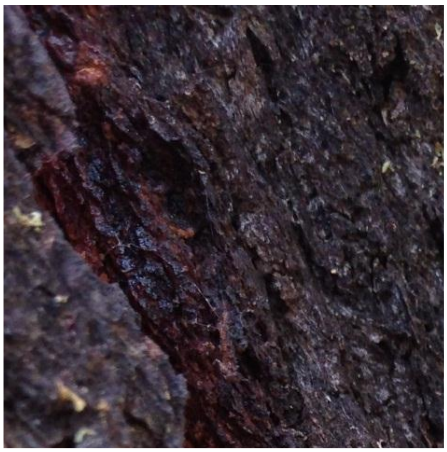
Appendix C

Ecological Impact Assessment



Boggabri Coal Expansion Project

Ecological Assessment for Boggabri Coal Project Modification

11 October 2013

PARSONS BRINCKERHOFF

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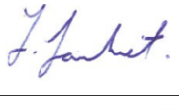
Reviewed by:	Toby Lambert	Date: 11/10/2013	Signature: 
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Glossary

BCEP	Boggabri Coal Expansion Project.
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: 1. Genetic diversity — the variety of genes (or units of heredity) in any population. 2. Species diversity — the variety of species. 3. Ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. The Modification Study Area is in the Brigalow Belt South bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & 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 Climate Change 2007). Critical habitat is listed under either the TSC Act or the EPBC Act and both the state (Office of Environment and Heritage) and Federal (Department of the Sustainability, Environment, Water, Population and Communities) Both of these departments 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 Sustainability, Environment, Water, Population and Communities (SEWPAC)	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of Department of Sustainability, Environment, Water, Population and Communities was known previously as: ▪ Department of the Environment, Water, Heritage and the Arts (DEWHA) ▪ Department of Environment and Heritage (DEH) ▪ Department of the Environment and Water Resources (DEWR).
Department of Trade and Investment (DTI)	This department aims to attract investment to NSW and support innovative, sustainable and globally competitive industries through technical knowledge. The department includes forestry and fisheries and administers the FM Act. Formerly known as: ▪ Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) ▪ Department of Industry and Investment (I&I).
Ecological community	An assemblage of species occupying a particular area.
EEC	Endangered Ecological Community (TSC Act, EPBC Act).
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Exotic	Introduced from outside the area (Royal Botanic Gardens and Domain Trust 2013). Used in the context of this report to refer to species introduced from overseas.
FM Act	NSW *Fisheries Management Act 1994.*
GPS	Global Positioning System- a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Indigenous	Native to the area: not introduced (Royal Botanic Gardens and Domain Trust 201).
Introduced	Not native to the area: not indigenous (Royal Botanic Gardens and Domain Trust 2012). Refers to both exotic and non-indigenous Australian native species of plants and animals.
Key Threatening Processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Climate Change 2007). Key Threatening Processes are listed under the TSC Act, the FM Act and the EPBC Act. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Climate Change 2007 Department of Environment and Conservation 2004).
Local population	The population that occurs within the site, 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 Department of Environment and Climate Change (2007).
Locality	The area within a 10 km of the site.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
Modification	Modification includes the following proposed Modification to Project Approval 09_0182: ▪ Construction of permanent mine access from the Kamilaroi Highway. ▪ Temporary storage of processed mine overburden material at the existing Rock Quarry and the reuse of this material during the construction of the rail spur embankments. ▪ Reuse of the existing Daisymede laydown compound.
Noxious weed	An introduced species listed under the NSW *Noxious Weeds Act 1993*. Under the Act, noxious weeds have specific control measure and reporting requirements.
NSW	New South Wales

Office of Environment and Heritage	Broadly, the Office of Environment 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: 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. Previously known as: ▪ Department of Environment, Climate Change and Water (DECCW) ▪ Department of Environment and Climate Change (DECC).
Priorities Action Statements (PAS)	Priorities Action Statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage Key Threatening Processes (Department of Environment and Climate Change 2007).
Project Boundary	Project Boundary describes the area approved under Project Approval 09_0182 for the BCEP.
Project Boundary Modification	Project Boundary Modification is defined as the area impacted by the Modification, outside the previous Project Boundary
Protected species	Those species defined as protected under the *National Parks and Wildlife Act 1974*. Includes all native animals, as well as all native plants listed on Schedule 13 of the *National Parks and Wildlife Act 1974*.
Recovery plan	A plan prepared under the TSC Act, FM Act or the EPBC Act to assist the recovery of a Threat-listed species, population or ecological community.
Significant	Important, weighty or more than ordinary as defined by Department of Environment, Climate Change and Water (2007).
Species richness	Species richness is simply the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity, which also incorporates evenness, that is, the relative abundance of species (Department of Environment and Climate Change 2007).
Modification Study Area	Areas within the locality that could potentially be affected by the Modification. This includes the Modification sites and all areas adjacent to the proposed Modification sites and potential construction work sites associated with the proposed Modification.
Subject site	The extent of direct impacts from the proposed Modification. This includes the footprint of the Modification related to infrastructure and potential construction work sites.
Threat-listed biodiversity	Threat-listed species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threat-listed species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as Threat-listed) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
TSC Act	NSW *Threatened Species Conservation Act 1995.*
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007).

Weed	A plant growing out of place or where it is not wanted: often characterized by high seed production and the ability to colonise disturbed ground quickly (Royal Botanic Gardens and Domain Trust 2012). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

1. Introduction

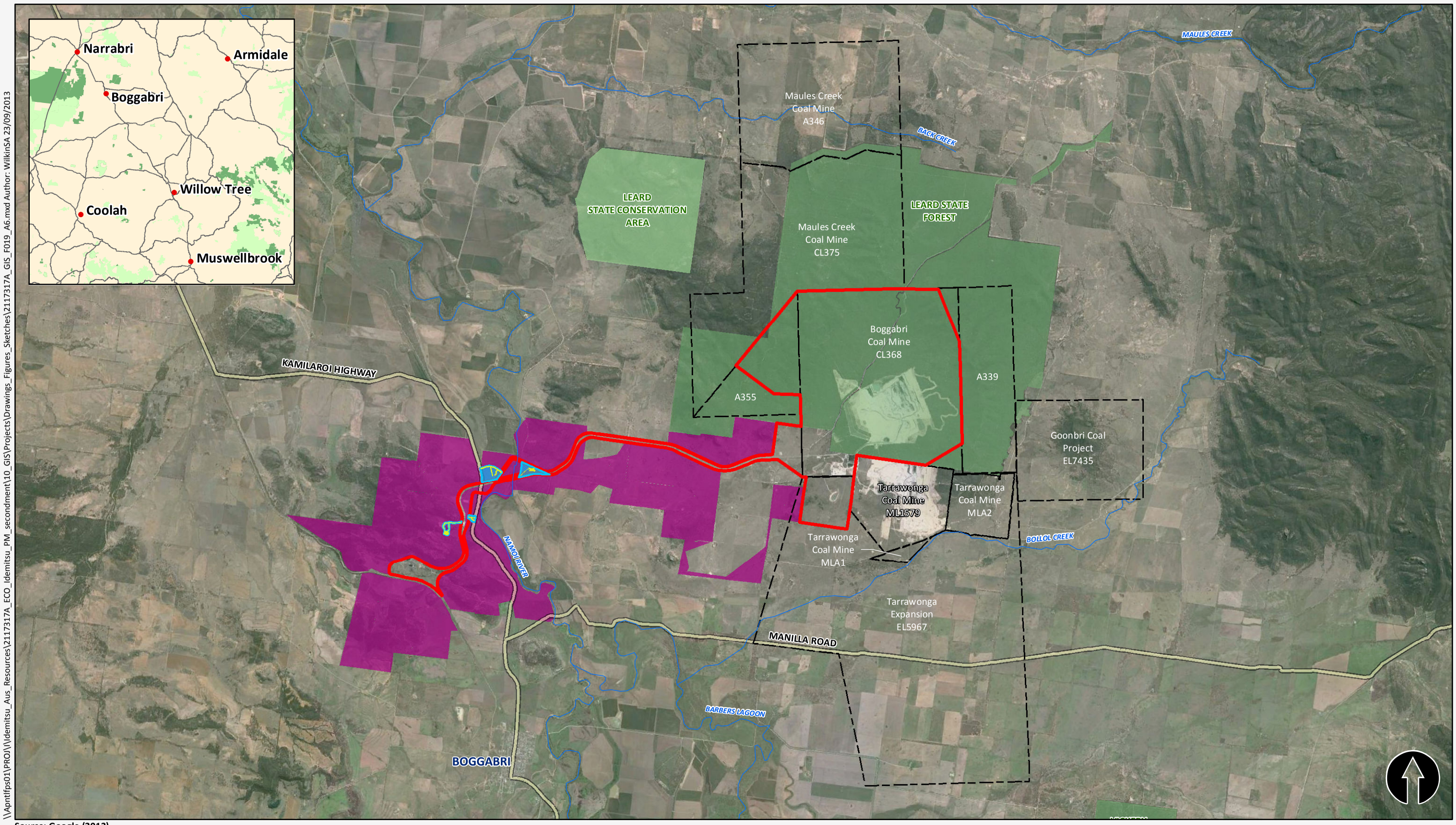
Boggabri Coal Pty Limited (Boggabri Coal) is a wholly owned subsidiary of Idemitsu Australia Resources Pty Limited, which operates the Boggabri Coal Mine. Boggabri Coal is located 15 km north-east of Boggabri in the North West Region of NSW. Following the grant of PA 09_0182, Boggabri Coal has conducted detailed design studies for the infrastructure required to facilitate the Project. These studies have identified the need for amendments to the conceptual Project layout for which approval was originally granted. Modification is being sought under Section 75W of the EP&A Act to facilitate these changes.

Hansen Bailey Pty Limited (Hansen Bailey) was recently commissioned by Boggabri Coal to prepare an Environmental Assessment (EA) to modify the Project Approval under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Specifically the Modification includes the following:

- Construction of permanent mine access from the Kamilaroi Highway (Kamilaroi Highway site access).
- Temporary storage of processed mine overburden material at the existing Rock Quarry and the reuse of this material during the construction of the rail spur embankments (Rock Quarry Construction Stockpile).
- Reuse of the existing Daisymede laydown compound (Daisymede Compound).

In total, the Modification requires 14.0 ha of native vegetation clearing, including 13.3 ha within areas previously identified as biodiversity offsets (Parsons Brinckerhoff 2010b). The additional disturbance due to the Modification will require the enhancement of the Biodiversity Offset Strategy approved under Project Approval 09_0182.

This report examines flora and fauna assemblages as well as habitats within the Modification Study Area (refer Figure 1.1) and identifies impacts to the ecological aspects, including species, populations and communities within the Project Modification (Figure 1.2). The report looks at impacts associated with construction and operation of the Modification. This report also outlines the mitigation measures and provides assessments of significance required under EP&A Act and the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).



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Source: Google (2013)

- River
- Road
- Mine Tenement
- Modification Study Area
- Project Boundary
- Project Boundary Modification
- Namoi Offset Area
- National Park
- State Forest

0 1 2 3 km

Figure 1.1
Locality Plan

Providing background to this EA is a number of related ecological studies which were undertaken for Boggabri Coal Project and are listed in Section 3.3. This includes assessments completed for the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) and the Boggabri Coal Mine – Biodiversity Offsets Strategy (Parsons Brinckerhoff 2010b), which included broad vegetation mapping conducted over the Modification Study Area.

