Appendix I

Biodiversity offset strategy

Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy

October 2010

Hansen Bailey Pty Ltd

Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798

Level 3
51–55 Bolton Street
NEWCASTLE NSW 2300
PO Box 1162
NEWCASTLE NSW 2300
Australia
Telephone +61 2 4929 8300
Facsimile +61 2 4929 8382
Email newcastle@pb.com.au

Certified to ISO 9001, ISO 14001, AS/NZS 4801

Revision	Details	Date	Amended By
	Draft Report	18 February 2010	
B	Final Report	3 March 2010	
C	Final Report	8 June 2010	
D	Final Report	10 June 2010	
E	Final Report	24 June 2010	
F	Final Report	6 October 2010	

Author: .....Deborah Landenberger/Alex Cockerill

Signed: .....

Reviewer: .....Selga Harrington

Signed: .....

Approved by: .....Alex Cockerill

Signed: .....

Date: .....6 October 2010

Distribution: .....

Please note that when viewed electronically this document may contain pages that have been intentionally left blank. These blank pages may occur because in consideration of the environment and for your convenience, this document has been set up so that it can be printed correctly in double-sided format.

Contents

Contents (Continued)

Contents (Continued)

List of tables

Contents (Continued)

Page number

List of figures

Glossary

BioBanking	Refers to the NSW Biodiversity Banking and Offsets Scheme.
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: ▪ genetic diversity — the variety of genes (or units of heredity) in any population ▪ species diversity — the variety of species ▪ ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. For this study this is the NSW Brigalow Belt South bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995).
Critical Habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an Endangered species, an Endangered population or an Endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004). Critical habitat is listed under both the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999* and both the State (Department of Environment and Climate Change) and Commonwealth (Department of the Environment, Water, Heritage and the Arts) Directors-General maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant State and Commonwealth legislation.
Department of Environment and Climate Change	Broadly, the Department of Environment and Climate Change works towards a healthy environment cared for and enjoyed by the whole NSW community; manages the state's natural resources, including biodiversity, soils and natural vegetation; manages natural and cultural heritage across the state's land and waters; acts to minimise the impacts of climate change; promotes sustainable consumption, resource use and waste management; regulates activities to protect the environment; and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making. The Department of Environment and Climate Change formed on 27 April 2007 incorporating the former NSW Department of Environment and Conservation in addition to some functions of the former Department of Natural Resources, Department of Energy, Utilities and Sustainability and The Greenhouse Office.
Department of the Environment and Heritage	The former name for the Commonwealth Department of the Environment, Water, Heritage and the Arts.
Department of the Environment and Water Resources	The former name for the Commonwealth Department of the Environment, Water, Heritage and the Arts.

Department of the Environment, Water, Heritage and the Arts	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the *Environment Protection and Biodiversity Conservation Act 1999*.The Commonwealth Department of the Environment, Water, Heritage and the Arts changed their name from the Department of the Environment and Water Resources in 2007, which was previously the Department of the Environment and Heritage.
Ecological community	An assemblage of species occupying a particular area.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004).
Local population	The population that occurs within the study area, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated(as defined by NSW National Parks and Wildlife Service 1996).
Subject site	The area to be directly impacted by the construction and/or operation of the proposal.
Project boundary	The subject site and an additional area of investigation around the study site that could potentially be affected by the Project indirectly.
Locality	The area within a 10 km of the study area.
Significant	Important, weighty or more than ordinary (as defined by NSW National Parks and Wildlife Service 1996) (Department of Environment and Climate Change 2007).
Threatened biodiversity	Threatened species, populations or ecological communities, or their habitats as listed under either the *Threatened Species Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999*.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as Threatened) under the *Threatened Species Conservation Act 1995*, *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999*. Capitalisation of the terms 'Threatened', 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers listing under the relevant State and/or Commonwealth legislation.

1. Introduction

Boggabri Coal Pty Limited (Boggabri Coal) is applying for approval to continue its open cut mining operations for a further 21 years. Project Approval is sought under Part 3A of the *Environmental Planning and Assessment Act 1979* to gain a single, contemporary planning approval for the continuation of its mining operations within the Project Boundary (the Project) (refer to Figure 1-1). An Environmental Assessment has been prepared for the Project which included a Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

This study found the majority of the Project Boundary within Leard State Forest comprises native forest and woodland communities with relatively few exotic species and high natural species diversity. However, these vegetation communities have often been structurally simplified, reflecting a history of disturbances consistent with forestry operations and thinning. The areas of the Project Boundary outside of Leard State Forest where characterised by highly disturbed communities affected by intensive agricultural land uses.

Based on the findings of this study the Project will remove nearly 1385 ha of native vegetation, much of which is listed as Threatened under NSW and/or Commonwealth legislation. In the absence of any amelioration, the Project will have a significant impact on the 'Box Gum Woodland' community as listed under the NSW *Threatened Species Conservation Act 1995* and the equivalent community listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act*. The Project is also considered likely to have a significant impact on Threatened woodland birds and hollow-dependent microchiropteran bats within the locality and potentially the Regent Honeyeater.

The development of a carefully designed and robust offsets package will compensate for the identified impacts and in the medium to long term potentially improve ecological outcomes. Furthermore, the development of such an offsets strategy is likely to sufficiently ameliorate these impacts to the extent that no Threatened flora and fauna are likely to become extinct as a result of the Project.

The potential for biodiversity offsets to compensate the Projects impacts on local biodiversity and form part of the overall mitigation strategy was also identified within the Director General's Requirements to the Environmental Assessment.

The Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) has also requested that offsets be provided as part of the Project and that these be assessed against the EPBC draft offsets policy (Department of the Environment and Water Resources 2007).

Further, NSW Forests are the current management authority for the Leard State Forest, in which the majority of the Projects impacts are associated. In the absence of mining they had proposed the continued sustainable harvesting of millable timber and the harvest of fire wood from the Leard State Forest. They have requested that where feasible, the rehabilitated mine areas of the Leard State Forest are to be available for sustainable forestry in the longer term in accordance with local and regional forestry management practices. Although not a strict biodiversity offset, this request has been considered in the strategy so as to address NSW Forests' requirements.

In recognition of the need for an integrated, robust and comprehensive offsets strategy the Department of Planning (DoP), in consultation with Boggabri Coal, established a joint working party between DEWHA, NSW Department of Industry and Investment — Forestry

(Forestry NSW), Department of Industry and Investment – Mineral Resources (I & I NSW Mineral Resources), Department of Environment, Climate Change and Water (DECCW), DoP, & Boggabri Coal known as the Boggabri Coal Biodiversity Offsets Steering Committee. Through this stakeholder consultation process there has been an emphasis that the strategy considers:

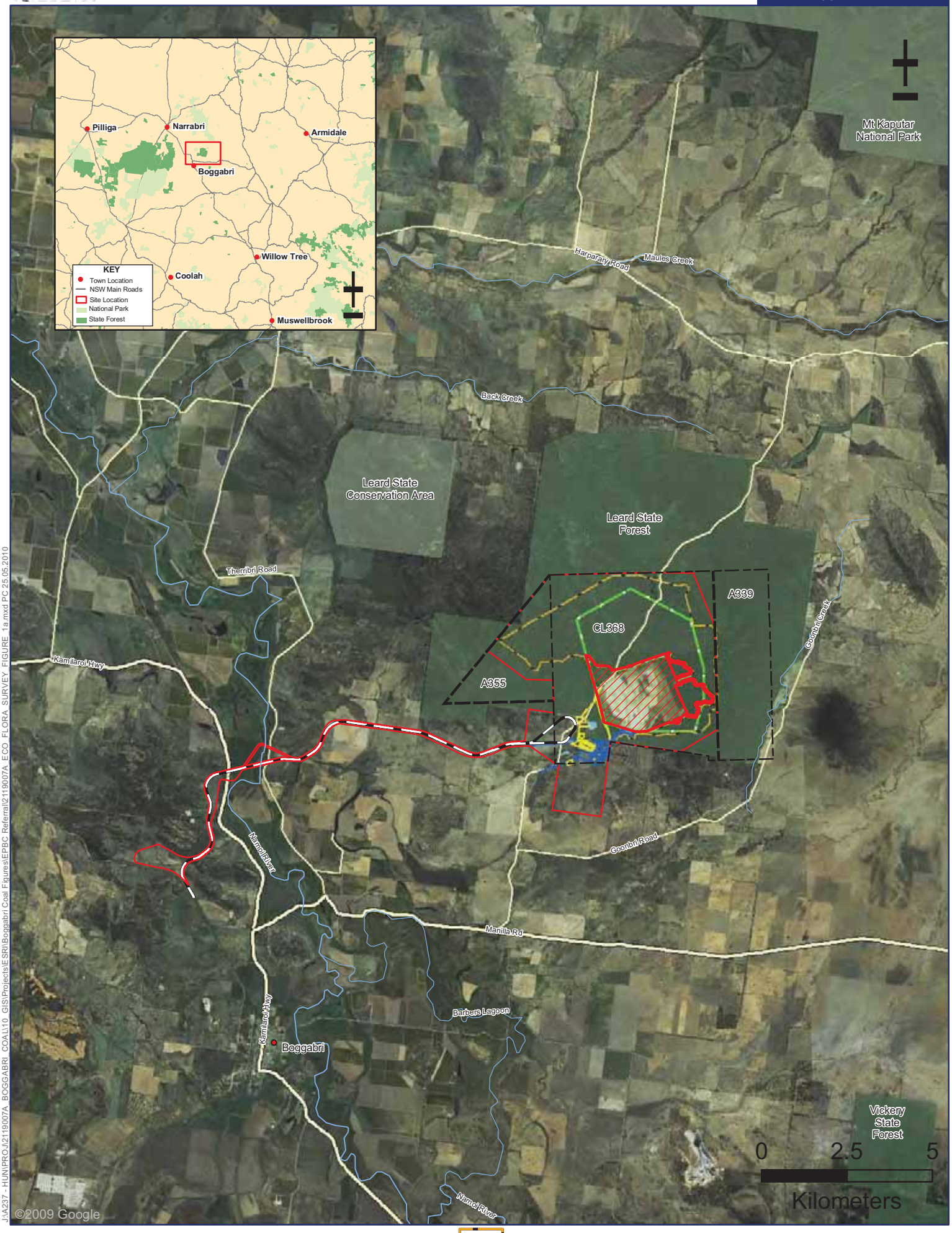
- The use of rehabilitation/restoration of existing lands for biodiversity.
- The regional context of the strategy and potential for restoration of Regional East-West Wildlife Corridor.
- Purchase of high value biodiversity lands.
- The provision for 'broad regional benefits' to biodiversity.
- Compensatory lands for forest production.
- More generally that the strategy meets the principles of Ecological Sustainable Development and State and Federal biodiversity offsets guidelines.

1.1 Aims

The aim of this report is to provide an assessment based on desktop studies and field survey of biodiversity values within a number of potential offsets surrounding the Project Boundary. Based on this assessment a Boggabri Coal Biodiversity Offset Strategy has been developed.

The specific objectives of this assessment are to identify potential offsets by:

- Consulting with the community and regulators to provide input into the development of the Boggabri Coal Biodiversity Offset Strategy.
- Providing information on the potential biodiversity values of a number of private properties possibly available for purchase as offsets.
- Recommending potential areas for rehabilitation within land owned by Boggabri Coal and potential land acquisitions identified in the zone of affectation (ZOA) to provide biodiversity offsets.
- Identifying landscape values of the potential biodiversity offsets using the broad principles of landscape assessment consistent with those identified in the BioBanking assessment methodology.
- Identifying potential offsets for their suitability for intensive forestry plantations.
- Develop a Boggabri Coal Biodiversity Offset Strategy that adequately compensates the Projects impacts on the local biodiversity
- Assessing the Boggabri Coal Biodiversity Offset Strategy against the 'improve or maintain' requirements and broader offsets policies.
- The consideration of the potential future cumulative impacts of mining and the strategic development of offsets that are consistent with the likely expansion of mining in the region.



Town Location
Existing Infrastructure to 2011
Proposed New Infrastructure
Proposed Rail Loop
Namoi River
Project Boundary
Mine Tenements
Mine Disturbance to 2011
Proposed Disturbance Limit (Boggabri Extension)
EIS Mine Disturbance (Boggabri Existing)
Sediment Dam

Figure 1- Locality Plan

1.2 Biodiversity offsets policies and guidelines

The need for biodiversity offsets is founded in the theory of 'avoid, minimise and mitigate' the impacts of proposals. Traditional approaches to environmental mitigation require that, in the first instance, environmental impacts are avoided or minimised as far as possible and subsequently reduced to acceptable levels through appropriate mitigation techniques. Where measures to avoid and mitigate impacts are not feasible or cost effective, then offsets strategies can be used to compensate the residual impacts of the development on biodiversity. Ideally offsets should be undertaken prior to development to provide certainty that the offsets are effective and to ensure that there will be no net loss in biodiversity (Department of Environment and Conservation 2005).

Fundamental to proposed offsets under the NSW legislation is the requirement for a Project to demonstrate a 'improve or maintain' outcome for impacts on biodiversity.

1.3 DECCW offsetting principles

The Department of Environment Climate Change and Water (DECCW) have provided guidelines for developing biodiversity offsets to achieve conservation outcomes, particularly for Projects where there will be an unavoidable loss of biodiversity (Department of Environment and Climate Change 2008). Although not a defined requirement under legislation, these guidelines provide a list of 13 principles to be followed when developing biodiversity offsets. These principles are described in more detail in Section 4.3.

