscellaneous feral species

| | |
|---|----------|
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 38.1 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 46.7 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 13 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 14.5 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 33.8 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 770.4 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 55.2 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 111.3 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 619.6 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 3.2 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 10.5 ha |

Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)

| | |
|---|----------|
| Heathy shrublands on rocky outcrops of the western slopes (NA145) | 18.2 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 38.1 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 46.7 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 13 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 14.5 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 33.8 ha |
| White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions (NA226) | 770.4 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 55.2 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 111.3 ha |
| White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (NA228) | 619.6 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 3.2 ha |
| White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA229) | 10.5 ha |

Maintain or reintroduce flow regimes (aquatic flora)

| | |
|---|---------|
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 38.1 ha |
| River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78) (NA193) | 46.7 ha |

Appendix 7: OEH letter regarding land transfer



Your reference :
Our reference : DOC11/41754
Contact : Todd Duffy – 02 68410937
Date : 8 September 2011

Mr Robert Humphries
Eco Logical Australia Pty Ltd
PO Box 12
Sutherland NSW 1499

Dear Mr Humphries,

Re: Proposal to transfer part of “Kenna” to the national park estate

The National Parks and Wildlife Service (NPWS) has reviewed the proposal of Whitehaven Coal to transfer part of the property “Kenna” from its ownership to the national park estate.

It is understood:

- The area proposed for transfer is approximately 520 ha and is indicated on the attached map as the vegetated forested area within blue line. The boundary of this area is understood to be currently defined through a combination of whole lots and part lots along existing fence lines.
- The transfer would occur at no cost to the NPWS.

In principle the NPWS would be willing to accept the transfer of this area of land on behalf of the Minister subject to:

1. Approval being obtained from the Minister for the Environment that the area is suitable for transfer and future reservation under the *National Parks and Wildlife Act 1974* (NPW Act);
2. Agreement being obtained within the NSW Government that the area can be reserved under the NPW Act (with the NPWS preference being as an addition to Mount Kaputar National Park);
3. An appropriate package of management funding being negotiated between the parties and paid by Whitehaven Coal to the NPWS at the time the land is transferred to the national park estate;
4. Whitehaven Coal agreeing to undertake and meet those costs as may be required in relation to survey, subdivision and registration of plans necessary to create the discrete area to be transferred;

PO Box 1020, Dubbo NSW 2830
92 Macquarie Street, Dubbo
Tel: (02) 6841 0900 Fax: (02) 6881 6941
ABN 30 841 387 271
www.environment.nsw.gov.au



5. Whitehaven Coal agreeing to reimburse the NPWS for its reasonable conveyancing costs associated with the land transfer; and
6. The negotiation of an easement granting appropriate access across the land retained by Whitehaven Coal to the transferred land which would be paid for by Whitehaven Coal.

As previously discussed, the NPWS may also consider the transfer of other areas of "Kenna" in the future subject those conditions listed above (as may be appropriate) and provided the areas are in a suitable condition.

Yours sincerely



Todd Duffy
Manager Reserve Establishment, Western Branch
National Parks and Wildlife Service

cc. Rob Smith, (Regional Manager, Northern Plains Region); Darren Pitt, (Area Manager, Narrabri Area); Peter Christie (Head, Biodiversity Conservation Unit).

PO Box 1020, Dubbo NSW 2830
92 Macquarie Street, Dubbo
Tel: (02) 68410900 Fax: (02) 68816941
www.environment.nsw.gov.au

Appendix 8: Narrabri Mine On-site Biodiversity Offset Management Plan

Separate report prepared:

Eco Logical Australia (2012) Narrabri Mine On-site Biodiversity Offset Management Plan. Report prepared for Narrabri Coal Operations Pty Ltd. Eco Logical Australia, Sutherland, NSW, 16 April 2014.

Appendix 9: Kenna Biodiversity Offset Management Plan

Separate report prepared:

Eco Logical Australia (2012) Kenna Biodiversity Offset Management Plan. Report prepared for Narrabri Coal Operations Pty Ltd. Eco Logical Australia, Sutherland, NSW, 16 April 2014.



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