The impact of the Project Modification (47.6 ha), includes 13.3 ha of native vegetation within a biodiversity offset identified in the biodiversity offset strategy, as part of the Boggabri Coal Project.

1.1 Legislative context

This report is to support an EA for the Modification, being prepared by Hansen Bailey. The Hansen Bailey EA will assess the environmental impacts of the proposed Modification to Project Approval (09_0182) for the Boggabri Coal Project under section 75W of the EP&A Act.

This EA has been completed in consideration of Commonwealth and state legislation and planning policies relevant to the protection of flora, fauna and biodiversity, including:

- EP&A Act
- EPBC Act
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Water Management Act 2000* (WM Act)
- *Fisheries Management Act 1994* (FM Act)
- *National Parks and Wildlife Act 1974* (NPW Act)
- *Noxious Weeds Act 1999* (NW Act)
- Boggabri Coal Mine Project Approval (09_0182).

These Acts and policies have been addressed where they apply.

1.2 Assessments of significance

Significance assessments as required under Section 94 of the TSC Act and Section 5A of the EP&A Act were undertaken if the species or community was recorded or its habitat was present in the areas proposed to be impacted by this Modification.

The significance assessments relating to biodiversity listed under the TSC Act are based on the Threatened Species Assessment Guidelines (Department of Environment and Climate Change 2007), indicating the significance of the impacts relative to the conservation importance of the habitat, individuals and populations likely to be affected. Threat-listed biodiversity under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was assessed following the Principal Significant Impact Guidelines (Department of the Environment Water Heritage and the Arts 2009).

1.3 Biodiversity offsets

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 neither feasible nor cost effective, offset strategies can be used to compensate the residual impacts of the development on biodiversity. Ideally offsets should be undertaken before 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.

A biodiversity offsets strategy (Parsons Brinckerhoff 2010b) was prepared for the continuation of Boggabri Coal Mine. Consideration of biodiversity offsets included surveys completed in accordance with the quantitative site assessment methodology of the Biobanking Operation Manual (Department of Environment Climate Change 2009) as well as in consideration of the 13 principles for the use of biodiversity offsets in NSW (Department of Environment and Climate Change 2008c) and the objectives of the National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Grassy Woodland).

Some components of the Modification (i.e. Project Boundary Modification) are within the identified biodiversity offsets in the Boggabri Coal Mine biodiversity offsets strategy (Parsons Brinckerhoff 2010b). Figure 1.1 shows the required Project Boundary Modification.

The Kamilaroi Site Access, The Rock Quarry Construction Stockpile and the Daisymede Compound, all have at least part of their associated impacts within previously identified Boggabri Coal Mine biodiversity offsets. A detailed breakdown of the impacts within the offset by vegetation community is presented in section 6 of this report. The additional disturbance due to the Modification will require revisions to the Biodiversity Offset Strategy approved under Project Approval 09_0182.

1.4 Proposed Modification

1.4.1 Kamilaroi Highway site access

The Modification involves a change to the method of site access for both the construction and operational workforce. Under PA 09_0182, construction personnel are approved to access the site via Therribri Road, Manilla Road and Leard Forest Road. The proposed changes will facilitate a safer access to the rail spur and power infrastructure corridor during construction. This new site access alternative will also alleviate traffic congestion on the Iron Bridge and the intersections of the Manila Road and Therribri/Leard Forest Roads during the operation of the mine.

To facilitate the alternative site access arrangements, Boggabri Coal proposes the construction of two access roads linking the private haul road to the Kamilaroi Highway (see Figure 1.2). These proposed access roads will provide left-turn access and egress from the Kamilaroi Highway onto the private haul road and will accommodate oversize and over mass vehicles and b-doubles required for construction activities and ongoing operation and maintenance associated with the mine.

Once coal haulage to the existing rail loadout via the private haul road has ceased (following commissioning of the rail spur approved under PA 09_0182), the Kamilaroi Highway access roads will be used on a permanent basis by a substantial component of the operational workforce.

This proposed Kamilaroi Highway Modification requires a total of 25.4 ha of disturbance, 24.3 ha of which is within the Namoi River Offset area, as described in Continuation of Boggabri Coal Mine – Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b). The impacts of this Modification on vegetation communities within the Modification Study Area are described in Section 6.1, while the impacts within the offset are detailed in Table 7.1.

1.4.2 Rock Quarry Construction Stockpile

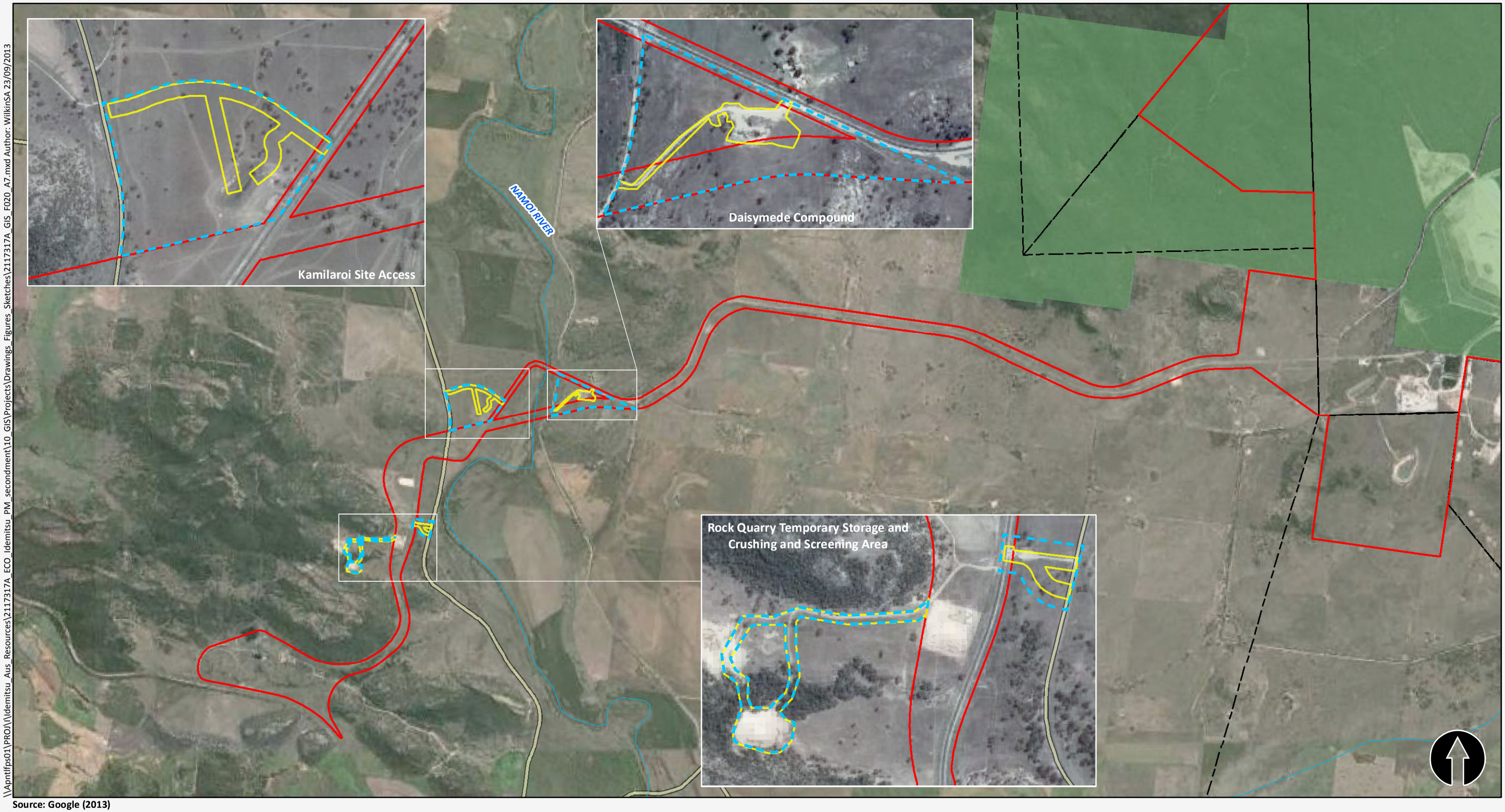
Of the total volume of overburden material to be processed at the crushing and screening area in the MIA for use as fill during rail spur embankment construction activities, approximately 180,000 t is to be stockpiled at the Rock Quarry area located to the west of the Kamilaroi Highway (see Figure 1.2). The processed material will be transported by truck via the existing private haul road and stockpiled at the Rock Quarry area for use during the construction of the rail spur formation.

The proposed Rock Quarry Construction Stockpile requires 4.3 ha of disturbance, of exotic grassland contained within the Project Boundary Modification and within the Namoi River Offset area, as described in Continuation of Boggabri Coal Mine — Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b). The impacts of this Modification on vegetation communities within the Modification Study Area are described in Section 6.1, while the impacts within the offset are detailed in Table 7.1.

1.4.3 Daisymede compound

The reuse of the existing Daisymede laydown compound located to the south of the private haul road (see Figure 1.2) is proposed to support the mining operations approved in the Boggabri EA. The existing hardstand area of the compound is proposed as a laydown area for vehicle storage and the stockpiling and use of materials and/or equipment during both the construction and operational phases of the Project.

The proposed Daisymede compound requires 17.8 ha of disturbance of exotic grassland contained within the Project Boundary Modification and within the Namoi River Offset area, as described in Continuation of Boggabri Coal Mine — Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b).No vegetation clearing is required to enable the reuse of the existing Daisymede laydown compound as the area has been cleared. The impacts of this Modification on vegetation communities within the Modification Study Area are described in Section 6.1.



Source: Google (2013)

- River
- Road
- Mine Tenement
- Modification Design Features
- Project Boundary
- Project Boundary Modification
- State Forest

0 0.5 1 1.5 km

Figure 1.2
Modification Features

1.5 Modification Study Area

The Modification Study Area (refer to Figure 1.1) includes the locations of all components of the Modification and associated works, both inside the approved Project Boundary and the Project Boundary Modification. This includes the footprint of all proposed Modifications to existing or approved infrastructure and any disturbance associated with the operation or construction of the proposed Modification. Where applicable, the Modification Study Area includes access tracks that will be used by vehicles or machinery, stockpiles of material, and any area likely to be impacted by the Modification and associated works and operation.

The Modification is predominantly outside the previously approved infrastructure layout and design (PA 09_0182). and within the previously identified BOAs , as described in the Continuation of Boggabri Coal Mine – Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b).

Location information for the Modification Study Area is outlined in Table 1.1.

Table 1.1 Modification Study Area location

Location information	Modification Study Area
Bioregion	Brigalow Belt South, Namoi sub-region (Thackway and Cresswell 1995)
Botanical subregion	North Western Slopes
Local government area	Narrabri Shire
Catchment Management Authority, subregion	Namoi CMA, Maules sub-catchment
Mitchell landscapes	Bugaldie Uplands and Liverpool Plains landscape

1.6 Study aims

The overall objective of this study was to assess the impacts of the Modification on the biodiversity values of the Modification Study Area. Specifically, this ecological assessment aimed to:

- determine and describe the characteristics and condition of the vegetation communities and flora and fauna habitats
- determine the occurrence, or likelihood of occurrence within the Modification Study Area, of threat-listed species, populations and communities (biodiversity) listed under the TSC Act, FM Act and EPBC Act
- undertake significance assessments for threat-listed biodiversity that occur or have potential habitat within the Modification Study Area
- propose further investigations and/or amelioration measures to mitigate impacts on the ecological values of the Modification Study Area.