1.3.1 *NSW Native Vegetation Act 2003*

An overarching theme of NSW biodiversity legislation is to achieve an 'improve or maintain' outcome for biodiversity values. The *Native Vegetation Act 2003* (NV Act) defines 'improve or maintain' as:

- The loss is offset by equivalent or greater gains for these Threatened species from management actions applied in perpetuity to offsets, as specified in a property vegetation plan.
- No Threatened plant species are identified as occurring within the area to be cleared.
- No Threatened fauna species are identified or known or likely to occur within the area to be cleared.
- No Threatened ecological communities are cleared.
- The clearing proposal is not likely to cause a loss to any Threatened species identified.
- The clearing proposal is not likely to cause loss of habitat or key habitat features for Threatened species known or likely to occur.

The NV Act was developed to protect biodiversity values within NSW. The NSW State Government has since developed a biodiversity banking scheme (BioBanking) to formalise the assessment of biodiversity offsets to help meet the goal of improving or maintaining biodiversity. This scheme is discussed further in Section 1.2.3 below.

1.3.2 NSW BioBanking scheme

The NSW government has developed a biodiversity banking and offsets scheme (BioBanking) to help address the loss of biodiversity values, including Threatened species. This Scheme was established under Part 7A of the TSC Act and uses offsets (where appropriate) to assist in addressing the cumulative effects of development in NSW and in particular, to help meet the goal of maintaining or improving biodiversity. This approach is intended to allow development to occur in a sustainable way without placing extra stress on the environment (Department of Environment and Conservation 2006).

In response to the Environmental Assessment of the Project, the DECCW and the DoP have requested that biodiversity offsets requirements for the Project are quantified by using the BioBanking assessment tool as a guide. The BioBanking assessment tool provides a consistent methodology for assessing and comparing the biodiversity values of the proposed impact site with those found in the proposed offsets or package. Although the BioBanking assessment tool forms part of the overall BioBanking scheme, it is not proposed that the scheme be implemented in the case of this Project, but rather that the assessment tool is used as a guide for the identification of potentially suitable offsets for incorporation into the Boggabri Coal Biodiversity Offset Strategy.

1.3.3 Draft DEHWA offsets policy

This draft policy (Department of the Environment and Water Resources 2007) has been developed by the commonwealth government to facilitate the development of a public policy and internal guidance for the application of environment offsets under the EPBC Act. The objectives of this policy were to ensure the best environmental outcomes are achieved through the consistent, transparent and equitable application of offsets under the EPBC Act. This will be achieved through the establishment of a clear set of principles for the development and assessment of offsets.

One of the key principles of this draft policy is that environmental offsets, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are ‘like for like’ (Department of the Environment and Water Resources 2007).

1.3.4 Brigalow and Nandewar western regional assessment

The Project is located within an area that has previously been assessed at a broad scale under the Brigalow and Nandewar Western Regional Assessments (WRA). In 1999, the NSW Government initiated a regional assessment of western NSW to guide future planning and encourage partnerships to protect the environment.

The former Resource and Conservation Assessment Council (RACAC) coordinated the assessment, and involved key NSW agencies representing forests, conservation, planning, Aboriginal interests, minerals and natural resources. The assessment included detailed scientific analysis and consultation with timber operators, conservation groups, Aboriginal stakeholders, minerals and gas industries, local communities and local government.

The aims of the Brigalow and Nandewar assessments were to deliver:

- Adequate and complete core data layers to inform regional land use planning, conservation and resource management.
- Enhanced partnerships between core agencies and interest groups concerned with natural resources and ecological sustainability, to increase sharing of information and to reduce duplication.
- The identification of a comprehensive, adequate and representative network of protected and managed areas.

Informed by the information collected during the WRAs, the NSW Government's decision in 2005 to conserve 350,000 ha of woodlands in the Brigalow and Nandewar bioregions through the *Brigalow and Nandewar Community Conservation Area Act 2005* (BNC Act) provided a regional approach to the protection of important conservation values with an aim of long-term sustainability of the region's important timber, gas, minerals and apiary sectors.

The Project is largely restricted to Leard State Forest, which was not identified for conservation in the regional assessments.

1.3.5 Brigalow and Nandewar community conservation agreement

The BNC Act provides for a Community Conservation Area Agreement (BNC Agreement) within the Project's Bioregion.

The BNC Agreement multiple-use protected areas are designed to allow for improved conservation outcomes, while providing for the sustainable use of natural resources. The BNC Act provided for the conservation of up to 350,000 ha of woodlands in the Brigalow and Nandewar bioregions. The intent of the BNC Act is to provide: potential

a) permanent conservation of land, their natural systems and biodiversity

b) protection of areas of natural and cultural heritage significance to Aboriginal people

c) continuation of forestry, exploration, mining, petroleum production and other uses in an ecologically sustainable manner within nominated zones

d) strong involvement by local communities in the management of land zoned within the BNC Act.

Within the BNC Agreement there are four dedicated management zones that have defined purposes allowing multiple uses (Table 1-1).

Table 1-1 Community conservation area agreement management zones

Zone	Study area
1	Zone 1 is reserved as national park under the National Parks & Wildlife Service Act (NP&W Act) for the purposes of conservation and recreation.
2	Zone 2 is reserved as Aboriginal Area under the NP&W Act for the purposes of conservation and Aboriginal culture.

Zone	Study area
3	Zone 3 is reserved as state conservation area under the NP&W Act for the purposes of conservation, recreation and exploration, mining and petroleum production.
4	Zone 4 is dedicated as State Forest under the *Forestry Act 1916* for the purposes of forestry, recreation and mineral extraction.

The Project Boundary is largely located within a part of Leard State Forest identified for management under Zone 4. This zone has been specifically identified for use for forestry and mineral extraction.

1.4 Background to the Project

1.4.1 Boggabri Existing

Boggabri Coal operates with approval DA 79/1443(z)2, allowing for mining of up to 5 Mtpa product coal for a period of 21 years from the date of granting of a mining lease. CL368 was granted on 15 November 1990 and as such DA 79/1443(z)2 expires on 15 November 2011.

The current operations involve open cut coal mining of up to 5 million tonnes per annum (Mtpa) of product coal within the area described in an Environmental Impact Statement (EIS) titled 'Boggabri Coal Project' dated 8 February 1988, which was prepared prior to the commencement of the operations. Mining Lease CL 368 was granted under the *Coal Mining Act 1973 NSW* on 15 November 1990 authorising coal mining at the surface.

Boggabri Existing was assessed under the Administrative Procedures under the *Environment Protection (Impact of Proposals) Act 1974* Cth (EPIP Act).

Boggabri Existing was approved under NSW planning and environmental legislation in 1989 and is more completely described in the EIS.

1.4.2 Boggabri Extension

Boggabri Extension involves the continuation of mining beyond that currently approved for mining in Boggabri Existing.

1.4.3 The Project

Boggabri Coal is seeking a new approval under the NSW EP&A Act and the Commonwealth EPBC Act to continue its open cut coal mining and associated activities largely consistent with the approved operation.

The Project will consist of actions that are:

(a) within the area of Boggabri Existing

(b) within additional adjacent areas ('Boggabri Extension').

1.4.4 Biodiversity offsets required for the Project

The development of a Boggabri Coal Biodiversity Offset Strategy has been specifically targeted at addressing the Projects residual impacts associated with both Boggabri Existing and Boggabri Extension, however in regards to the requirements of DEWHA only those

impacts associated with Matters of National Significance within areas of Boggabri Extension will require offsetting.

The majority of the works for the Project will be located within vegetated or relatively undisturbed areas and will require clearing of native vegetation (refer to Figure 1-1). Mitigation measures likely to be provided to minimise potential impacts to biodiversity are outlined in detail in the environmental assessment. Despite these mitigation measures, the Project will still have a number of residual impacts on biodiversity including:

- clearing of vegetation and habitat disturbance
- removal of dead wood and trees
- fragmentation and edge effects
- noise and other human disturbance
- soil erosion and compaction
- fauna injury
- increased weed invasion.

1.5 Project alternatives considered

Environmental impacts have been avoided where possible throughout the Project planning and design phases. There will also be ongoing opportunities to further avoid impacts at a local scale through the detailed design process.

The capacity of major components of the Project, such as the void layout to minimise environmental impacts while achieving the objectives of the Project (coal extraction) is limited. However, much of the design and layout of the remaining infrastructure, such as the coal transport infrastructure, site and water infrastructure have been positioned to avoid or limit impacts to remnant vegetation and regrowth and the associated flora and fauna habitats. Further avoidance should be an aim during detailed design.

Significant modification to the current Mining Operations Plan (MOP) and design of the Project has led to improved Biodiversity outcomes (refer Table 1-2).

Table 1-2 Modification avoiding impacts

Modification	Area avoided (ha)	Habitat type
Removal of the western drainage contour from the remnant Box Gum Woodland within Leard State Forest	6	CEEC, Box Gum Woodland
Relocation of proposed mine site infrastructure to existing areas of disturbance	25	Derived grassland and Grassy Woodlands
Utilisation of existing haulage route for the majority of the proposed rail corridor	24	Derived grassland, Riverine Woodland and Grassy Woodlands

1.5.1 Underground mining

A conceptual study was undertaken by WDS Consulting to assess the potential of underground mining options at Boggabri Coal Mine. The study developed a conceptual design and evaluation for the recovery of the targeted resource area by underground mining methods within the extent of the current mine plan. A summary of the report is provided below.

The Boggabri coal resource consists of eight mineable coal seams. Of these, three were identified as having economic potential for underground mining with the remaining five seams not being considered economically viable using underground mining methods due to a combination of low seam thickness, safety issues and lack of physical area.

The underground mine access strategy was developed on the basis of using the projected 2011 face position of the open cut highwall. The retreat longwall method of mining was identified as the preferred underground mining method. Conceptually, longwall mining at Boggabri offers the highest resource recovery rate, consistent production rates, is inherently safe and is widespread across Australia. The main downfall to longwall mining is the large initial capital cost required to establish and the significant lead time necessary prior to production achieving economic levels.

Three options for underground mine access were examined including an independent open box cut, establishment of drifts and the utilisation of the existing open cut highwall. The negatives associated with the construction of a box cut or drift were considered too great when compared to the advantages associated with the highwall access option, therefore the study was confined to open cut highwall access only.

The mine schedule was based on 364 days per annum production, consisting of two 10 hour shifts and a four hour maintenance window. A mine workforce of 263 personnel, made up of 204 underground shift workers and 59 support staff will be required. Total ROM production as a result of this method will have an estimated average of 5.3 Mtpa. Recoveries of between 68%–86% are predicted resulting in an average of 4.0 Mtpa product coal available for export.

It has been determined that underground mining is not practically feasible given a number of disadvantages identified below:

- only three seams of the proposed eight target seams will be economically viable for longwall extraction
- high initial capital cost
- the sterilisation of more than 100 Mt of coal resource due to the multi seam nature of the deposit
- lower production levels with an average of 4 Mtpa
- requirement of all ROM coal to be washed
- the construction of a large tailings dam to manage coal fines and rejects.

The economic viability of an underground operation is questionable due to the nature of the resource and additional cost of mining and transporting the resource.

1.5.2 Underground mining verses open cut mining

Open cut mining can recover a significantly greater proportion of the coal including the thinner seams that are not viable for underground mining. Open cut mining methods will extract coal from eight identifiable seams consisting of numerous splits from the Herndale to the Merriown seam with an estimated total coal resource of 200 Mt. Production levels obtained using the current open cut mine plan will reach a maximum of 7 Mtpa of product coal and employ up to 500 full time equivalent personnel.

While, the concept study identified that underground mining is possible it will sterilise a large portion of the coal resource identified for open cut mining.

1.6 Impacts to be offset under the EPBC Act

Assessment under the EPBC Act is only required for impacts resulting from 'Boggabri Extension', as approval under the *Environment Protection (Impact of Proposals) Act 1974* currently exists for all impacts associated with 'Boggabri Existing'.

The proposed action is likely to have a significant impact on the following Matters of National Significance:

- The proposed action involves the removal of 82 ha of the Critically Endangered Ecological Community Box Gum Woodland.
- The proposed action will remove 650.2 ha of native vegetation that provides potential habitat for Threatened species including *Pultenaea setulosa*, Regent Honeyeater and Eastern Long-eared Bat, which occur, or are likely to occur within the Project Boundary.
- The proposed action will remove 650.2 ha of native vegetation that provides potential habitat for a migratory species of bird, Regent Honeyeater, which is predicted or likely to occur within the Project Boundary.

Given the scale of the Project's potential impacts on the local Threatened species and the Critically Endangered Ecological Community, Box Gum Woodland, the Project triggered an assessment by DEWHA and was deemed to be a controlled action under the EPBC Act.

1.7 Impacts to be offset under the NSW Government's requirements'

The most significant impact of the Project will be loss of native vegetation and associated habitats. The Project will result in the loss of native vegetation within the subject site including up to 1385 ha of native vegetation. This includes up to 624 ha of Threatened ecological communities (Box-Gum Woodland, Weeping Myall Woodlands, Aquatic ecological community in the Natural Drainage System of the Lowland Catchment of the Darling River and Plains Grassland) listed under the TSC Act*, Fisheries Management Act 1994* (FM Act).

Clearing of native vegetation is listed as a Key Threatening Process under the TSC Act.

Threatened biodiversity that were recorded or were likely to occur within the Project Boundary are listed in Table 1-3. This includes four Threatened ecological communities, four species of plant and 33 species and/or guild (woodland birds) of animal.

Table 1-3 Summary of significance assessments completed

Threatened biodiversity	Recorded in Project Boundary	TSC Act[1]	FM Act[2]	EPBC Act[3]	Likely significant impact
Endangered Ecological Communities					
Box-Gum Woodland	Yes	E		CE	Yes
Weeping Myall Woodland	Yes	E		E*	No
Plains grassland	Yes	E		CE	No
Lowland Catchment of the Darling River	Yes		E		No
Threatened plants					
Digitaria porrecta	No	E		E	No
Diuris tricolor	No			V	No
Pomaderris queenslandica	Yes	E			No
Pultenaea setulosa	Yes			V	No
Threatened animals					
Sloane's Froglet	No	V			No
Threatened woodland birds assessed as a group (Brown Treecreeper, Hooded Robin, Black-chinned Honeyeater, Painted Honeyeater, Pied Honeyeater, Grey-crowned Babbler, Speckled Warbler, Diamond Firetail and Varied Sittella†)	Yes	V			Yes
White-browed Woodswallow	Yes	V†			No
Spotted Harrier	Yes	V†			No
Little Lorikeet	Yes	V			No
Little Eagle	Yes	V†			No
Swift Parrot	No	E		E	No
Square-tailed Kite	No	V			No
Turquoise Parrot	Yes	V			No
Barking Owl	Yes	V			No
Masked Owl	Yes	V			No
Superb Parrot	No	V		V	No
Regent Honeyeater	No	E		EM	Yes
Black-necked Stork	Yes	V			No
Threatened hollow-dependent microchiropteran bats assessed as a group (Eastern False Pipistrelle, Greater long-eared Bat and Yellow-bellied Sheath-tail Bat)	Yes	V		V[4]	Yes
Threatened cave-dependent microchiropteran bats assessed as a group (Eastern Cave Bat, Eastern Bent-wing Bat, Large-eared Pied Bat and Little Pied Bat	Yes			V[4]	No
Spotted-tailed Quoll	No	V		E	No
Squirrel Glider	No	V			No
Koala	Yes	V			No
Border Thick-tailed Gecko	No	V		V	No

Notes: 1 – TSC Act, V = Vulnerable, E = Endangered. 2 – FM Act, E = Endangered. 3 – EPBC Act, CE = Critically Endangered, V = Vulnerable, E = Endangered, M = Migratory. 4 – Greater Long-eared Bat and Large-eared Pied Bat only. † Preliminary listing.

Table 1-4 summaries the potential loss of Threatened vegetation communities and fauna habitat as a result of the Project.

Table 1-4 Potential loss of vegetation and habitat in the study area

Vegetation communities	Total Project Disturbance (Boggabri Existing and Boggabri Extension) (ha)	Boggabri Existing (ha)	Boggabri Extension (ha)
Threatened ecological communities			
CEEC[1]	623.6	541.6	82.0
CEEC[2]	0.4	0.4	0.0
EEC[3]	0.3	0.3	0.0
EEC[4]	0.6	0.6	0.0
Total	**624.9**	**542.9**	**82.0**
Fauna habitats for Threatened species (excluding exotic grassland)			
Grassy Woodland on fertile soils	634.2	543.4	90.8
Shrubby Woodlands/Open Forest on skeletal soils	722.7	163.3	559.4
Riverine Woodland	1.2	1.2	0.0
Grassland	26.5	26.5	0.0
Total	**1384.6**	**734.4**	**650.2**

Notes:

* forms part of an Endangered Ecological Community.

1 – Critically Endangered Ecological Community, White Box -Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

2 – Critically Endangered Ecological Community, Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales (NSW) and southern Queensland.

3 – Endangered Ecological Community, Weeping Myall Woodlands.

4 – Endangered Ecological Community, Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River FM Act.

5 – Based on (James B. Croft and Associates 1983).

The majority of the clearing is proposed within Leard State Forest, which forms part of an extensive area of remnant native vegetation covering approximately 7407 ha. While significant areas of these communities will remain within the locality and adjoining the Project Boundary and the amount of clearing is relatively small in relation to their extent in the Brigalow Belt South, the extent of vegetation removal is still important to the locality.

The remaining areas of vegetation clearing are associated with the proposed upgrade of the approximate 17 km haul route which generally traverses a modified agricultural landscape. However it will also impact on remnant native vegetation across the Namoi River floodplain.

1.8 BioBanking Assessment

A detailed BioBanking credit calculation for the Projects impacts has been completed in accordance with the BioBanking Assessment Methodology (Department of Environment Climate Change 2009a).

1.8.1 Background

The DoP established a Biodiversity Offset Working Group for the Boggabri Project to assist in developing an appropriate level of biodiversity offsets to mitigate the impacts of the Project. The Biodiversity Offset Working Group included representatives from DoP, DECCW, DSEWPC, I&I NSW, Forestry NSW and Boggabri Coal. It was determined and agreed through the above committee that the Biodiversity Offset requirements for the Project would be developed based on a principles based approach. Due to the uncertainties regarding the application of the BioBanking tool at the time it was agreed that the BioBanking Assessment Methodology should be undertaken to inform the development of the Boggabri Coal Biodiversity Offset Strategy but not strictly applied to assess its adequacy.

1.8.2 Ecosystem credit requirements

Following detailed vegetation surveys, as described in the Boggabri Coal Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a), fourteen broad vegetation community types were identified as being impacted by the Project. The Project was assessed in accordance with the BioBanking Assessment Methodology(Department of Environment Climate Change 2009a). The BioBanking assessment determined that a total of **97,909** ecosystem credits are required to offset the Project (Table 1-5). In accordance with the BioBanking Methodology these credits must, depending on the ecosystem:

- Have a minimum area of between 25 and 100 ha of contiguous vegetation.
- Be obtained in:
  - Namoi CMA:
    - Liverpool Plains Part B, Liverpool Plains Part A, Pilliga Part A, Pilliga Part B, Pilliga Outwash, Castlereagh-Barwon, Kaputar, Eastern Nandewar's, Liverpool Range, Northern Basalt, Peel and Walcha Plateau subregions and, or
  - Central West CMA:
    - Pilliga subregion.
  - Consist of the range of vegetation communities identified in Table 1-5.

Table 1-5 Summary of ecosystem credit requirements for the Project

Vegetation types	Area (ha)	Red flag (Type)	Credits required
Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion [NA138]	0.3	No	18
Narrow-leaved Ironbark - pine - Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion [NA163]	14.8	No	953
Narrow-leaved Ironbark shrubby woodland of the	175.12	No	10,661

Vegetation types	Area (ha)	Red flag (Type)	Credits required
Brigalow Belt South bioregion [NA165]			
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) [NA179]	10.4	Yes (Over cleared)	634
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) [NA179]	26.1	No	762
Plains Grass - Bluegrass grassland of the Nandewar and Brigalow Belt South Bioregions [NA180]	0.4	Yes (Over cleared, Threatened ecological community)	10
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) [NA191]	0.6	No	39
River Red Gum Riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions(Benson 78) [NA193]	0.6	Yes Over cleared,)	35
Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson27) [NA219]	0.3	Yes (Over cleared, Threatened ecological community)	6
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions[NA225]	474.5	Yes (Over cleared, Threatened ecological community)	39,220
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226]	147.2	Yes (Over cleared, Threatened ecological community)	9,204
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [NA228]	528.9	No	35,989
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions[NA229]	3.7	No	260
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [NA237]	2	Yes (Over cleared, Threatened ecological community)	118
Total	**1385**		**97,909**

1.8.3 Species credit requirements

A total of **67** species credits are required to offset the Project impacts on approximately 2 ha of habitat (Table 1-6). These credits must:

- have a minimum area of 25 ha of contiguous vegetation
- be obtained in Namoi CMA, Liverpool Plains B subregion
- consist of the species identified in Table 1-6.

Table 1-6 Summary of species credit requirements for Project area

Species	Area of habitat	Credits
Black Necked Stork	2 ha	67

Additional species credits may be required for the Project's potential impacts on the Eastern Cave Bat. This species was found roosting within a cave outside of the Project Boundary, west of the Kamilori Highway. Given the distance (approximately 10 km to the south west) of this potential breeding habitat from majority of the Project's disturbance to Leard State Forest, the breeding habitat it is not considered to be impacted (Parsons Brinckerhoff 2010b).

2. Methods

2.1 Selection of potential offsets

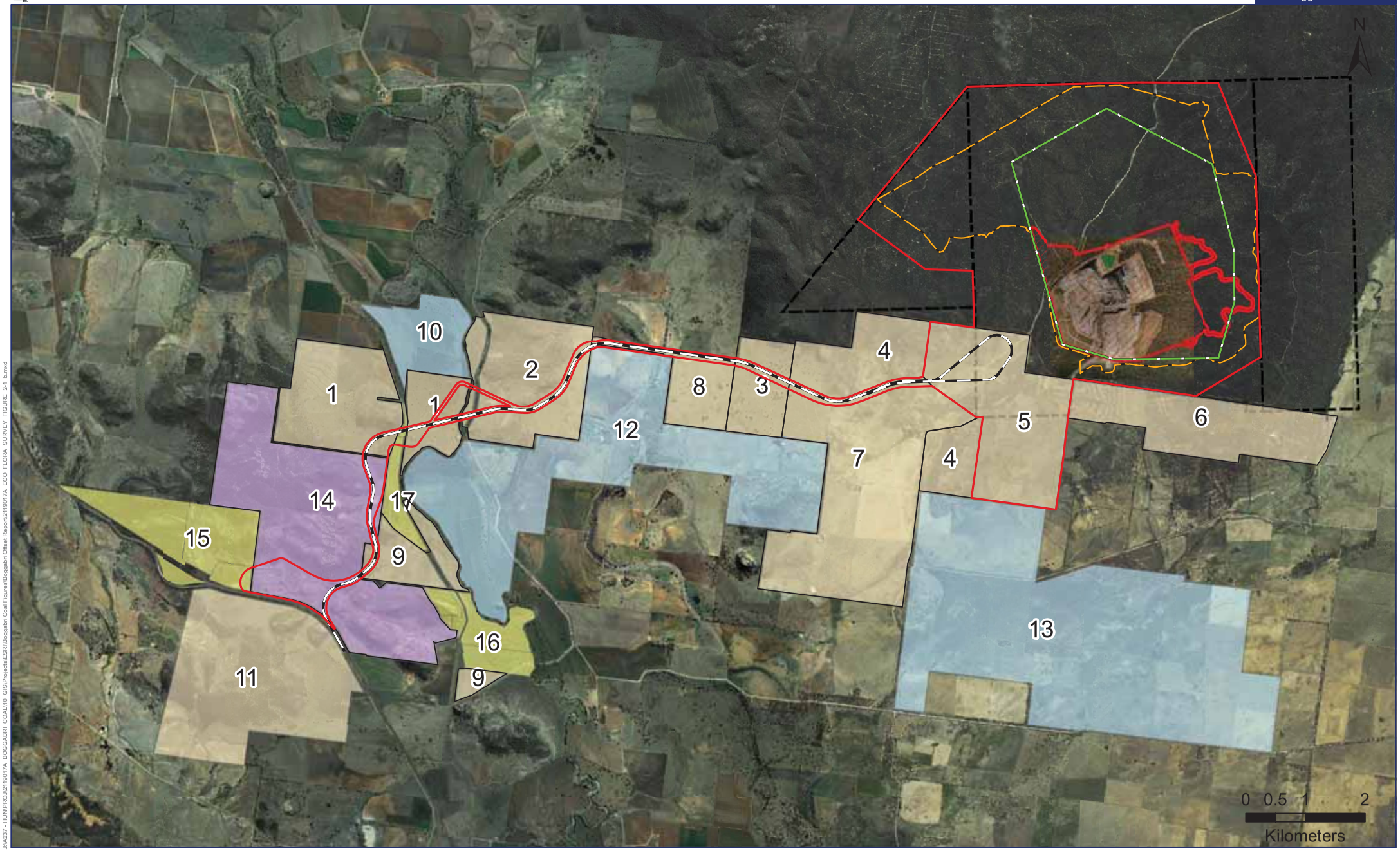
The initial selection of potential offsets was developed in response to the Boggabri Coal Biodiversity Offsets Steering Committee preference for the Boggabri Coal Biodiversity Offset Strategy to develop a local offset strategy that adequately compensates the Projects impacts on local biodiversity.

The initial offsets were identified as those properties currently owned by Boggabri Coal or likely to form part of the acquisition liability. They also considered previous studies, preliminary desktop analysis and consultation with Hansen Bailey Pty Ltd and Boggabri Coal.

The preliminary investigation was completed on 17 properties considered as potentially suitable offset sites for the Project. These properties were investigated through further desktop assessments and detailed field surveys (Parsons Brinckerhoff 2009) (Parsons Brinckerhoff 2010). The potential offset sites 1-9, 11, 14 -17 have had detailed surveys completed. The remaining sites, 10 and 12-13 have been assessed at a desktop level based on potential presence of similar vegetation and proximity to the impact sites (Table 2-1 and Figure 2-1).