2. Project Boundary (PA 09_0182) ecological characteristics

2.1 Overview

A large portion of the land within the Project Boundary is located within Leard State Forest, which covers an area of 8,134 ha, the majority of which is natural vegetation. Surrounding land uses include mineral extraction and rural activities, including pasture improvement, cropping and cattle grazing.

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). The Leard State Forest, was not identified for conservation in the regional assessments, rather the areas was identified for management under Zone 4, specifically set aside for forestry and mineral extraction.

The mining portion of the Project Boundary lies within a large relatively intact remnant patch of vegetation surrounded by a landscape that has been modified significantly through anthropogenic disturbance associated with the above listed land uses. The pattern of vegetation clearing and modification within the locality has increased the significance of the remnant vegetation within the Project Boundary, both in terms of its conservation value and its role in the broad-scale corridor network.

The biodiversity values of the Project Boundary have been extensively assessed and documented from concept studies completed in 1976, to detailed surveys recently completed for the continuation of mining submission. Ecological surveys were completed within the locality for the following studies:

- Boggabri Coal – Biodiversity Monitoring, February 2006 – August 2012 (Parsons Brinckerhoff 2011).
- Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).
- Preliminary vegetation mapping and survey report for Boggabri Coal lease (Parsons Brinckerhoff 2009).
- Flora and Fauna Summary of the Boggabri Coal Project (Parsons Brinckerhoff 2005).
- Results of Fauna survey work undertaken by the NSW National Parks and Wildlife Service within Leard State Forest (Pennay 2001).
- Report on the botany, wildlife and ecology of the Leard State Forest. Draft Environmental Impact Statement for Amax-BHP Joint Venture Boggabri Coal Project (James B. Croft and Associates 1983).

Biodiversity values within the Project Boundary are described in Sections 2.2 and 2.3. This information is based on findings of previous studies noted above, particularly the results of seasonal surveys completed between December 2008 and September 2009 for the Continuation of Boggabri Coal Mine — Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

This information is provided in order to outline the ecological context within which the Modification is located.

2.2 Flora values

Flora values within the Project Boundary are illustrated in Figure 2.1 below and described in the following sections.

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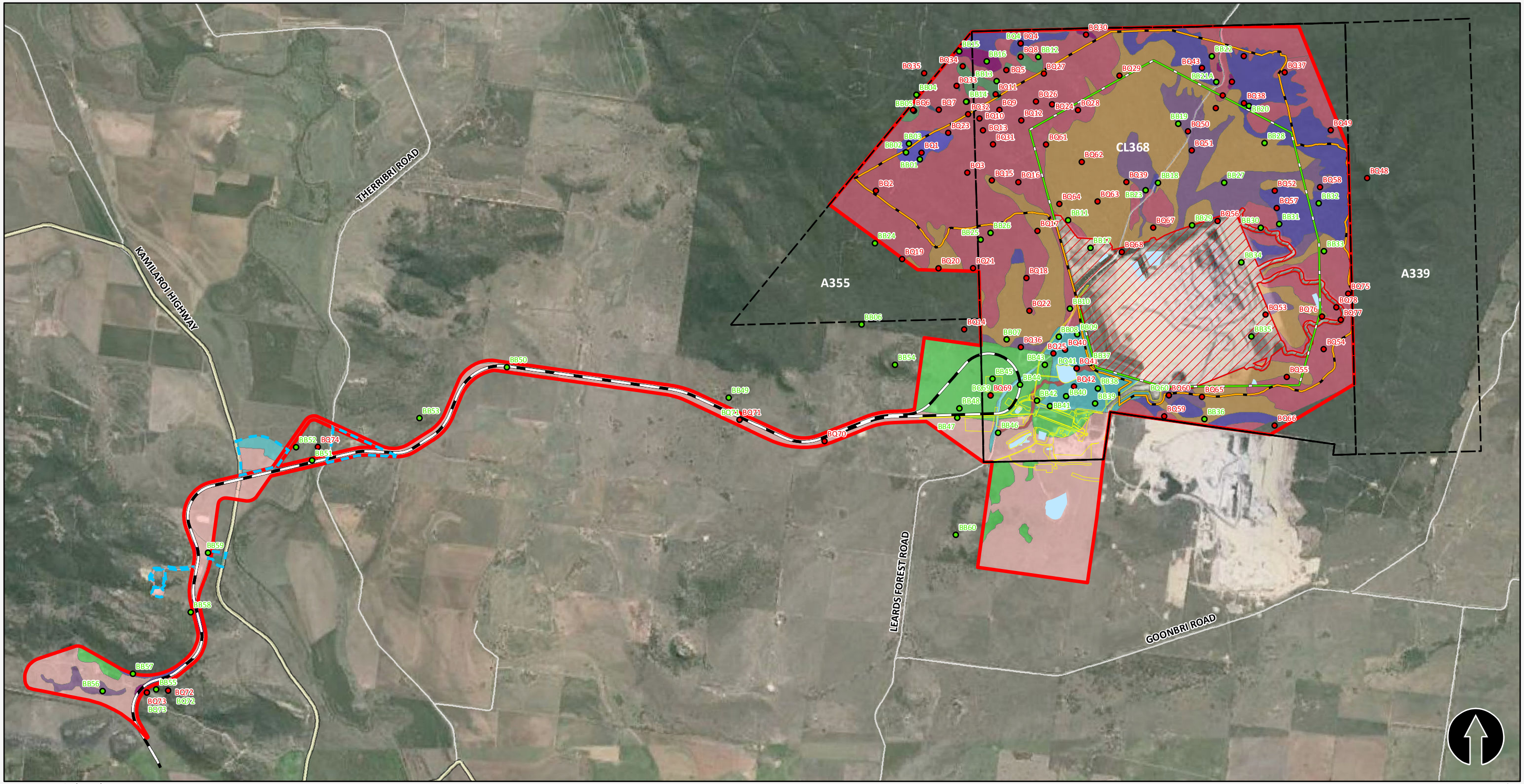


Source: Google (2013)

0 0.5 1 1.5 km

- Flora Survey Quadrats (Jan 2009)
- Flora Survey Quadrats (April 2009)
- Road
- Proposed Rail Loop
- Mine Tenement
- Proposed Infrastructure Area
- Project Boundary
- Project Boundary Modification
- Mine Disturbance to 2011
- Proposed Disturbance Limit
- EIS Mine Disturbance
- Dam

Identified Vegetation Communities within Study Area

- Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine grassy open forest
- Native Olive dry gully forest
- Narrow-leaved Ironbark - Brown Bloodwood -White Cypress Pine shrubby open forest
- Dwyer's Red Gum woodland
- Derived native grassland
- Exotic grassland
- Pilliga Box - Poplar Box – White cypress pine grassy open forest (Low Condition)
- Pilliga Box - Poplar Box – White cypress pine grassy open forest
- Plains Grassland
- River Red Gum Riparian woodland and forest
- River Red Gum Riparian woodland and forest (Low Condition)
- Silver-leaved Ironbark heathy woodland
- White Box – White Cypress Pine grassy woodland (Low Condition)
- White Box – Melaleuca riparian forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box – White Cypress Pine grassy woodland
- Yellow Box - Blakely's Red Gum grassy woodland

Figure 2.1
Flora values within the Project Boundary

2.2.1 Vegetation communities

Sixteen (16) distinct vegetation communities have been recorded in the Project Boundary (Parsons Brinckerhoff 2010) (Figure 2.1).

2.2.2 Threat-listed ecological communities

Three ecological communities listed under the EPBC Act, four ecological communities listed under the TSC Act and one ecological community listed under the FM Act have been recorded within the Project Boundary (Parsons Brinckerhoff 2010a). These threat-listed ecological communities and their corresponding vegetation communities within the Project Boundary are provided in Table 2.1.

Table 2.1 Threat-listed ecological communities and corresponding vegetation communities within the Project Boundary

Threat-listed ecological community	Corresponding vegetation community within the Project Boundary	Area removed within Project Boundary (ha) as part of existing EA
EPBC Act		
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered	White Box – White Cypress Pine grassy woodland White Box – Narrow-leaved Ironbark – White Cypress Pine grassy open forest Yellow Box – Blakely's Red Gum grassy woodland	623.6
Weeping Myall Woodlands – Endangered	Weeping Myall grassy open woodland	0.3
Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld – Critically Endangered	Plains Grassland	0.4
TSC Act/FM Act		
White Box Yellow Box Blakely's Red Gum Woodland (Box Gum Woodland)	White Box – White Cypress Pine grassy woodland White Box – Narrow-leaved Ironbark – White Cypress Pine grassy open forest Yellow Box – Blakely's Red Gum grassy woodland	This community corresponds with the EPBC Act listing
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions	Weeping Myall grassy open woodland	As above
Native Vegetation on Cracking Clay Soils of the Liverpool Plains	Plains Grassland	As above
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River[1]	The Namoi River and several creeks within the Project Boundary are included in the determination for this aquatic ecological community	0.6

(1) Listed as an Endangered Ecological Community (EEC) under the FM Act

2.2.3 Threat-listed flora species

A review of biodiversity databases indicates that 12 threat-listed flora species have been recorded or are predicted to occur within 20 km of the Project Boundary. Two of these threat-listed flora species were recorded within the Project Boundary during seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff 2010a) (Figure 2.1):

- *Pultenaea setulosa* – listed as Vulnerable under the EPBC Act.
- *Pomaderris queenslandica* – listed as Endangered under the TSC Act.

A further two threat-listed flora species have potential to occur in the Project Boundary with a moderate or greater likelihood:

- *Digitaria porrecta* – listed as Endangered under the EPBC and TSC Act.
- *Diuris tricolor* – listed as Vulnerable under the EPBC Act and TSC Act.