Table 2-1 Land tenure of potential offsets and assessment methodology

Land tenure	Site number	Assessment
Boggabri Coal	1-9, 11	Desktop and Field based surveys
Private Property - Land identified in the ZOA	10, 12-13	Desktop based
Joint Venture	14	Desktop and Field based surveys
Crown Lands	15-17	Desktop and Field based surveys



Project Boundary
EIS Mine Disturbance (Boggabri Existing)
Proposed Disturbance Limit (Boggabri Extension)
Proposed Rail Loop
Mine Tenement
Mine Disturbance to 2011
Crown Land
Potential Land Acquisition Liability
Mining Joint Ownership
Boggabri Coal Pty Limited

Figure 2-1 - Potential Offset Sites and Land Tenure

2.2 Desktop analysis

The 17 properties identified for potential offsets were initially analysed at a desktop level, this desktop level analysis was then used to identify areas of native vegetation that required more detailed site specific field survey. The methodology considers the biodiversity characteristics, rehabilitation potential and suitability for offsetting within the locality. The specific methodology used in the assessment is provided below:

2.2.1 Identification of remnant vegetation and derived grassland

Identification of the remnant vegetation, habitats and derived grassland was undertaken for each of the potential offsets shown in Figure 2-1. Stratification of the sites vegetation was initially based on correlating distinct vegetation communities identified by Aerial Photograph Interpretation with a combination of existing vegetation mapping studies. Spatial analysis of available regional vegetation studies includes the following:

- Department of Land and Water Conservation 1:100,000 Vegetation Map Sheet for Boggabri NSW (Department of Land and Water Conservation 2003).
- The land use map produced by Duggin & Allison (1984) was utilised to identify the intensity of past grazing and agriculture use. This information gives an indication of the presence of possible soil seed bank and/or remnant native derived grassland.
- Native Vegetation Extent (Keith & Simpson 2006).
- The Natural Grasslands of the Liverpool Plains, New South Wales (Duggin & Allison 1984).
- *Bothriochloa biloba* (Poaceae) in natural grasslands on slopes of the Liverpool Plains, New South Wales (Bean 1999).

The analysis of aerial photographs dated 3 May 2005 (Department of Lands, film number - 4909) identified past land use practices, disturbance and native vegetation regrowth, changes in vegetation structure and some key floristics throughout the study area. This provided a further split of vegetation into simple structural and disturbance classifications and provided some delineation of areas currently under intensive agricultural practices and areas of derived grassland.

The initial stratification of the sites vegetation communities for the detailed site specific surveys was based on the modification of the previously mapped vegetation communities, consideration of other relevant environmental layers (i.e. topography, geology) and findings of the aerial-photograph analysis.

2.2.2 Identification of Threatened ecological communities

An assessment of each of the vegetation communities identified from the desktop analysis as occurring within the potential offsets properties was assessed against the essential criteria for locally occurring Threatened ecological communities as defined by the NSW Scientific Committee. The following three locally occurring Threatened ecological communities were assessed:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed as critically endangered under the EPBC Act and White Box, Yellow Box, Blakely's Red Gum Woodland listed as an Endangered Ecological Community

under the TSC Act. This community will be referred to as 'Box-Gum Woodlands' throughout the remainder of this report.

- Weeping Myall Woodlands listed as endangered under the EPBC Act and the Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed as endangered under the TSC Act. This community will be referred to as 'Weeping Myall Woodlands' hereafter in this report.

- Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld listed as critically endangered on the EPBC Act and Native Vegetation on Cracking Clay Soils of the Liverpool Plains listed as endangered on the TSC Act. This community will be referred to as 'Plains Grassland' hereafter in this report.

The identification of potential areas of Threatened ecological communities was guided and refined by the following desktop assessments:

- Analysis of aerial photographs to identify potential areas of remnant native vegetation.

- The mapping of vegetation communities by Department of Land and Water Conservation 1:100,000 Vegetation Map Sheet for Boggabri NSW (Department of Land and Water Conservation 2003).

- The mapping of Natural Grasslands of the Liverpool Plains, New South Wales (Duggin & Allison 1984).

- The soil characteristics and land use characteristics as mapped in Duggin & Allison (1984).

Vegetation communities identified by the desktop analysis as having potential to contain direct or partial similarities with one of the Threatened ecological communities were subsequently assessed in detail against available identification guidelines (NSW National Parks and Wildlife Service 2002a); advice of the Threatened Species Scientific Committee to the Minister for the Environment and Heritage (Department of the Environment and Heritage 2006a, 2006b; NSW National Parks and Wildlife Service 2002a; NSW Scientific Committee 2001, 2002, 2005; Threatened Species Scientific Committee 2006) and NSW Scientific Committee final determinations (NSW Scientific Committee 2001, 2002, 2005).

Threatened ecological communities that have been identified at a desktop level were verified by field surveys in the majority of the biodiversity offsets.

2.2.3 Identification of potential rehabilitation areas enhancing existing habitats

Each of the potential biodiversity offsets were assessed for their rehabilitation potential, either through sustained active management and revegetation or natural regeneration through changes in land management. For this assessment areas of remnant vegetation or potential derived native grassland were separated and prioritised for potential rehabilitation against areas of intensive cropping agriculture and grazing.

One or more of the following methods were used in assessing whether an area had the potential for natural rehabilitation:

- Preliminary site inspections and detailed BioBanking quadrat surveys were undertaken within properties 1-9, 11 and 14-17 on Figure 3-1. The results of these quadrats provided detailed information on the vegetation types and the condition of areas that were under intensive agriculture use. An assessment of the land use map produced by Duggin & Allison (1984) was utilised to identify the intensity of past grazing and agriculture use. This information gives an indication of the presence of a possible soil seed bank and/or remnant native grassland species.

- An assessment of the land use map was used in conjunction with the land systems of the study area by Duggin & Allison (1984) to identify potential areas of Black Earth Alluvial Plains which could indicate the presence of native grassland.

- An assessment of the sites landscape context, including the proximity of the land to other areas of remnant vegetation, potential for wildlife linkages and stepping stones to larger intact patches of remnant vegetation.

- An assessment of the sites potential contribution to the establishment of Wildlife corridors, in particular the potential for areas to provide linkages to larger areas of native vegetation such as national park estates or state forests.

- Whether the area was located in the riparian landscape. Riparian landscapes are considered important due to their potential to link riparian areas and provide bank stabilisation and improving water quality. In addition the riparian habitats within the Boggabri locality are generally of poor quality and this will enhance the biodiversity values in the region.

2.2.4 Landscape values

Landscape values of the offsets were determined using the broad principles of landscape assessment generally consistent with those identified within the BioBanking Assessment Methodology. In assessing the landscape values of each of the potential offsets the following factors were considered:

- extent of adjoining remnant vegetation

- percent native vegetation cover in the landscape

- connectivity value

- regional values in terms of position in the landscape with the potential to form and maintain regional vegetation corridors.

2.2.5 Forestry values

The offsets were also evaluated on their potential suitability for intensive forestry plantations, to offset the potential loss of timber reserves within Leard State Forest. Criteria used in this assessment included the following:

- past land use

- soil type and topography

- existing biodiversity values

- proximity to current forestry operations
- access and management requirements
- availability of water, irrigation.

2.3 Field survey

The level of additional field survey completed within the Projects offset areas varied largely depending on property access, timing and project requirements.

The three levels of survey completed involved:

1. Detailed quantitative site surveys in accordance with the BioBanking Operation Manual (Department of Environment Climate Change 2009a) — completed within the Project Boundary and proposed rehabilitation areas between 26 May and 2 June 2009 to provide quantitative measures of site specific condition attributes of the Project.

2. Vegetation mapping, selective sampling and limited quantitative site surveys in accordance with the BioBanking Operation Manual (Department of Environment Climate Change 2009a) — completed throughout the accessible 'Namoi River Offset' areas between 7 and 13 April 2010.

3. Broad scale vegetation mapping, aerial surveys (via helicopter) and limited ground truthing — completed throughout the additional 'Regional East West Corridor Offset' areas between 7 and 13 April 2010.

2.3.1 Vegetation surveys

In addition to previous surveys completed within the Project Boundary (James B. Croft and Associates 1983; Parsons Brinckerhoff 2010b) detailed quantitative site surveys were completed, including both quadrat and transect surveys as outlined in the methodology contained within BioBanking Operation Manual (Department of Environment Climate Change 2009a) (refer to Figure 2-4 below).

The vegetation surveys were initially undertaken between 26 May and 2 June 2009 on four properties (labelled 1 to 4 in Figure 2-1) owned by Boggabri Coal. With further detailed field surveys undertaken between 9 April and 12 April 2010 on the remaining biodiversity offsets properties not currently in private ownership. Details of the survey methodology is provided below and depicted in Figure 2-2.

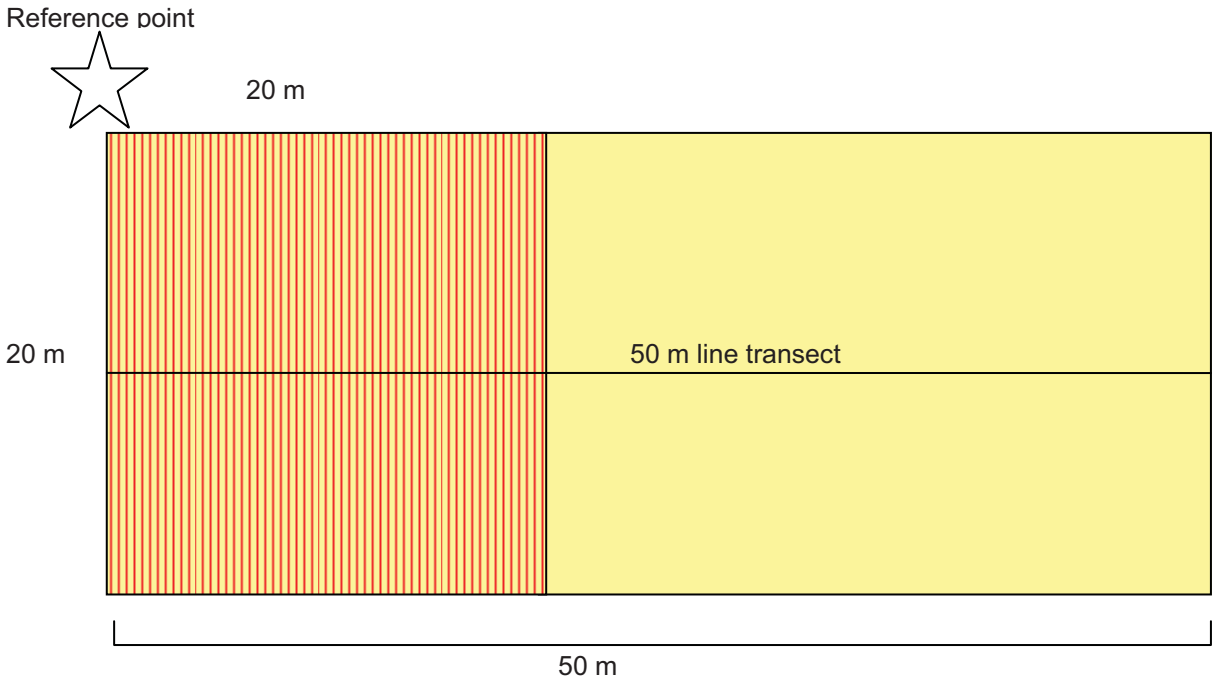


Figure 2-2 Schematic diagram illustrating the layout of the nested 20 x 50 m and 20 x 20 m quadrats used for the assessment of condition attributes at each site

Key: 20 x 20 m quadrat 20 x 50 m quadrat

2.3.2 Quadrats

The following site attributes were recorded within each quadrat:

- **Native and exotic species richness** (within a 400 m^2 quadrat): This consisted of recording all species by systematically walking through each 20 x 20 m quadrat.
- **Number of trees with hollows** (1000 m^2 quadrat): This was the frequency of hollows within living and dead trees within each 50 x 20 m quadrat. A hollow was only recorded if (a) the entrance could be seen; (b) the estimated entrance width was at least 5 cm across; (c) the hollow appeared to have depth; (d) the hollow was at least 1 m above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- **Total length of fallen logs** (1000 m^2 quadrat): This was the cumulative total of logs within each 50 x 20 m quadrat with a diameter of at least 10 cm and a length of at least 0.5 m.

2.3.3 Transects

The following attributes were measured along a 50 m transect:

- **Native overstorey cover**: This consisted of estimating the percentage cover of the tallest woody stratum present (> 1 m and including emergents) at 10 evenly spaced points (i.e. every 5 m) along each 50 m transect. The percentage foliage cover was determined as the average of all measurements taken at each point using a reference

set of images (Walker & Hopkins 1990). The woody stratum included species that were native to New South Wales and not necessarily those that were locally endemic.

- **Native mid-storey cover**: This involved estimating the cover of vegetation between the overstorey stratum and a height of 1 m (i.e. tall shrubs, under-storey trees and tree regeneration) at 10 evenly spaced points along a 50 m transect. The percentage foliage cover was estimated as described above.

- **Ground cover**: This comprised estimating the cover of plants below 1 m in height at 50 points along a 50 m transect. Percentage cover was estimated by dividing the total number of intersections at each point by the total number of points (i.e. 50).The following categories of plants were recorded:

  - **Native ground cover (grasses):** native grasses (Poaceae family native to New South Wales).

  - **Native ground cover (shrubs)**: all woody vegetation below 1 m in height and native to New South Wales.

  - **Native ground cover (other)**: non-woody vegetation (i.e. vascular plants — ferns and herbs) below 1 m in height and native to New South Wales.

  - **Exotic plant cover**: vascular plants not native to Australia.

2.3.4 Summary of survey effort

The stratification of vegetation communities within the offsets was initially based on distinct vegetation communities identified by Aerial Photograph Interpretation and the existing vegetation mapping (Croft 1979; Department of Land and Water Conservation 2003) and subsequent detailed vegetation mapping (Parsons Brinckerhoff 2009).

A summary of the quadrat/transects sampled per vegetation stratification unit for the Namoi River Offset is provided in Table 2-2.

Table 2-2 Stratification units and number of quadrats surveyed

Stratification unit	Area (hectares)	Number of quadrats surveyed
Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion	279.7	4
Narrow-leaved Ironbark - pine - Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion [NA163]	NA	0
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion [NA165]	901.5	8
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) [NA179]	573.8	9
Plains Grass - Bluegrass grassland of the Nandewar and Brigalow Belt South Bioregions [NA180]	16.1	2
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) [NA191]	3.2	2
River Red Gum Riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions(Benson 78) [NA193]	176.3	3
Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson27) [NA219]	3.60 3.7	2
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226]	700.9	8
White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [NA228]	247.9	1
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions[NA229]	159.6	2
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion [NA237]	31.2	2
Total	**3090.2**	**43**

2.4 Aerial helicopter surveys of additional offsets

To assess quickly and efficiently a number of potential additional offsets that could be included in this Boggabri Coal Biodiversity Offset Strategy, aerial surveys were conducted via a helicopter. These surveys were undertaken in May 2010. The aerial route included low altitude aerial surveys over the Nandewar Range extending from Mt Kaputar National Park west to the Pilliga State Forest, south to Quirindi and east over Keepit Dam. During the aerial surveys identification of potential areas of Box-Gum Woodland were identified.

2.5 Recommended assessment criteria for biodiversity offsets

2.5.1 Distance from proposal

Biodiversity offsets should be located appropriately and offset the impact in the same region. Ideally, offsets habitat areas should be located as close as possible or strategically located to form part of a regional offset strategy.

Choosing offsets located close to the proposal is also consistent with the need to provide compensatory habitat of similar type and quality to that being removed. The integrity of the habitat network and biodiversity values of the locality are retained and habitat is secured and existing corridors consolidated for local flora and fauna populations.

In addition to the ecological benefits, by choosing offsets located near the Project, conservation planning can be integrated with development planning and this is also likely to benefit the reputation of the proponent, particularly with local stakeholders.

2.5.2 Presence of Threatened biodiversity

When determining offsets, they must be targeted and offset the impacts on a 'like for like or better' basis. Given that the Project includes clearing of Threatened ecological communities, offsets should include these communities.

2.5.3 Current condition and potential for improvement

Habitat condition gives an indication of its quality for flora and fauna habitat and long-term viability. The condition of a remnant is a result of a number of factors including weed invasion, fragmentation, pollution and disturbances including clearing, fire and grazing. The condition provides an index of past uses of the area and its potential to support Threatened species, populations and communities. Although it is preferable that the condition/habitat quality of offsets exceeds or matches that of habitat removed, this is not always achievable. Where the condition or quality of the offsets isn't equivalent to that of the area being cleared, a greater area of offsets will be required.

Where the condition of habitats can be improved through changes in management (for example cessation of grazing), this improvement in condition can be used to offset a development.

2.5.4 Connectivity

Connectivity of habitats is essential to the long-term survival of many species because it facilitates movement on a local scale, for foraging and sheltering, as well as on a regional scale as a wildlife corridor, for dispersal and migration. Remnants with habitat linkages are more likely to maintain their biodiversity in the long-term because wildlife corridors:

- Provide increased foraging area for wide-ranging species.
- Provide cover for movement between habitat patches, particularly for cover-dependent species and species with poor dispersal ability and enhancing the movement of animals through sub-optimal habitats.
- Reduce genetic isolation.

- Facilitate access to a mix of habitats and successional stages to those species which require them for different activities (for example, foraging or breeding).
- Provide refuge from disturbances such as fire.
- Provide habitat in itself.
- Link wildlife populations and maintain immigration and re-colonisation between otherwise isolated patches. This in turn may help reduce the risk of population extinction (Wilson & Lindenmayer 1995).

Connectivity of habitats creates larger remnants that are likely to be of higher quality and support higher biodiversity.

Offsets are likely to be of greater biodiversity value where they are located adjacent to remnant vegetation creating a larger remnant or where they provide linkages within otherwise fragmented landscapes. Compensatory habitat should act to consolidate existing corridors or, occur adjacent to existing areas of native vegetation in order to maintain or increase their habitat quality and long-term viability.

2.5.5 Security of tenure

Offsets must be enduring and must offset the impact of the development for the period that the impact occurs. The security of tenure and ongoing management of offsets is critical to the long-term viability of offsets and must be carefully considered.

2.5.6 Management issues

Although ecological criteria are considered of primary importance, other factors also need to be taken into account. The practical and cost implications of managing offsets in the long-term also need to be considered by relevant land managers.

2.6 Offsets requirements under the EPBC Act

When identifying offsets for a development, these offsets should possess certain desirable characteristics, particularly those relating to matters covered by the EPBC Act. These requirements are discussed in more detail in Section 4-5.

3. Results of assessment

3.1 Landscape context

The development site and all offsets investigated occur within:

- Brigalow Belt South Bioregion.
- Namoi Catchment Management Area, Liverpool Plains B and Peel Subregions.
- Bugaldie Uplands and Liverpool Plains Mitchell Landscapes.

This is consistent with the landscapes and area criteria identified in the BioBanking credit requirements for the Project (Parsons Brinkerhoff 2009).

The desktop analysis of the landscape context generally indicates that the majority of the proposed offsets lie within a large relatively disturbed agricultural landscape with scattered remnant patches of vegetation and derived grassland and partial connectivity to the larger remnant patches of vegetation within the locality including, Leard State Forest/State Conservation Area, the Nandewar Range, Namoi River Floodplain and remnant to the west of the Kamilaroi highway. These sites are surrounded by a landscape that has been modified significantly through anthropogenic disturbance, including cropping, grazing and other developments.

From a regional perspective the Brigalow Belt Bioregion has only limited areas of conservation-oriented tenures: together, they occupy about 155,353 ha or 2.91% of its area (NSW National Parks and Wildlife Service 2003). These reserves are made up of nineteen National Parks and Nature Reserves. About 10.6% of the bioregion is managed as State Forests. Nine Flora Reserves, occupying 4,091 ha (0.008%) also occur in the bioregion. Several State Forests occur within the region; including Leard, Kerringle, Kelvin, Vickery, Bibblewindi and Pilliga East.

Mount Kaputar National Park and the Pilliga Nature Reserve are the largest areas conserved within the Brigalow Belt South Bioregion and occur approximately 27 km to the north and 50 km to the south-west of the Project respectively. These areas occupy approximately 1,207 ha (not including area within the Nandewar bioregion for Mt Kaputar) and 80,239 ha respectively (Resource and Conservation Assessment Council 2000). Recently gazetted Killarney (1,858 ha) and Leard (1,176 ha) State Conservation Areas occur also nearby in the bioregion.

The State Forests of Kerringle and Vickery are located approximately 44 km to the south-west and 15 km to the south-east of the study area respectively. Cumulative these reserves play an important role in the landscape as fragmented vegetated links within the bioregion.

The combined offsets provide the potential to facilitate linkages between these conservation reserves in the wider Brigalow Belt South Bioregion. Furthermore, they provide potential rehabilitation of important Regional East-West Wildlife Corridors between the Leard State Forest and the Namoi River floodplain and will facilitate potential biodiversity linkages between remnant vegetation of the Nandewar Range, the Leard State Forest through to the Pilliga Nature Reserve. Such corridors will increase the biodiversity values of the region.

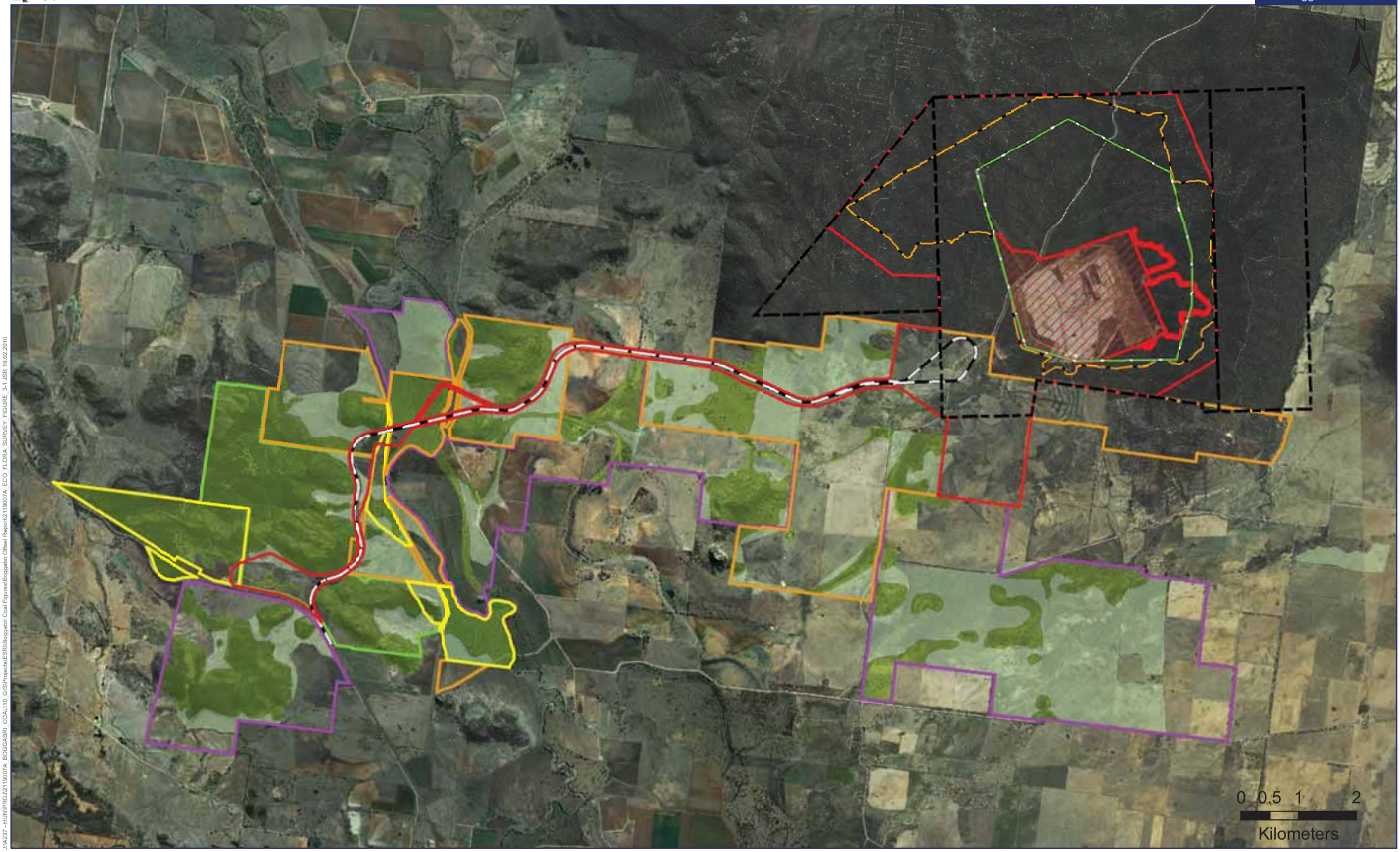
3.2 Identification of remnant vegetation

The identification of the remnant vegetation within the potential offsets properties was based on a combination of the desktop investigations and subsequent detailed field investigations. Desktop investigations included aerial photography interpretation and review of the relevant regional vegetation mapping Projects (Bean 1999; Department of Land and Water Conservation 2003; Keith & Simpson 2006; Parsons Brinckerhoff 2010a); land use maps of Duggin & Allison (1984). The desktop analysis was subsequently verified by field surveys to identify areas of remnant native vegetation and derived grassland and these are depicted in Figure 3-1.

Table 3-1 outlines the extent of remnant vegetation and derived grassland for each of the potential biodiversity offsets properties. It is clear from results that the majority of the properties have been previously cleared for grazing and agriculture purposes; however a number of properties contain significant areas of remnant vegetation including 1, 2, 11-15.

Table 3-1 Potential remnant vegetation and derived grassland

Potential biodiversity offsets site	Remnant vegetation (ha)	Derived grassland (ha)
1 – Boggabri Coal (Heathcliff)	216.7	93.0
2 – Boggabri Coal (Daisymede)	232.7	117.0
3 – Boggabri Coal (Velyama)	95.5	40.9
4 – Boggabri Coal (Merriown)	75.3	234.0
5 – Boggabri Coal	0.0	10.0
6 – Boggabri Coal	0.0	0.0
7 – Boggabri Coal	57.0	118.5
8 – Boggabri Coal	27.4	91.5
9 – Boggabri Coal	12.0	95.0
10 – Private Property	3.0	111.0
11 – Boggabri Coal	319.0	113.0
12 – Private Property	292.0	119.0
13 – Private Property	316.0	895.0
14 – Joint Venture	658.0	102.0
15 – Crown Land	267.0	0.0
16 – Crown Land	95.0	43.2
17 – Crown Land	16.0	17.9
TOTAL	**2682.3**	**2210**



Project Boundary
Mine Tenement
Mine Disturbance to 2011
Proposed Rail Loop
Proposed Disturbance Limit (Boggabri Extension)
EIS Mine Disturbance (Boggabri Existing)
Crown Land
Mining Joint Ownership
Boggabri Coal Pty Limited
Derived Native Grassland
Remnant Vegetation

Figure 3-1 Remnant Vegetation and Derived Grassland

3.3 Identification of Vegetation Communities

The areas of remnant vegetation have been further classified into distinct vegetation communities identified in the field during detailed vegetation mapping for the Project (Parsons Brinckerhoff 2010a) refer Figure 3-2.