These species are described in detail in Section 4.2.3 of the Continuation of Boggabri Coal Mine — Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

2.2.4 Introduced and noxious weeds

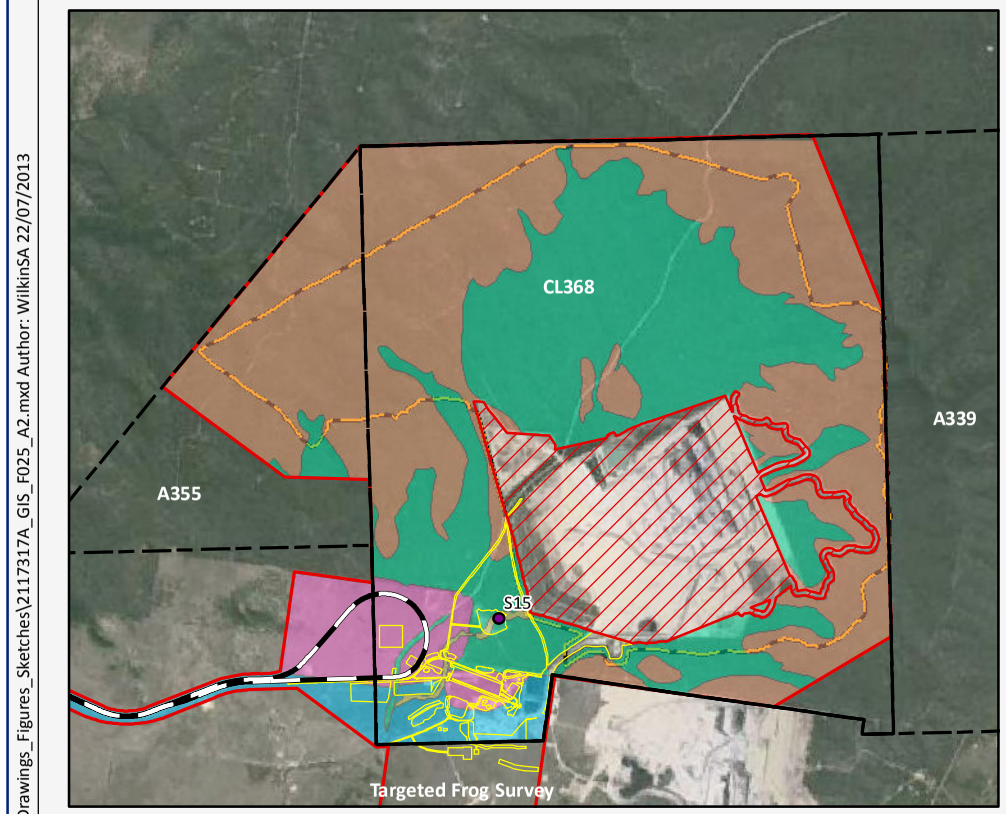
During seasonal surveys which were completed between December 2008 and September 2009 (Parsons Brinckerhoff 2010a) 61 species of introduced plants were recorded within the Project Boundary. Of the introduced species recorded, nine are declared Class 4 Weeds under the *Noxious Weeds Act 1993* for the Narrabri weed control area and one (*Rubus ulmifolius*) is classified additionally as a Weed of National Significance (WoNS) (Weeds Australia 2011):

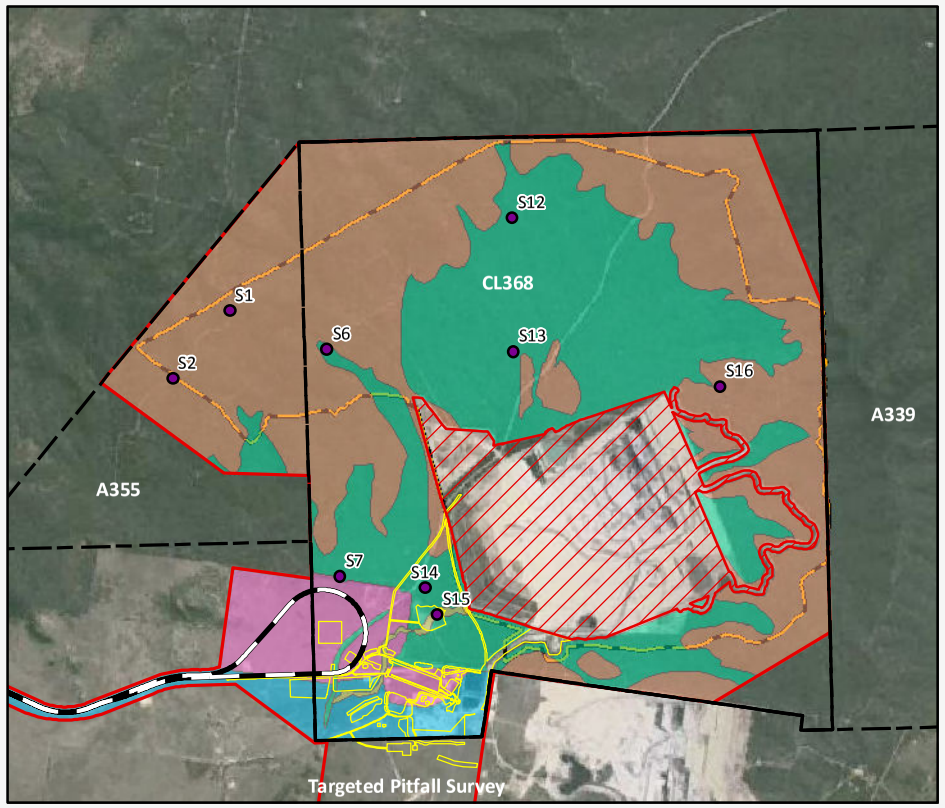
- *Conium maculatum (Hemlock).*
- *Heliotropium amplexicaule (Blue Heliotrope).*
- *Opuntia aurantiaca (Tiger Pear).*
- *Opuntia stricta (Prickly Pear).*
- *Opuntia tomentosa (Velvet Tree Pear).*
- *Oxalis corniculata.*
- *Rubus fruticosus (Blackberry).*
- *Sclerolaena birchii (Galvanised Burr).*
- *Xanthium sp.*

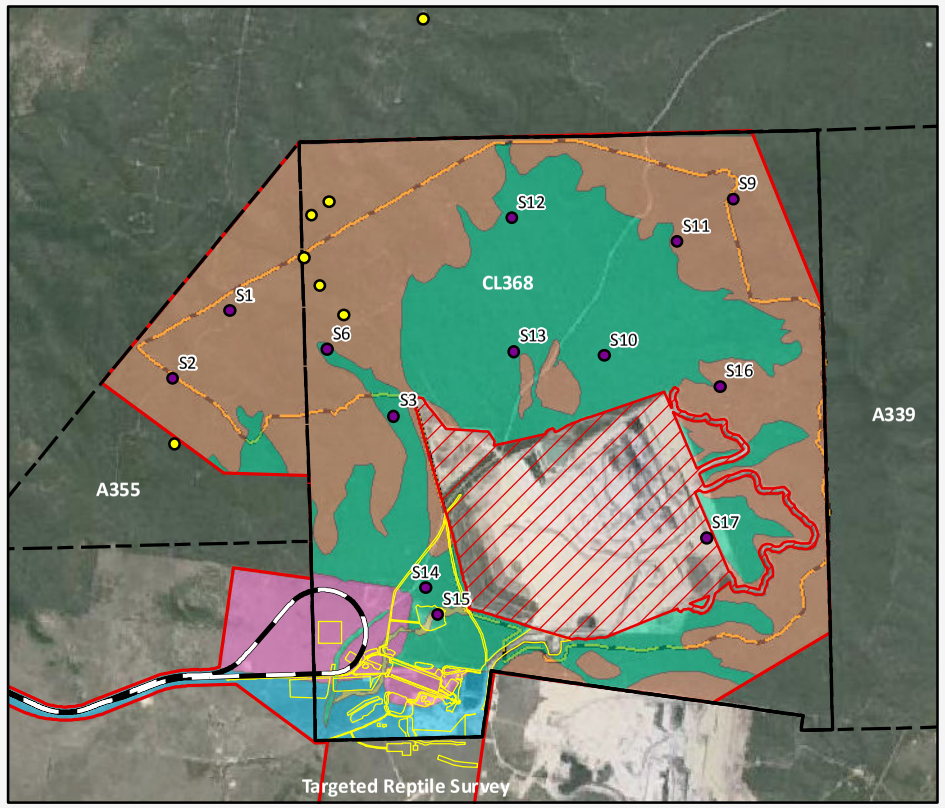
A Weed and Pest Management Strategy for the Project Boundary is provided as Appendix C of the Boggabri Coal Mine – Biodiversity Management Plan (Parsons Brinckerhoff 2012).

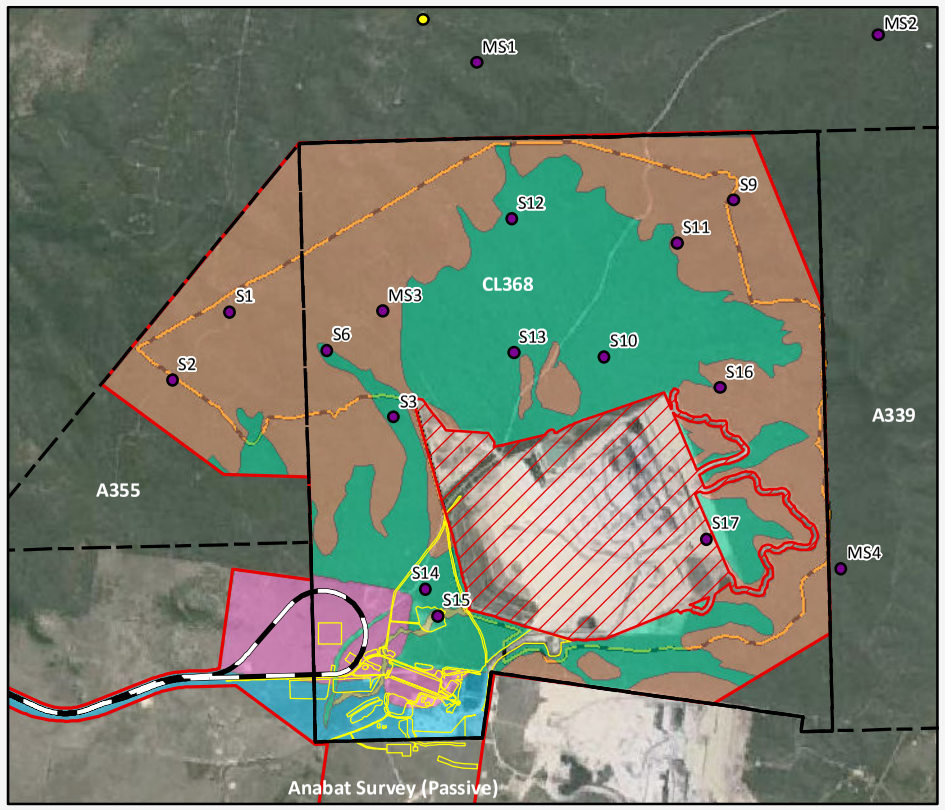
2.3 Fauna values

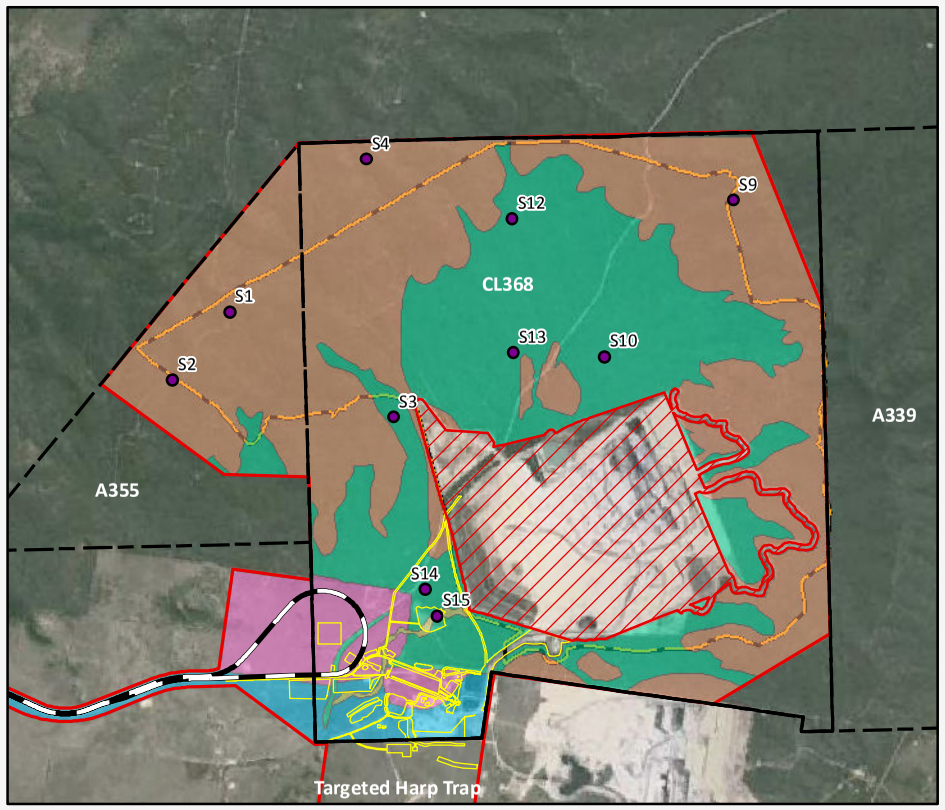
Fauna values within the Project Boundary are illustrated in Figures 2.2a and b and described in the following sections.

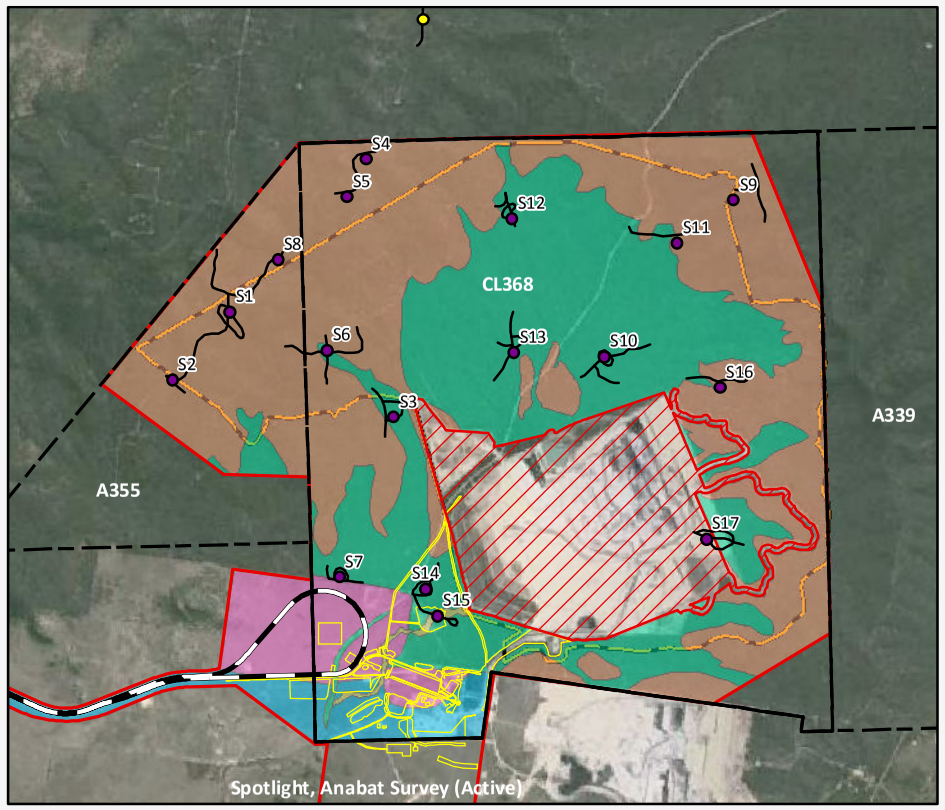












\\APNTLFPS01\proj\\Idemitsu_Aus_Resources\2117317A_ECO_Idemitsu_PM_secondment\10_GIS\Projects\Drawings_Figures_Sketches\2117317A_GIS_F025_A2.mxd Author: WilkinSA 22/07/2013

Source: Google (2013)

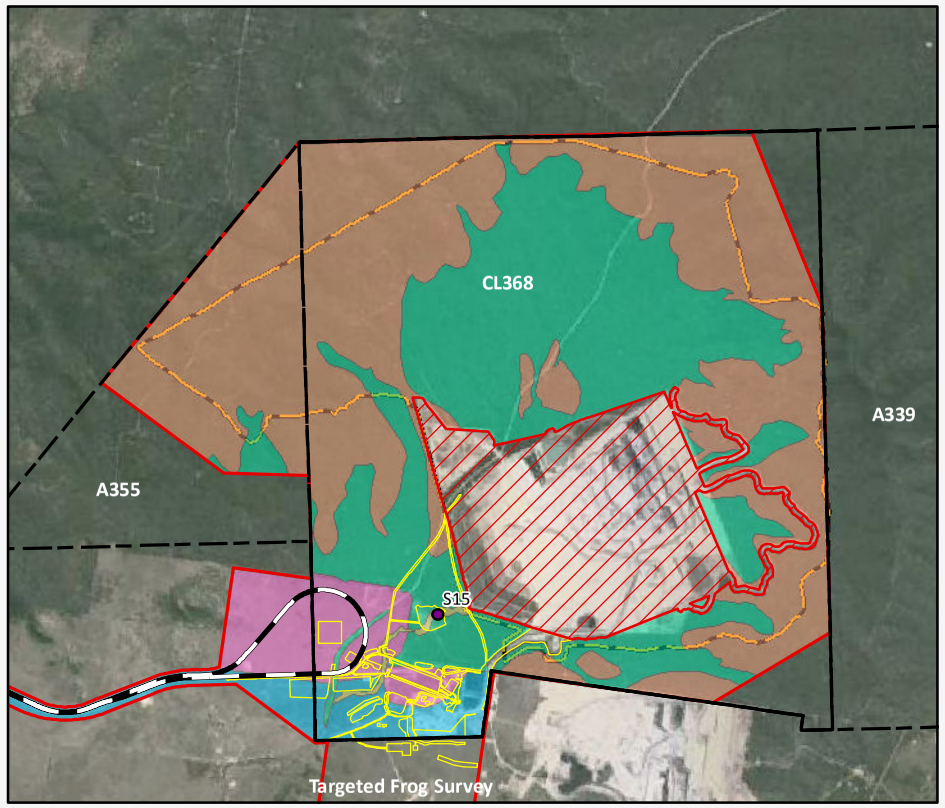
- Targeted Survey
- Survey Location
- Spotlight Transect
- Proposed Rail Loop
- Proposed Infrastructure Area
- Project Boundary
- Mine Tenement
- Mine Disturbance to 2011
- Proposed Disturbance Limit

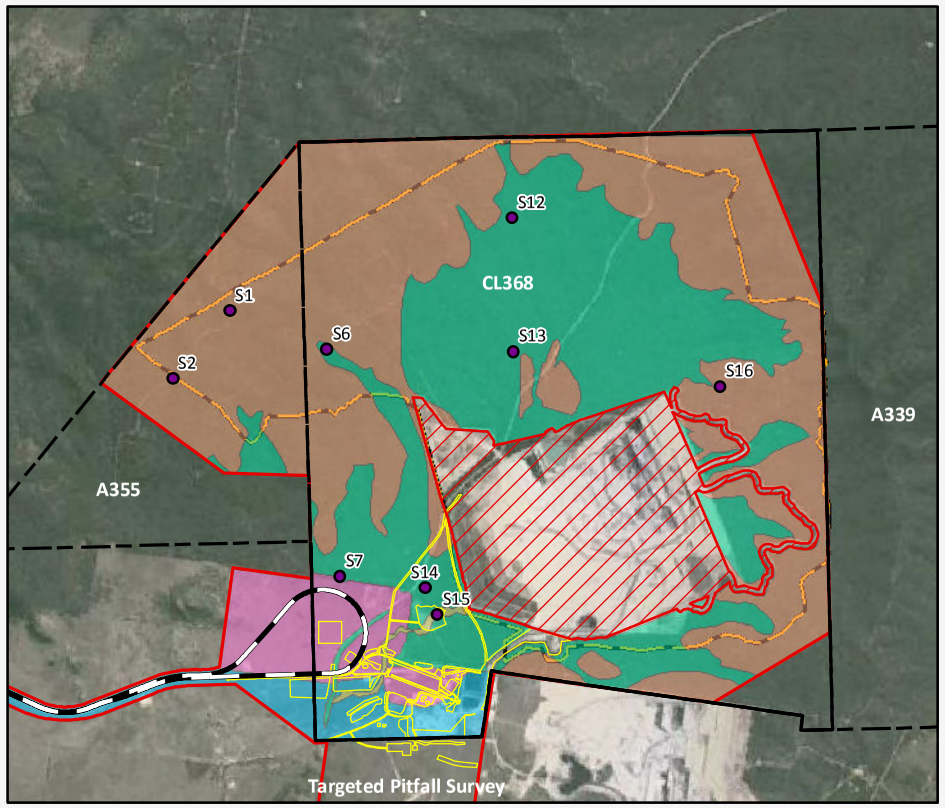
Fauna Habitat Areas

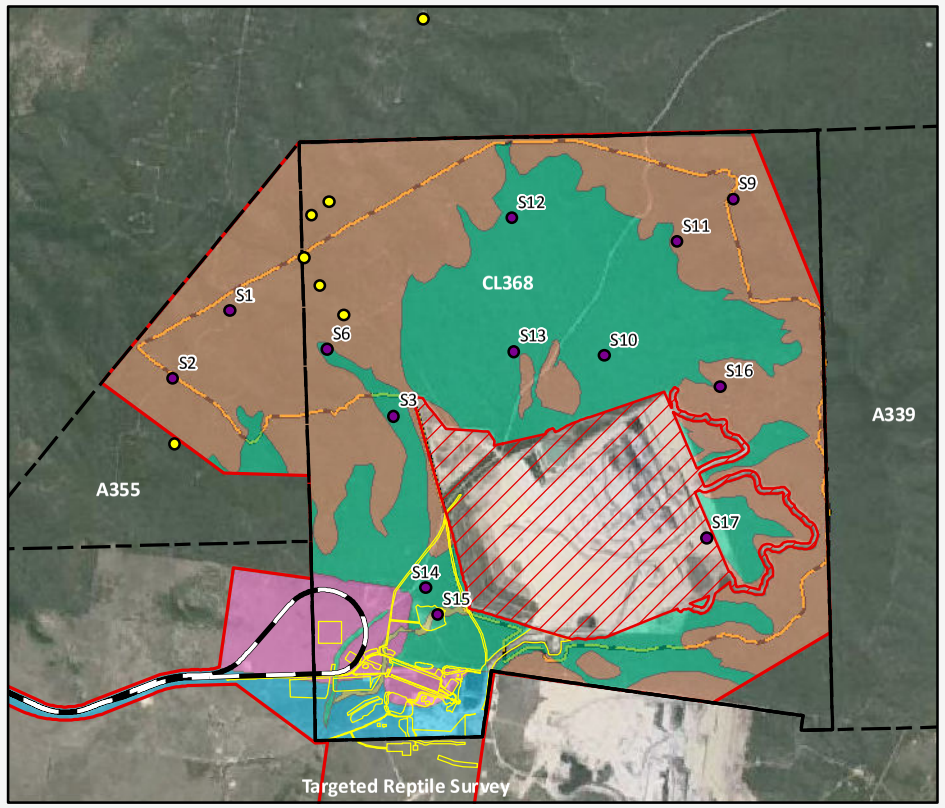
- Derived Native Grassland
- Exotic Grassland
- River Red Gum Riparian Woodlands and Forests
- Shrubby Woodlands/Open Forest on Skeletal Soils
- White Box – Narrow-leaved Ironbark - White Cypress Pine Grassy Open Forest