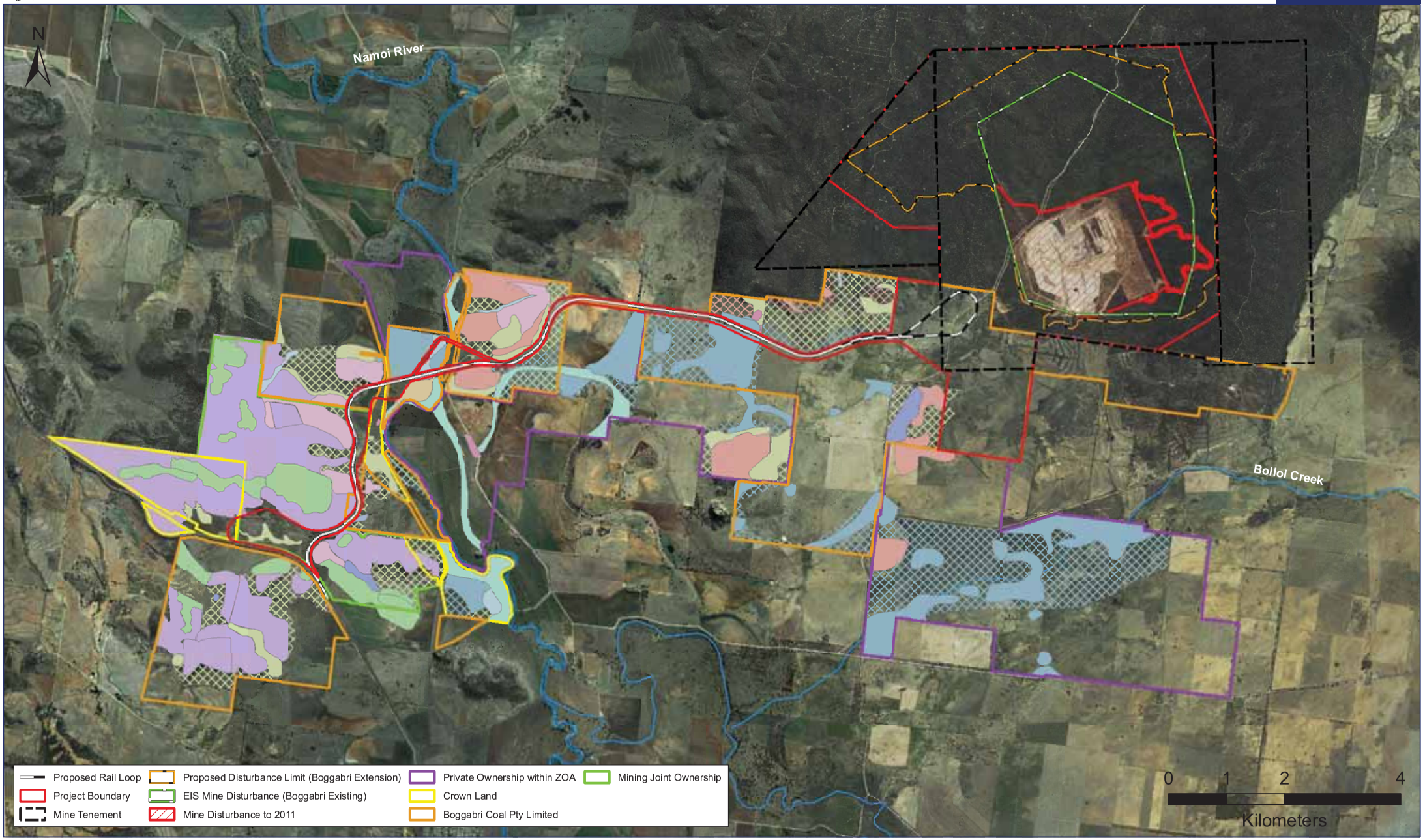
Table 3-2 lists the 15 vegetation communities which are present within the potential offsets and their classification under the four broad regional vegetation groups. This table also identified the corresponding BioBanking Vegetation type (Department of Environment Climate Change 2009b) and Namoi CMA vegetation types (Namoi Catchment Management Authority 2010).

Table 3-2 Broad Vegetation categories/habitats

Vegetation Community (Parsons Brinckerhoff 2010a)	BioBanking Vegetation type (Department of Environment Climate Change 2009b)	Namoi CMA regional vegetation communities (Namoi Catchment Management Authority 2010)
Grassy Woodlands on fertile soils		
White Box – White Cypress Pine grassy woodland	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226]	RVC 18 White Box grassy woodland, Brigalow Belt South and Nandewar
White Box – Narrow-leaved Ironbark – White Cypress Pine grassy open forest	White Box – White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions[NA225]	RVC 18 White Box grassy woodland, Brigalow Belt South and Nandewar
Pilliga Box – Poplar Box – White Cypress Pine grassy open forest	Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (Benson 88) [NA179]	RVC 32 Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland on alluvial loams, Darling Riverine and Brigalow Belt South
Weeping Myall grassy open woodland	Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (Benson27) [NA219]	RVC 75 Weeping Myall open woodland, Darling Riverine Plains Brigalow Belt South and Nandewar
Shrubby Woodland/Open Forest on skeletal soils		
Narrow-leaved Ironbark – White Cypress Pine shrubby open forest	White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [NA228]	RVC 59 Narrow-leaved Ironbark – pine – box woodlands and open forests, Brigalow Belt South and Nandewar

Vegetation Community (Parsons Brinckerhoff 2010a)	BioBanking Vegetation type (Department of Environment Climate Change 2009b)	Namoi CMA regional vegetation communities (Namoi Catchment Management Authority 2010)
White Box – Narrow-leaved Ironbark – White Cypress Pine shrubby open forest	Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South bioregion [NA165]	RVC 59 Narrow-leaved Ironbark – pine – box woodlands and open forests, Brigalow Belt South and Nandewar
Silver-leaved Ironbark heathy woodland	White Cypress Pine – Silver-leaved Ironbark – Tumbledown Red Gum shrubby open forest of the Nandewar and Brigalow Belt South Bioregions[NA229]	RVC 44 White Box – pine Silver leaved Ironbark shrubby open forests, Brigalow Belt South and Nandewar
Dwyer's Red Gum woodland	Dwyer's Red Gum woodland on siliceous substrates in the Brigalow Belt South Bioregion	RVC 58 Shrubby woodlands or mallee woodlands on stoney soils, Brigalow Belt South and Nandewar
Native Olive dry gully forest	NA	RVC 02 Rusty Fig – Wild Quince – Native Olive dry rainforest of rocky areas, Nandewar and New England Tablelands
Riverine Woodlands		
Yellow Box – Blakely's Red Gum grassy woodland	Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion [NA237]	RVC 17 Box – gum grassy woodlands , Brigalow Belt South and Nandewar
River Red Gum riparian woodlands and forest	River Red Gum Riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions(Benson 78) [NA193]	RVC 73 River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar
White Box – Blakely's Red Gum – Melaleuca riparian forest	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) [NA191]	RVC 72 Bracteate Honey Myrtle riparian shrubland, Brigalow Belt South

Vegetation Community (Parsons Brinckerhoff 2010a)	BioBanking Vegetation type (Department of Environment Climate Change 2009b)	Namoi CMA regional vegetation communities (Namoi Catchment Management Authority 2010)
Grasslands		
Plains Grasslands	Plains Grass – Bluegrass grassland of the Nandewar and Brigalow Belt South Bioregions [NA180]	RVC 29 Plains Grass – Blue Grass grassland, Brigalow Belt South and Nandewar
Derived Native grassland	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions [NA226] ' Low condition'	RVC 18 White Box grassy woodland, Brigalow Belt South and Nandewar
Regrowth – White Cypress Pine	White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion [NA228] 'regrowth'	NA



PB Vegetation Mapping

- Dwyer's Red Gum woodland
- Narrow-leaved Ironbark - Brown Bloodwood -White Cypress Pine shrubby open forest
- Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- Narrow-leaved Ironbark – White Cypress Pine shrubby open forest (Low Condition)
- Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland
- Pilliga Box - Poplar Box – White cypress pine grassy open forest (Low Condition)
- Plains Grassland
- Regrowth - White Cypress Pine
- River Red Gum Riparian woodland and forest
- River Red Gum Riparian woodland and forest (Low Condition)
- Silver-leaved Ironbark heathy woodland
- Weeping Myall grassy open woodland
- White Box – Melaleuca riparian forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine grassy open forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box – White Cypress Pine grassy woodland (Low Condition)
- White Box – White Cypress Pine grassy woodland
- Yellow Box - Blakely's Red Gum -Melaleuca riparian forest
- Yellow Box - Blakely's Red Gum grassy woodland

Figure 3-2 Vegetation Communities

3.4 Presence of Threatened ecological communities

Three Threatened ecological communities have been identified within the potential offsets, including Box-Gum Woodlands, Weeping Myall and Plains Grassland.

The results of this current survey describe approximately 822 ha of existing Threatened ecological communities within the potential biodiversity offsets properties (Table 3-3 and Figure 3-3).

Table 3-3 Area of remnant Threatened ecological communities within potential offsets

Potential biodiversity offsets Property	Box Gum Woodland (ha)	Box Gum Woodland 'Low Condition' (ha)	Weeping Myall Woodland (ha)	Potential Plains Grassland (ha)
1 – Heathcliff	46.0	66.8	0.0	16.1
2 – Daisymede	46.0	56.3	0.0	0.0
3 – Velyama	8.0	0.1	3.0	0.0
4 – Merriown	18.0	169.3	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	7.8	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.2	16	0.0	0.0
10	0.0	0.0	0.0	0.0
11	25.0	113.2	0.0	0.0
12	49.0	0.0	5.0	0.0
13	0.0	0.0	0.0	0.0
14	11.0	76.9	0.0	0.0
15	8.4	0.0	0.0	0.0
16	10.0	37.2	0.0	0.0
17	15.1	16.9	0.7	0.0
TOTAL	**236.7**	**560.5**	**8.7**	**16.1**

3.4.1 Box-Gum Woodland

The following three vegetation communities as mapped using the current field survey data and previous field surveys by Parsons Brinckerhoff (2010a) correspond to the Box-Gum Woodland Threatened ecological community as listed under the EPBC Act and the TSC Act:

- White Box – White Cypress Pine grassy woodland.
- White Box – Narrow-leaved Ironbark – White Cypress Pine grassy woodland.
- Yellow Box – Blakely's Red Gum grassy woodland.

The above three vegetation communities were assessed in detail against available identification guidelines (NSW National Parks and Wildlife Service 2002a); advice of the Threatened Species Scientific Committee to the Minister for the Environment and Heritage (Department of the Environment and Heritage 2006a; Threatened Species Scientific Committee 2006) and NSW Scientific Committee final determination (NSW Scientific Committee 2002) to ensure that they correspond to the Box-Gum Woodland Threatened ecological community as listed on the EPBC Act and the TSC Act.

The results from the current vegetation surveys and previous vegetation surveys describes approximately 236.7 ha of existing good condition remnant Box Gum Woodland within the potential biodiversity offsets properties. These surveys also identified approximately 560.5 ha of Box Gum Woodland of 'Low Condition' or derived native grassland with scattered canopy and natural regeneration potential.

Areas of 'Low Condition' are likely to meet the (NSW National Parks and Wildlife Service 2002a) identification guidelines for Box Gum Woodland 'Class 4' condition.

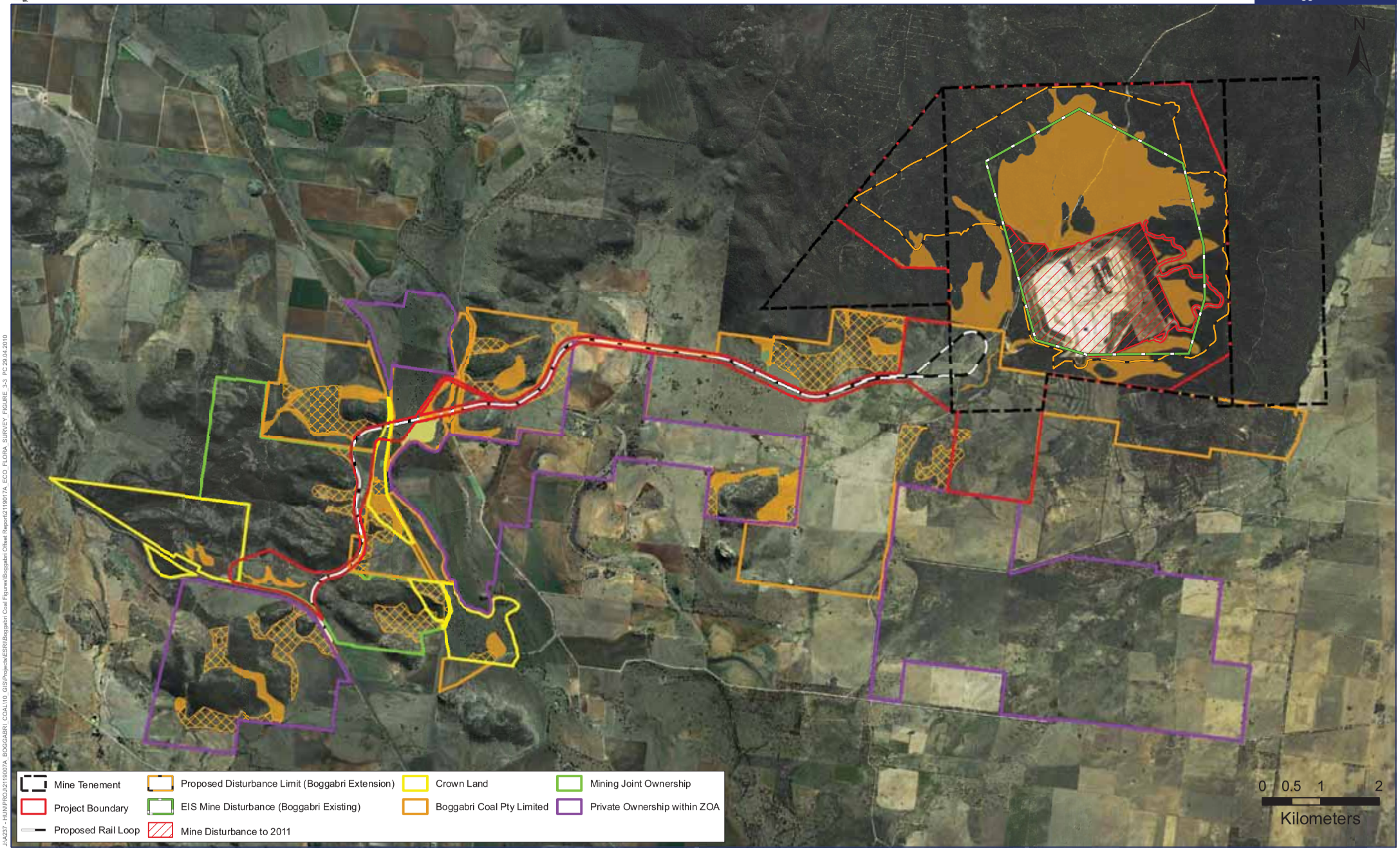
Areas of derived native grassland with potential to correspond with Box-Gum Woodland as determined in the EPBC Act policy guidelines for Box-Gum Woodlands have not been included (Department of the Environment and Heritage 2006a).

3.4.2 Weeping Myall Woodland

Approximately 8.7 ha of the Threatened vegetation community of Weeping Myall Woodland has been mapped as Weeping Myall grassy open woodland within property number 3 (Velyama) and property number 12 (Figure 3-2). The results from the detailed BioBanking surveys were assessed against the advice of the Threatened Species Scientific Committee to the Minister for the Environment, Water, Heritage and the Arts and EPBC Policy Statement for Weeping Myall Woodlands (Department of Environment Water Heritage and the Arts 2008b; Department of the Environment Water Heritage and the Arts 2009) and the NSW Scientific Committee final determination (NSW Scientific Committee 2005) to ensure that this community corresponds to the Weeping Myall Woodland Threatened ecological community as listed on the EPBC Act and the TSC Act.

3.4.3 Plains Grassland

Approximately 16.1 ha of Plains Grassland have been mapped within property number 1 (Heathcliff), this community corresponds to the Plains Grassland community as mapped by (Parsons Brinckerhoff 2010a). The results from the detailed BioBanking surveys were assessed against the advice of the Threatened Species Scientific Committee to the Minister for the Environment, Water, Heritage and the Arts (Department of Environment Water Heritage and the Arts 2008a) and the NSW Scientific Committee final determination (NSW Scientific Committee 2001) to ensure that this community corresponds to the Plains Grassland Threatened ecological community as listed on the EPBC Act and the TSC Act.



Identified Threatened Vegetation Communities within study area

- Box Gum Woodlands (Low Condition)
- Box-Gum Woodlands
- Plains Grassland
- Weeping Myall grassy open woodland

Figure 3-3 Threatened Ecological Communities

3.5 Rehabilitation potential

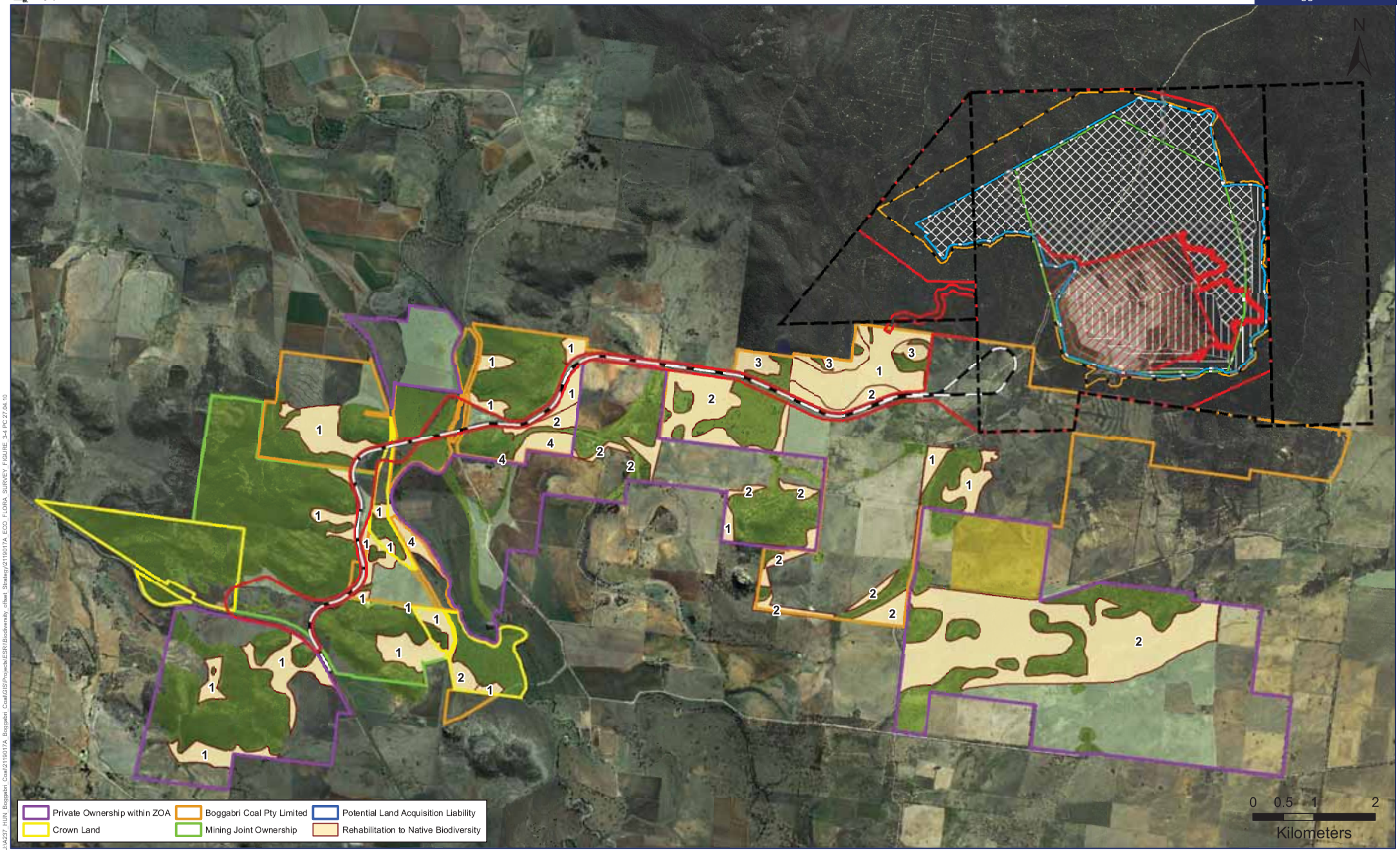
Careful consideration was given to the areas identified for rehabilitation to maximise the biodiversity outcomes as outlined in Section 2.2.3 of the methodology section. The majority of potential rehabilitation areas occur adjacent to remnant vegetation as this provides wildlife corridors and maximises the likely success of rehabilitation of native species (Figure 3-4). All of the rehabilitation areas have been located within derived native grassland with natural regeneration potential.

The restoration works will include the removal of stock, fencing and generally rely on natural regeneration. Restoration works will be undertaken only on native derived grassland where there is high potential for a native soil seedbank. However, supplementary planting of tubestock and selective direct seeding will be undertaken to provide linkages between the remnant vegetation patches and in areas where natural regeneration is not successful. The vegetation will be rehabilitated to resemble the adjoining vegetation communities with particular emphasis on restoration of the Threatened Box-Gum Woodland. The use of local province seed stock and tubestock will be used in the restoration works to retain local genetic content.

The vegetation communities to be restored include but are not limited to the following four vegetation types:

- White Box – White Cypress Pine grassy woodland – commensurate to Box-Gum Woodland CEEC.
- Pilliga Box – Poplar Box – White Cypress Pine grassy open forest.
- Narrow-leaved Ironbark – White Cypress Pine shrubby open forest.
- River Red Gum Riparian woodland and forest.

The properties which adjoin Leard State Forest have been targeted for rehabilitation due to their location and facilitation of a major Regional East-West Wildlife Corridor (see Figure 3-4). The other areas of rehabilitation are on the Namoi floodplain, in the western properties adjoining remnant vegetation and in the eastern strategic corridor properties (see **Section 3.8**). Combined with areas of remnant vegetation, the rehabilitation will facilitate linkages across the Namoi floodplain, through the Leard State Forest and east to the Nandewar Range.



Proposed Rail Loop
Project Boundary
Mine Tenement
Mine Disturbance to 2011
Final Rehabilitation Boundary
Proposed Disturbance Limit (Boggabri Extension)
EIS Mine Disturbance (Boggabri Existing)

Vegetation Types
Derived Native Grassland
Remnant Vegetation
Forestry Plantation (Eucalypt)

Mine Plan - Rehab of land for Bio / Forestry - Year 1
Mine Plan - Rehab of land for Bio / Forestry - Year 5
Mine Plan - Rehab of land for Bio / Forestry - Year 10
Mine Plan - Rehab of land for Bio / Forestry - Year 21

Proposed Rehabilitation Vegetation Types
1= White Box - white cypress pine grassy woodland
2= Pilliga Box - Poplar Box – White cypress pine grassy open forest
3= Narrow-leaved Ironbark – White Cypress Pine shrubby open forest
4= River Red Gum Riparian woodland and forest

Figure 3-4 Potential rehabilitation areas

3.6 Forestry values

The original land use within the majority of the Project Boundary was forestry associated with the Leard State Forest. This area has been regularly logged over the past century and as recently as the 1980s. While there is no harvestable timber available in the area today there is likely to be in 20-30 years if it were not affected by the Project. It is considered that the Leard State Forest, including those areas to be impacted by the Project will provide a valuable timber resource area in the medium to long term.

The relatively high biodiversity values currently existing within the Leard State Forest are indicative that areas under the management and sustainable logging practises of Forests NSW can contribute to the local biodiversity and its conservation.

As part of post mine rehabilitation and restoration processes, it is proposed to manage sections of the Leard State Forest that are located within the Project Boundary for timber production. Timber harvesting activities will be restricted to Forestry NSW owned land and the proposed forestry plantation area. Timber harvesting activities will not be permitted in the Biodiversity offset areas. Any sustainable forestry activities will be conducted in accordance with local and regional sustainable forestry management practices.

To further offset the Projects short term impacts on the timber reserves of the Leard State Forest, it is also proposed to create an intensive forestry eucalypt plantation within the overall strategy. The details of this plantation have not been formalised however, it is likely to comprise relatively fast growing eucalypt species with potential for some supplementary planting of native understorey species for additional biodiversity habitat value. It should be noted that the provision of a forestry eucalypt plantation will not completely compensate for the loss of potential harvestable timber from the Leard State Forest.

An area of approximately 186 ha within property number 13 has been set aside for intensive forestry operations (Figure 3-4). The proposed plantation will allow for increased connectivity between remnant vegetation located to the north and south and is in close proximity to the current forestry operations of Leard State Forest.

3.7 Summary of ecological values in the offsite sites

Table 3-4 is a summary of the characteristics of the potential offsets provided by the desktop and field assessments.

Table 3-4 Summary of potential offsets investigated

Site	Tenure	Property size (ha)	Distance from proposal	Connectivity	Threatened Biodiversity	General Description	Management Issues	Field surveys undertaken?
1(Heathcliff)	Private - Boggabri Coal	454	Adjoining Rail loop, 8 km from open cut	Provides a valuable link between large natural vegetated lands to east and west and the Namoi floodplain.	Threatened communities of Plains Grassland and Box-Gum Woodlands. Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	Large areas of native grasslands on rich riverine soils that are likely to correspond with the Threatened ecological community, Native Vegetation on Cracking Clay Soils on the Liverpool Plains. Areas cleared for grazing and for cultivation of crops. Contains approximately 2 km of riverine habitats fronting the Namoi River.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
2 (Daisymede)	Private - Boggabri Coal	406	Adjoining Rail loop, 6 km from open cut	Provides a valuable link between large natural vegetated lands to east and the Namoi floodplain.	Threatened community of Box-Gum Woodlands. Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	▪ Large areas of derived grasslands and remnant native vegetation. ▪ Contains large areas of the Namoi River floodplain and riverine corridor. ▪ Provides a valuable link between large natural vegetated lands to east and the Namoi floodplain. ▪ Regeneration of the overstorey evident.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
3 (Velyama)	Private - Boggabri Coal	149	Adjoining Rail loop, 4 km from open cut	Provides linkage between the adjoining Leard State Forest and potential biodiversity sites to the south of the rail corridor.	Threatened communities of Box-Gum Woodlands and Weeping Myall Woodlands.	▪ The majority of site grazed with limited vegetation canopy cover. ▪ Areas of derived grassland native vegetation with potential regeneration capability. ▪ Contains visually significant rise dominated by native vegetation. ▪ Some rocky outcrops and cliff areas. ▪ Includes patches of *Callitris glaucophylla*. ▪ Is adjacent to large areas of remnant native vegetation within Leard State Forest.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
4 (Merriown)	Private - Boggabri Coal	325	Adjoining Rail loop, 2 km from open cut	Provides linkage between the adjoining Leard State Forest and potential biodiversity sites to the south of the rail corridor.	Threatened community of Box-Gum Woodlands.	▪ The majority of site grazed with limited vegetation canopy cover. ▪ Areas of derived grassland native vegetation with potential regeneration capability. ▪ Contains visually significant rise dominated by native vegetation. ▪ Some rocky outcrops and cliff areas. ▪ Includes patches of *Callitris glaucophylla*. ▪ Is adjacent to large areas of remnant native vegetation within Leard State Forest.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.