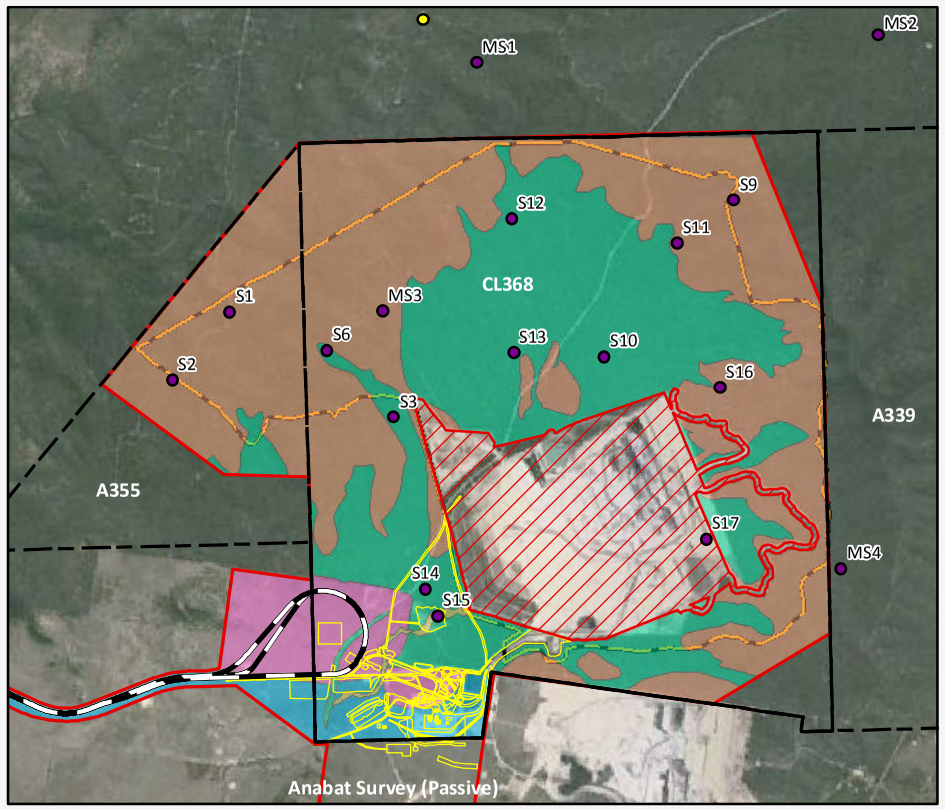
0 0.5 1 1.5 km

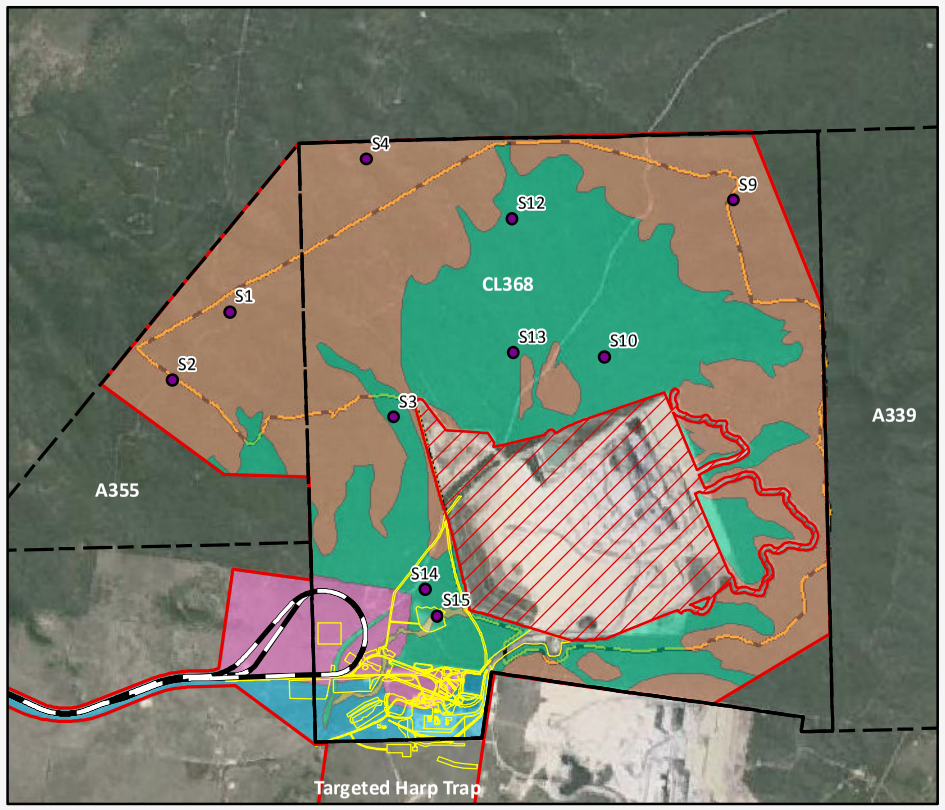
Figure 2.2a
Fauna Values within Project Boundary

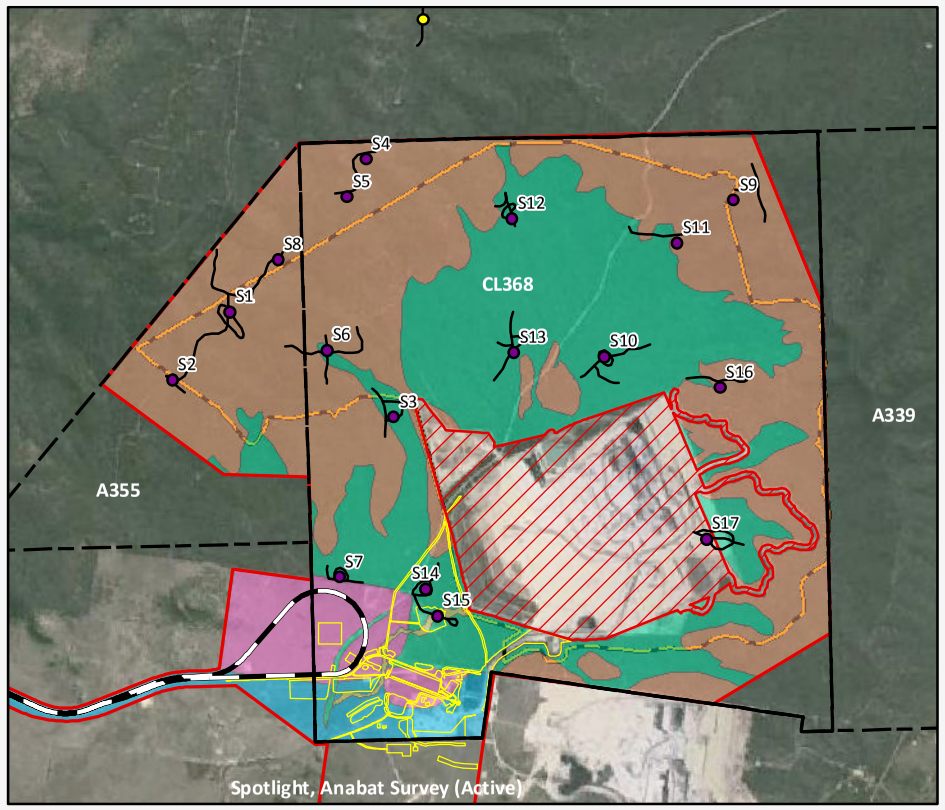












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Source: Google (2013)

- Targeted Survey
- Survey Location
- Spotlight Transect
- Proposed Rail Loop
- Proposed Infrastructure Area
- Project Boundary
- Mine Tenement
- Mine Disturbance to 2011
- Proposed Disturbance Limit

Fauna Habitat Areas

- Derived Native Grassland
- Exotic Grassland
- River Red Gum Riparian Woodlands and Forests
- Shrubby Woodlands/Open Forest on Skeletal Soils
- White Box – Narrow-leaved Ironbark - White Cypress Pine Grassy Open Forest

0 0.5 1 1.5 km

Figure 2.2b
Fauna Values within the Project Boundary

2.3.1 Fauna habitat types

The suitability, size and configuration of the fauna habitats within the Project Boundary correlate broadly with the structure and quality of the local and regional vegetation types (Section 2.2.1). Fauna habitats, particularly those located in the Leard State Forest, provide moderate to good condition habitat for a range of woodland birds, mammals (particularly microchiropteran bats) and reptiles.

Habitat features recorded in the Project Boundary generally include those associated with grassy woodlands on fertile soils, shrubby woodlands/open forest on skeletal soils, riverine woodland and derived/exotic grassland.

Key aquatic habitats within the Project Boundary are associated with the Namoi River and its flood plain. Additional aquatic habitat features include minor ephemeral streams within the proposed open cut disturbance area and permanent water sources associated with artificial drainage contours and dams.

2.3.2 Threat-listed fauna

21 threat-listed fauna species (15 birds and six mammals) were recorded within the Project Boundary during seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff 2010a). A further 11 threat-listed fauna species are considered to have potential habitat and a moderate or greater likelihood of occurring within the Boggabri EA Project Boundary.

2.3.3 Migratory species

Three species of bird (White-throated Needletail, Rainbow Bee-eater and Satin Flycatcher) listed under the migratory provisions of the EPBC Act were recorded during seasonal surveys completed between December 2008 and September 2009 (Parsons Brinckerhoff 2010a). A further four migratory birds are considered likely to occur in the Project Boundary with a moderate or greater likelihood (Great Egret, Cattle Egret and Regent Honeyeater, Swift Parrot).

2.3.4 Introduced fauna and pest species

During seasonal surveys which were completed between December 2008 and September 2009 (Parsons Brinckerhoff 2010a) seven species of feral animal including Common Starling, Fox, Brown Hare, Rabbit, Black Rat, Common House Mouse and Pig were recorded.

A Weed and Pest Management Strategy for the Project Boundary is provided as Appendix C of the Boggabri Coal Mine – Biodiversity Management Plan (Parsons Brinckerhoff 2012).

3. Methods

This ecological assessment is largely based on a series of field inspections within the Modification Study Area and surrounding landscape, a desktop review of available information for the Project Boundary and a review of previous studies (refer section 3.3).

For the purpose of this report the following definitions apply:

- Project Boundary describes the area approved under Project Approval (09_0182).
- Modification Study Area is defined as the broader area surrounding the proposed Modification and is indicated in Figure 1.1.
- Project Boundary Modification is defined as the area impacted by the Modification, outside the previous Project Boundary
- Locality is defined as 10 km within the vicinity of the Modification Study Area.
- Region is a bioregion defined in a national system of bioregionalisation. For this study this is the Brigalow Belt South bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).

3.1 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (The Royal Botanic Gardens and Domain Trust 2013). Scientific names are used in this report for species of plant. Scientific and common names are provided in plant lists in Appendix A.

Names of vegetation communities used in this report are based on the broad scale vegetation mapping of the Vegetation of the Namoi Catchment Management Authority (EcoLogical Australia 2008) and the threat-listed ecological community names where applicable. Flora species that are not native are marked with *.

Names of vertebrates used in this document follow the Australian Faunal Directory (ABRS 2009) and as used in the Bionet Atlas of NSW Wildlife (Office of Environment and Heritage 2011, 2012b). Common names are used in the report for species of animal. Scientific and common names are provided in the list of animals recorded in Appendix B.

3.2 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 3.1.

Table 3.1 Contributors and their roles

Name	Qualification	Role
Jacob Sife	BEnvSc	Ecologist – botanical and fauna surveys, report preparation
Sam Wilkin	BAppSc	Geospatial Consultant
Alex Cockerill	BEnvSc (Hons)	Project manager, technical input
Toby Lambert	BEnvSc	Report review
Kim Lentz	BSc	Field survey

All work was carried out under the appropriate licences, including scientific licences as required under Clause 22 of the National Parks and Wildlife Regulations 2002, Section 132C of the *National Parks and Wildlife Act 1974*, as well as animal research authorities issued by the Department of Trade Investment, Regional Infrastructure and Services.

3.3 Earlier studies

The following is a list of publically available documents prepared for the Continuation of Boggabri Coal Mine Environmental Assessment (Boggabri EA) that are used for background information and referred to in this assessment and that should be read in conjunction with this document. These include:

- continuation of Boggabri Coal Mine Environmental Assessment (Hansen Bailey 2010):
  - continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a)
  - continuation of Boggabri Coal Mine – Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b)
  - continuation of Boggabri Coal Mine – Worst Case Cumulative Impact Scenario for Biodiversity (Parsons Brinckerhoff 2010c).
- continuation of Boggabri Coal Mine – Response to Submissions (Parsons Brinckerhoff 2011a)
- continuation of Boggabri Coal Mine – Matters of National Environmental Significance (Parsons Brinckerhoff 2011b)
- continuation of Boggabri Coal Mine – Residual Matters Report (Hansen Bailey 2011):
  - continuation of Boggabri Coal Mine – Residual Biodiversity Matters Report (including a revised biodiversity offset strategy) (Parsons Brinckerhoff 2011c).

3.4 Database searches and literature reviews

Database searches provided a list of threatened flora and fauna species and communities known or predicted to occur in the locality. The results of the database searches undertaken for this project are provided in Appendix C and D.

From the list of threatened species generated, 24 species of animal and three species of plant are considered to have potential habitat within the Modification Study Area and have a likelihood of occurrence of moderate or greater.

3.5 Desktop analysis of vegetation

The vegetation community boundaries within the Modification Study Area were initially assessed using aerial photo interpretation. Analysis of the aerial photographs identified past land use practices, disturbance and native vegetation regrowth, changes in vegetation structure and floristics. This provided an initial split of vegetation communities into simple structural and disturbance classifications.

3.6 Field verification of existing vegetation mapping

Vegetation within the Modification Study Area and locality has been mapped at the regional scale by the Vegetation Map for the Namoi Catchment Management Authority (EcoLogical Australia 2008). Further, Parsons Brinckerhoff completed vegetation mapping of the Project Boundary for the Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

Field validation (ground-truthing) of the existing mapping (EcoLogical Australia 2008 and Parsons Brinckerhoff 2010a) and potential threat-listed ecological communities identified from aerial photograph interpretation, existing vegetation mapping and previous studies was undertaken to determine the specific classification of vegetation structure, dominant canopy species, native diversity and condition within the Modification Study Area.

3.7 Surveys in the Modification Study Area

Parsons Brinckerhoff ecologists completed field surveys within the proposed Modification Study Area over a series of site visits.

Table 3.2 Dates of field surveys and inspections

Modification	Dates of survey	Comments	Ecologist/s
Kamilaroi Highway Mine Access	9 January 2013	Quadrats for this Modification were completed for the; southern area, road reserve, and northern area	Jacob Sife and Chad Browning
Rock Quarry temporary storage	28 May 2013	Ecological survey was carried out in the proposed location of the temporary stockpile.	Jacob Sife
Reuse of existing Daisymede Laydown compound	17 July 2013	Inspection conducted in the Daisymede Compound area.	Kim Lentz

3.7.1 Survey effort

3.7.1.1 Flora and vegetation survey within Modification Study Area

A walk over inspection was conducted throughout the Modification Study Area with the floristic composition and structure, dominant species and vegetation communities identified. Potential habitat for threat-listed flora and fauna was noted, as was all hollow bearing trees and other habitat attributes such as drainage lines and farm dams.

The inspections and field surveys sought primarily to provide ground-truthing of information provided by the desk-based review, particularly in relation to:

- threat-listed ecological communities listed under the EPBC Act, TSC Act or FM Act
- potential flora and fauna habitat
- significant habitat for threat-listed and Migratory species or locally significant species.

The floristic diversity and possible presence of threat-listed species was assessed during random meanders within the Modification Study Area. Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random manner recording all species observed, boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

Three quantitative (quadrat) site surveys were undertaken as outlined in the methodology contained within BioBanking Operation Manual (Seidel & Briggs 2008).

3.7.2 Fauna survey within the Modification Study Area

Fauna survey was conducted via; opportunistic surveys, hollow tree survey and habitat assessment. Table 3.3 reflects the amount of survey effort for each of these techniques across the Modification Study Area. Each of these survey techniques are described in further detail in the following sections (Sections 3.7.2.1–3.7.2.3).

3.7.2.1 Opportunistic surveys

Opportunistic surveys consisted of random meanders across the Modification Study Area and while completing other survey techniques, including habitat assessments and hollow-bearing tree surveys. Opportunistic surveys included herpetofauna searches throughout the Modification Study Area wherever potential habitat (fallen logs, debris, drainage lines and rock outcropping) was found. Searches included turning over suitable ground shelter, such as fallen timber, sheets of iron and exposed rock, timber railway sleepers, and peeling decorticating bark where appropriate. Specimens were either identified visually, by aural recognition of calls (frogs and birds) or were collected and identified with reference to Swan et al. (2004) or Robinson, M. (1998). All inspected ground shelter was returned to its original position.

3.7.2.2 Hollow-bearing tree survey

Hollow-bearing trees in the Modification Study Area were recorded on a handheld GPS (Garmin 62s) whereby the number of trees with hollows were based on visual inspection.

3.7.2.3 Fauna habitat assessment

Fauna habitat assessments were completed to assess the likelihood of threat-listed species of animal occurring in the Modification Study Area. Habitat assessments included the assessment and identification of habitat features, including hollow-bearing tree and random meander surveys.

Fauna habitats were assessed generally by examining characteristics such as the structure and floristics of the canopy, understorey and ground vegetation, the structure and composition of the litter layer, and other habitat attributes important for feeding, roosting and breeding. The following criteria were used to evaluate habitat values:

- Good: A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- Moderate: Some fauna habitat components are missing (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- Poor: Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

Table 3.3 Survey effort within the Modification Study Area

Survey type[1]	Number of survey points	Location	
Flora quadrats	3	Easting	Northing
	Quadrat 1	215424.13	6606413.49
	Quadrat 2	216115.66	6607935.3
	Quadrat 3	215797.87	6607541.42
Random meander survey	7	Throughout Modification Study Area	
Fauna habitat assessment	7	Throughout Modification Study Area	
Bird surveys	7	Throughout Modification Study Area	
Opportunistic surveys	7	Throughout Modification Study Area	
Hollow tree survey	7	Throughout Modification Study Area	

(1) Details of the methodologies employed are outlined in Section 3.8.2.

3.8 Likelihood of occurrence and assessment of impact significance

Significance assessments were completed for those species recorded or predicted to occur with a moderate or greater likelihood (Appendices E) within the Modification Study Area. For this purpose, likelihood of occurrence is defined in Table 3.4.

Table 3.4 Likelihood of occurrence of threat-listed species

Likelihood	Description
Low	Species considered to have a low likelihood of occurrence include species not recorded during the field surveys that fit one or more of the following criteria: ■ Have not been recorded previously in the Modification Study Area and surrounds and for which the Modification Study Area is beyond the current distribution range. ■ Use specific habitat types or resources that are not present in the Modification Study Area. ■ Are considered locally extinct.
Moderate	Species considered to have a moderate likelihood of occurrence include species not recorded during the field surveys that fit one or more of the following criteria: ■ Have infrequently been recorded previously in the Modification Study Area and surrounds. ■ Use habitat types or resources that are present in the Modification Study Area, although generally in a poor or modified condition. ■ Are unlikely to maintain sedentary populations, however, may seasonally use resources within the Modification Study Area opportunistically during variable seasons or migration. ■ Are cryptic flowering flora species that were not seasonally targeted by surveys.
High	Species considered to have a high likelihood of occurrence include species recorded during the field surveys or species not recorded that fit one or more of the following criteria: ■ Have frequently been recorded previously in the Modification Study Area and surrounds. ■ Use habitat types or resources that are present in the Modification Study Area that are abundant and/or in good condition within the Modification Study Area. ■ Are known or likely to maintain resident populations surrounding the Modification Study Area. ■ Are known or likely to visit the site during regular seasonal movements or migration.
Recorded	Species recorded within the Modification Study Area.

3.9 Limitations

Limitations of our assessment are presented in Appendix F.

4. Description of the existing environment

4.1 Landscape context

4.1.1 Bioregion

The Modification Study Area is located in the Brigalow Belt South bioregion. This region covers an area of approximately 27,196,933 ha encompassing the towns of Baradine, Binnaway, Coonabarabran, Dubbo, Gunnedah, Merriwa, Moree and Narrabri (NSW National Parks and Wildlife Service 2003). The region also includes a significant proportion of NSW major rivers: MacIntyre, Gwydir, Namoi, Castlereagh, Goulburn, Talbragar and Macquarie Rivers, with their catchments forming an integral part of the Murray–Darling River System (NSW National Parks and Wildlife Service 2003).

The region forms the southern extremity of the Brigalow Belt, however is not dominated by Brigalow (*Acacia harpophylla*). According to the baseline surveys that supported the Brigalow Nandewar Conservation Agreement, the signature trees that occur throughout the Brigalow Belt South bioregion are White Box, White Cypress Pines and various Ironbarks. These species also dominate the communities that occur in the approved area of impact of the Project.

Geologically the region consists of landscapes derived from both extensive basalt flows and quartz sandstones and consequently has very variable soils and vegetation depending on the local rock type or sediment source. Geologically the bioregion's bedrock comprises horizontally bedded Jurassic and Triassic quartz sandstone and shale with limited areas of conglomerate or basalts. The landscape is dominated by Quaternary sediments in the form of alluvial fans and outwash slopes composed of coarser sediment, that fan out at slightly steeper angles. The relative distribution of sediment from basalt or sandstone has a major impact on soil quality and vegetation (NSW National Parks and Wildlife Service 2003).

A number of threatened ecological communities, plants and animals are restricted to the bioregion. With over 3,190,400 ha or 60.85% of the regions vegetation being cleared, the majority of threatened species records tend to be concentrated in the major reserves and state forests. 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, Vickery, Kelvin, Kerringle, Bibblewindi and Pilliga East.

4.1.2 Brigalow and Nandewar Western Regional assessment

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

4.2 Vegetation communities within the Modification Study Area

Three vegetation communities were recorded within the Modification Study Area, including two native communities and one exotic or disturbed communities. These vegetation communities are outlined in Table 4.1 and further descriptions of the communities can be found in Section 4.2.