Site	Tenure	Property size (ha)	Distance from proposal	Connectivity	Threatened Biodiversity	General Description	Management Issues	Field surveys undertaken?
5	Private - Boggabri Coal	487	Adjoining Rail loop, and open cut	This area will be used for mine infrastructure and will have limited connectivity.	-	▪ This property will be used for mine infrastructure and rail loop. ▪ Small areas of derived native grasslands adjoining Leard State Forest. ▪ Areas cleared for grazing and for cultivation of crops. ▪ Rehabilitation of the site will be part of the post mining activities for Boggabri Coal Mine.	Areas cleared for grazing and for cultivation of crops. Rehabilitation of the area will be completed as part of the mine closure plan.	Yes. Quadrat/transect surveys undertaken.
6	Private - Boggabri Coal/Tarrawonga Coal Mine	373	Adjoining open cut	Provides a future link between the post mining rehabilitation areas of Tarrawonga and Boggabri Coal Mine.	-	▪ Includes the Tarrawonga Coal Mine operations. ▪ Includes riparian vegetation along Goonbri Creek. ▪ Large area of native vegetation adjoining Leard State Forest. This area is proposed for future mining operations. ▪ Rehabilitation of the site will be part of the post mining activities for Tarrawonga Coal Mine.	Large Areas cleared for grazing and for cultivation of crops. Rehabilitation of the area will be completed as part of the mine closure plan.	Yes. Quadrat/transect surveys undertaken.
7	Private - Boggabri Coal	770	Adjoining Rail loop, 3 km from open cut	Provides an important link between adjoining two proposed biodiversity properties to the east and west.	-	▪ Small areas of remnant vegetation and derived grassland in south west corner. ▪ Dominated by cleared lands used for grazing and agriculture. ▪ Limited vegetation canopy cover. ▪ Provides an important linkage between the potential land acquisitions of properties 12 and 13 and between the currently owned Boggabri Coal properties of Velyama and Merriown.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
8	Private - Boggabri Coal	140	Adjoining Rail loop, 8 km from open cut	Provides a northern link from Boggabri Coal owned properties adjoining Leard State Forest to properties on the Namoi River Floodplain.	-	▪ Potential to contain large areas of derived grasslands. ▪ Limited vegetation canopy cover. ▪ Previously grazed and cleared. ▪ Property could provide linkages between Leard State Forest and biodiversity offsets properties to the west.	Areas of cleared lands used for grazing.	Yes. Quadrat/transect surveys undertaken.
9	Private - Boggabri Coal	163	Adjoining Rail loop, 9 km from open cut	Provides a linkage between the Namoi River Floodplain and remnant vegetation to the west. Small area to the south could provide linkage between Crown Lands and potential offsets.	Threatened community of Box-Gum Woodlands. Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	▪ Large areas of derived grasslands and remnant native vegetation. ▪ Contains large areas of the Namoi River floodplain and riverine corridor. ▪ Small disjunct area to the south adjoins crown land which contains remnant Box-Gum woodlands, this property could be used to consolidate these linkages to the south. ▪ Visually significant rises dominated by native vegetation. ▪ Some rocky outcrops and cliff areas. ▪ Grazed and agriculture practices.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.

Site	Tenure	Property size (ha)	Distance from proposal	Connectivity	Threatened Biodiversity	General Description	Management Issues	Field surveys undertaken?
10	Private property	171	1 km from Rail loop, 8 km from open cut	Provides a valuable link between Leard National Park and the Namoi River floodplain and existing remnant vegetation to the west over the Kamilaroi Highway.	Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	▪ Potential to contain areas of native grasslands on rich riverine soils that are likely to correspond with the Threatened ecological community, Native Vegetation on Cracking Clay Soils on the Liverpool Plains. ▪ Provides a valuable link between Leard National Park and the Namoi River floodplain and existing remnant vegetation to the west over the Kamilaroi Highway. ▪ Contains approximately 1 km of riverine habitats fronting the Namoi river. ▪ Clearing and grazing evident.	Areas cleared for grazing.	No. Limited desktop/aerial photograph interpretation completed. Requires detailed field investigations to accurately determine biodiversity values.
11	Boggabri Coal	705	Adjoining Rail loop, 12 km from open cut	Provides linkage for a regional wildlife corridor linking the Pilliga National Park, Kerringle State Forest to the Namoi floodplain and thus a corridor to the east to the Nandewar Range.	Potential habitat for Threatened woodland birds and hollow dependent microchiropteran bats.	▪ Dominated by visually significant rises dominated by native vegetation. ▪ Rocky outcrops, cliff areas and potential for caves. ▪ Provides the potential to facilitate the regional wildlife corridor linking the Pilliga National Park, Kerringle State Forest to the Namoi floodplain and thus a corridor to the east to the Nandewar Range. ▪ Derived native grasslands with regeneration potential. ▪ Grazed on floodplains.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
12	Private property	1088	Adjoining Rail loop, 5 km from open cut	Provides a valuable link between large natural vegetated lands to east and west and the Namoi floodplain.	Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	▪ Visually significant rises dominated by native vegetation in southwest corner. ▪ Some rocky outcrops and cliff areas. ▪ Areas of derived grassland and remnant vegetation. ▪ Grazed and cultivation occurring in some portions. ▪ Provides a valuable link between large natural vegetated lands to east and west and the Namoi floodplain. ▪ Regeneration potential for linkages to the Namoi River. ▪ Contains approximately 7 km of riverine habitats fronting the Namoi River.	Areas cleared for grazing and for cultivation of crops.	No. Limited desktop/aerial photograph interpretation completed. Requires detailed field investigations to accurately determine biodiversity values.
13	Private property	1709	3 km from open cut	Provides an important linkage between potential offsets which will facilitate a regional vegetated corridor from the Nandewar Range to the Namoi River floodplain.	-	▪ Dominated by derived grasslands with regeneration potential. ▪ Large area of remnant native vegetation in the northern portion. ▪ Visually significant rise in the north-west corner dominated by native vegetation. ▪ Some areas cleared for cultivation of crops and grazing.	Areas cleared for grazing and for cultivation of crops.	No. Limited desktop/aerial photograph interpretation completed. Requires detailed field investigations to accurately determine biodiversity values.

Site	Tenure	Property size (ha)	Distance from proposal	Connectivity	Threatened Biodiversity	General Description	Management Issues	Field surveys undertaken?
14	Private property – Mining Joint Ownership	875	Adjoining Rail loop, 10 km from open cut	Provides linkages with the proposed offsets properties to the north and south. With a potential linkages to the west to Pilliga National Park and Kerringle State Forest.	Threatened community of Box-Gum Woodlands. Contains habitat for Threatened woodland birds, and hollow dependent and cave dependent microchiropteran bats. Habitat for Threatened flora species *Pomaderris queenslandica.*	▪ Dominated by ridgelines with large areas of intact native vegetation. ▪ Contains significant environmental features including, cliff lines, rocky outcrops, caves and potential for gully forests. ▪ Important linkage area between Namoi River to Pilliga National Park and Kerringle State Forest. ▪ Remnant native riparian vegetation in creek lines. ▪ Floodplains dominated by derived grasslands with potential for rehabilitation. ▪ Some areas cleared for cultivation of crops and grazing.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
15	Crown Lands	462	Adjoining Rail loop, 10 km from open cut	Provides linkages with the proposed offsets properties to the east. With a potential linkages to the west to Pilliga National Park and Kerringle State Forest.	Threatened community of Box-Gum Woodlands. Contains habitat for Threatened woodland birds, and hollow dependent and cave dependent microchiropteran bats. Habitat for Threatened flora species *Pomaderris queenslandica.*	▪ Dominated by ridgelines with large areas of intact native vegetation. ▪ Contains significant environmental features including, cliff lines, rocky outcrops, caves and potential for gully forests. ▪ Important linkage area between Namoi River to Pilliga National Park and Kerringle State Forest. ▪ Remnant native riparian vegetation in creek lines. ▪ Some areas cleared for cultivation of crops and grazing.	Areas cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.
16	Crown Lands	142	8 km from open cut	Provides a valuable link between large natural vegetated lands to west and north and the Namoi floodplain.	Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats. Potential for Threatened community of Box-Gum Woodlands. Contains habitat for Threatened woodland birds, and hollow dependent and cave dependent microchiropteran bats.	▪ Visually significant rises dominated by native vegetation in northwest corner. ▪ Incorporates areas surrounding the locally significant feature 'Gins leap'. ▪ Some rocky outcrops and cliff areas. ▪ Large areas of Riverine woodlands, derived grassland and remnant vegetation. ▪ Some areas cleared for grazing. ▪ Provides a valuable link between large natural vegetated lands to west and the Namoi floodplain. ▪ Regeneration potential for linkages to the Namoi River. ▪ Contains approximately 3 km of riverine habitats fronting the Namoi River.	Some areas cleared for grazing, and possibly travelling stock.	Yes. Quadrat/transect surveys undertaken.

Site	Tenure	Property size (ha)	Distance from proposal	Connectivity	Threatened Biodiversity	General Description	Management Issues	Field surveys undertaken?
17	Crown Lands	52	Adjoining Rail loop, 8 km from open cut	Provides a valuable link along the Namoi floodplain.	Riverine habitats provided habitat for Threatened owls and hollow dependent microchiropteran bats.	▪ Areas of derived grassland and remnant vegetation. ▪ Some areas cleared for grazing. ▪ Provides a valuable link between large natural vegetated lands to west and the Namoi floodplain. ▪ Regeneration potential for linkages to the Namoi River. ▪ Contains approximately 2 km of riverine habitats fronting the Namoi River.	Predominately cleared for grazing and for cultivation of crops.	Yes. Quadrat/transect surveys undertaken.

3.8 Regional East-West Wildlife Corridor offsets

Boggabri Coal has identified additional Regional East-West Wildlife Corridor offset properties remote from the mine site, particularly targeting areas containing Threatened Box Gum Woodland. These offsets are strategically located within the local landscape, facilitating the creation of a broad Regional East-West Wildlife Corridor linking the Namoi River with the Nandewar Range. Boggabri Coal is also committed to including within the Boggabri Coal Biodiversity Offset Strategy additional private land areas, ensuring a minimum of 1:1 offsetting of the 623.6 ha of Box Gum Woodland to be impacted by the Project.

The selection and identification of the regional offsets included the following process:

- Initial consultation with DECCW officers to identify any high priority acquisition sites within the locality for the National Reserve system.
- A review of the NSW BioBanking, Expressions of Interest (EOI) web sites. This included a site visit and preliminary vegetation surveys of one property.
- A review of the available suitable DECCW Land Alive projects.

This process failed to identify any suitable offsets within the locality of the Project. Boggabri Coal has subsequently completed extensive assessments adjacent to the Project Boundary within the locality and region for suitable properties with the required characteristics. The assessment of these Regional East-West Wildlife Corridor properties was based on:

- Aerial Survey (via helicopter) for Box-Gum Woodland remote from the Project Boundary.
- Further aerial photographic interpretation and desktop analysis of broad scale vegetation mapping.
- Limited site inspections.
- Regional landscape values of connectivity, patch size and topography.
- Proximity to existing conservation reserves.
- Engagement of a local real estate agent.
- Preliminary discussions with landowners.

An additional 22 potential sites were identified as areas of interest, from which five offset (8 Lots) properties (Figure 3-5) have been recommended for inclusion in the Boggabri Coal Biodiversity Offset Strategy. Preliminary details on each of the proposed Regional East-West Wildlife Corridor offset properties are provided in Table 3-5, Section 4-2-4, and depicted in Figures 3-6–3-8.

Table 3-5 Summary of Regional East-West Wildlife Corridor offset properties

Lot	DP	Owner	Property Details	Property Size (ha)	Total Remnant [1] Vegetation (ha)	Box Gum Woodland[1] (ha)	Derived Native Grassland Box Gum Woodland Condition 4 for (Rehab) [1](ha)
50	754948	Private	'Therandra'	244.0	166.0	98.0	77.0
1	726585	Private	'Merriendi'	135.0	114.0	30.0	17.0
Part Lot A	358451	Private	'Merriendi'	17.5	16.0	11.0	3.0
Part Lot 55	754948	Private	'Merriendi'	114.0	51.0	25.0	17.0
56	754924	Private	'Myall Plains'	468.0	419.0	197.0	19.6
12	754927	Private	'Wirrilah'	257.0	35.0	33.0	39.0
13	754927	Private		770.0	328.0	178.0	215.0
15, 28, 29, 37	754927	Private	'Mallee'	2060	2,019.4	40.9	27.6
TOTAL				**4,065.5**	**3,148.4**	**612.9**	**415.3**

1 = Areas are based on the assessments completed to date and have not been ground truthed by detailed field surveys.

The remaining 17 properties not recommended for inclusion within the Boggabri Coal Biodiversity Offset Strategy were discounted from further investigation due to either one or a combination of the following:

- lack of Box Gum Woodland
- absence of suitable 'Like for Like' vegetation
- unavailable for sale
- limited access and difficult to manage
- inappropriate reserve design
- limited connectivity, corridor values within the Regional East-West Wildlife Corridor.

The five offset (8 Lots) properties identified for purchase and inclusion within the Boggabri Coal Biodiversity Offset Strategy were considered the most appropriate given their contribution to; the establishment of a Regional East-West Wildlife Corridor, consolidating remnant vegetation with existing local conservation reserves and reservation of Box Gum Woodland.

Boggabri Coal has as a minimum the option to purchase all properties described in Table 3-5 and is progressing the purchase of these properties. These sites will provide an upfront offset as part of the Boggabri Coal Biodiversity Offset Strategy.

Project Boundary
"Mallee" Offset
"Merriendi" Offset
"Myall Plains" Offset
"Wirrilah" Offset

Figure 3-5 Strategic Corridor Offset