Table 4.1 Vegetation communities within the Modification Study Area

Vegetation community	Corresponding Threatened Ecological Community (TEC)[2]
White Box – White Cypress Pine grassy woodland[1]	Box Gum Woodland (TSC Act)
Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland[3]	Not Listed
Exotic grassland	Not Listed

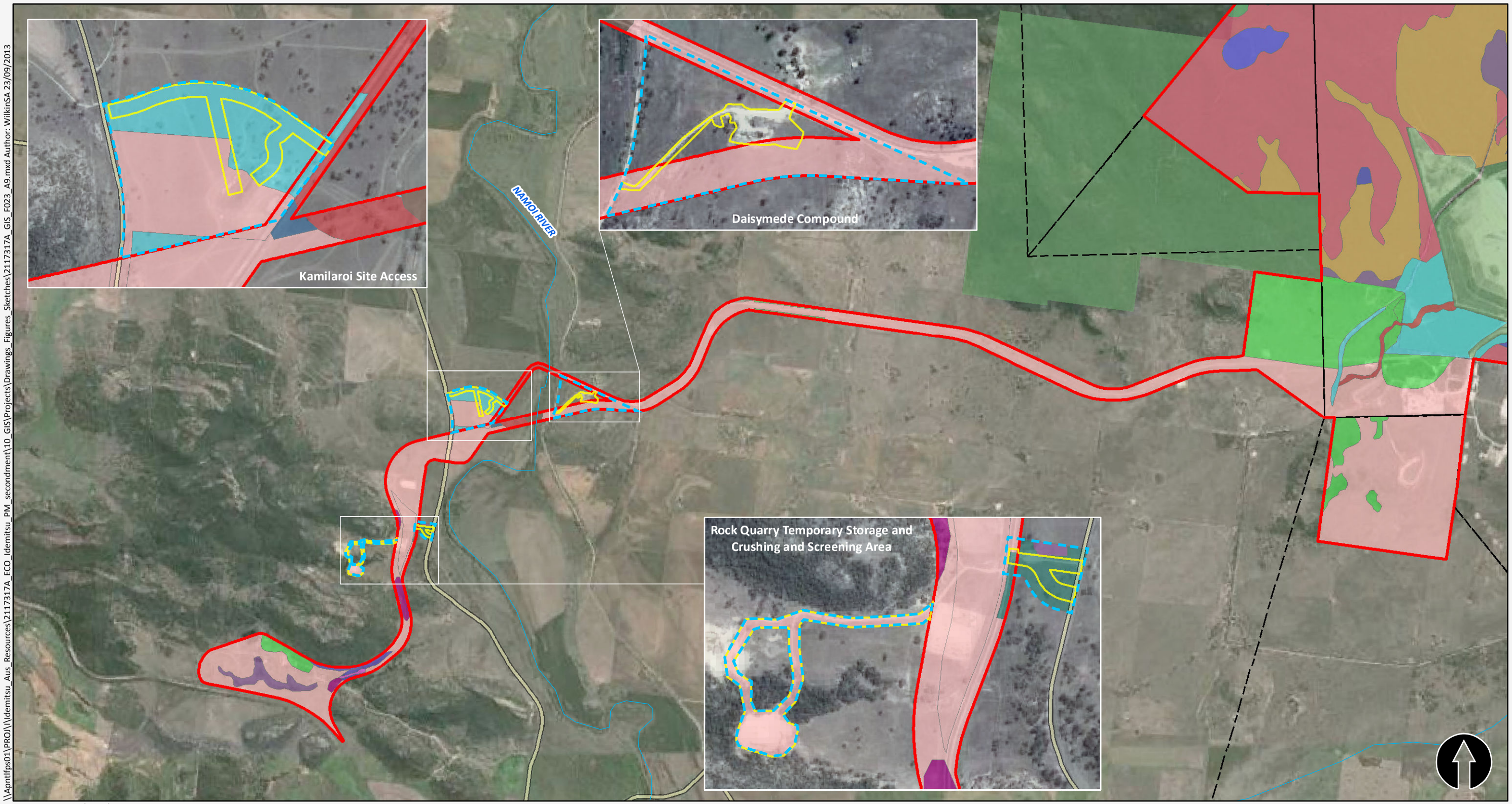
(1) The white box grassy woodland does not meet the criteria for the Critically Endangered Ecological Community, White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland as described under the EPBC Act. It does meet the criteria for endangered ecological community listed under the TSC Act.

(2) Threatened Ecological Community (TEC) as listed under the NSW TSC Act or the Commonwealth EPBC Act.

(3) Piliga Box – Poplar Box – White Cypress Pine grassy open woodland includes the community Poplar Box woodland recorded in the Kamilaroi Highway Site Access.

Table 4.2 Vegetation communities within each of the Modification sites

Vegetation community	Site location		
	Kamilaroi access	Rock Quarry	Daisymede Compound
White Box – White Cypress Pine grassy woodland	X		
Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland	X		
Exotic grassland	X	X	X



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Source: Google (2013)

- River
- Road
- Mine Tenement
- Modification Design Features
- Project Boundary
- Project Boundary Modification
- State Forest

Vegetation Communities

- Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine grassy open forest
- Native Olive dry gully forest
- Narrow-leaved Ironbark - Brown Bloodwood -White Cypress Pine shrubby open forest
- Dwyer's Red Gum woodland
- Derived native grassland
- Exotic grassland
- Pilliga Box - Poplar Box – White cypress pine grassy open forest (Low Condition)
- Pilliga Box - Poplar Box – White cypress pine grassy open forest
- Plains Grassland
- River Red Gum Riparian woodland and forest
- River Red Gum Riparian woodland and forest (Low Condition)
- Silver-leaved Ironbark heathy woodland
- White Box – White Cypress Pine grassy woodland (Low Condition)
- White Box – Melaleuca riparian forest
- White Box – Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- White Box – White Cypress Pine grassy woodland
- Yellow Box - Blakely's Red Gum grassy woodland

0 0.5 1 1.5 km

Figure 4.1
Vegetation Communities within the Study Area

4.2.1 Grassy Woodlands on fertile soils

4.2.1.1 White Box – White Cypress Pine grassy woodland

This vegetation community was recorded within the Kamilaroi Highway Site Access Modification site.

This community is consistent with Box-Gum Woodlands listed as an endangered ecological community under the TSC Act. The community is not commensurate with the Box-Gum Woodlands, listed as critically endangered under the EPBC Act. For a detailed description of how this determination was made, see Section 5.2. Within the Project Boundary White Box – White Cypress Pine grassy woodland was present as woodland up to 20 m in height dominated by a *Eucalyptus albens* canopy with 15–30% foliage cover (Photo 4.1). It occurred on the lower slopes and alluvial plains mainly on sedimentary substrates.

Photo 4.1 White Box – White Cypress Pine grassy woodland within the Project Boundary

The age classes of the canopy *Eucalyptus albens* within the Project Boundary was predominantly limited to semi-mature regrowth resulting from past logging. Very few large hollow-bearing trees were recorded. A sub canopy of *Callitris glaucophylla* was also present.

The shrub layer throughout most of the community was generally absent with very sparse shrub species including *Acacia decora, Beyeria viscosa, Geijera parviflora, Cassinia* spp and *Dodonaea viscosa.* The groundcover typically contained 50–60% cover and was dominated by a diverse range of grasses and herbs including, *Cyperus gracilis, Austrodanthonia racemosa, Bothriochloa macra, Desmodium brachypodum, Aristida ramosa, Calotis cuneifolia, Brunoniella australis, Swainsona galegifolia, Austrostipa spp*. *Vittadinia cuneata, Dichondra repens* and *Lomandra multiflora*.

The White Box – White Cypress Pine Woodland in the Project Boundary was in low to moderate condition, with moderate native species diversity.

4.2.1.2 Pilliga Box – Poplar Box – White Cypress Pine grassy woodland

This vegetation community was recorded within the Kamilaroi Highway Site Access Modification site.

Pilliga Box – Poplar Box – White Cypress Pine grassy woodland was a woodland community up to 25 m in height dominated by *Eucalyptus pilligaensis* and *Eucalyptus populnea subsp. bimbil* with a dense subcanopy (50–75% cover) of *Casuarina cristata* ssp*. cristata, Callitris glaucophylla* and *Allocasuarina luehmannii*.

Within the Project Boundary this community consisted predominantly of a large remnant patch on the southern perimeter of Leard State Forest associated with alluvial flats and plains of peneplains (Photo 4.2). There was also a narrow remnant of semi-continuous canopy and isolated trees along Leard State Forest road corridor and adjoining paddocks.

Photo 4.2 Pilliga Box – Poplar Box – White Cypress Pine grassy woodland in the Project Boundary

This community shares similar habitat conditions with the adjoining White Box – White Cypress Pine grassy woodland and Blakely's Red Gum – Yellow Box grassy woodland. The dominant eucalypts ranged in age from older hollow-bearing (habitat) trees to young regrowth within the road reserves.

The understorey was a dense (60–85% cover) mixture of grasses, sedges and a range of small herbs including *Enchylaena tomentosa, Einadia nutans subsp. linifolia, Austrostipa scabra* subsp*. scabra, Austrostipa verticillata, Calotis cuneifolia and Vittadinia cervicularis* var*. cervicularis*. The vegetation community had a sparse (5–20% cover) shrub layer dominated by *Geijera parviflora, Cassinia aculeata* and *Acacia deanei*.

Some of the isolated paddock and roadside patches were highly disturbed by past land uses, including, grazing and other agricultural practices. These disturbances have fragmented the vegetation community and modified the floristic composition and structure.

While the majority of patches of this community were in moderate condition, with a mix of native and exotic groundcover species, most contained large areas dominated by native species. Many of the exotic species observed were 'pasture improvement' species used to improve soil conditions and/or provide feed for grazing stock in the adjoining pastures. The most abundant exotic species within the community were; *Cirsium vulgare, Chloris gayana*, *Conyza albida, Lepidium africanum, Verbena officinalis, Hypochaeris radicata* and *Paspalum urvillei.*

4.2.2 Grasslands

4.2.2.1 Exotic grassland

In the Modification Study Area this community was recorded at all the Modification sites.

The Exotic Grassland is a highly disturbed vegetation community that occurs throughout the southern portions of the Project Boundary and along the majority of the existing haul route associated with areas impacted by a history of agricultural activities. This community no longer resembles any local native remnant vegetation communities. The condition of the community is very poor due to the absence of any canopy or shrublayer, with the dominance of exotic and cultivated native pasture weeds.

The majority of this community was dominated by a variety of exotic and cultivated native pasture grasses, and exotic herbs. The dominant species observed include*; Aristida ramosa, Enchylaena tomentosa, Galenia pubescens, Paspalum dilatatum, Chloris gayana, Lolium perenne, Cynodon dactylon, Trifolium repens, Senecio madagascariensis, Pennisetum clandestinum, Cirsium vulgare, Sida rhombifolia* and *Brassica sp.*

4.3 Fauna habitats

Two fauna habitats identified within the Modification Study Area are listed in Table 4.3 and further detailed below.

Table 4.3 Fauna habitats with corresponding vegetation community

Fauna habitat description	Corresponding vegetation community	Modification Sites with this fauna habitat
Grassy Woodland on fertile soils	White Box – White Cypress Pines grassy woodland, Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland.	Kamilaroi Highway Site Access
Grassland	Exotic grassland.	All

Grassy woodlands on fertile soils occurred as stands of low to moderately disturbed vegetation on the mid to lower slopes and flats. Given the presence of numerous tree hollows and the role of remnant vegetation in providing connectivity amongst the cleared landscape, Grassy Woodlands on Fertile Soils within the Modification Study Area are considered to have moderate value for fauna habitat. As with the majority of vegetation in Leard State Forest, the habitat within the Modification Study Area has been structurally simplified as a result of previous disturbance regimes, however the paucity of such vegetation at a landscape scale suggests that it is likely to provide important resources for native fauna.

The Grasslands habitat provides generally low quality habitat for a range of common species of fauna and supplementary habitat for common and threatened species. Given the abundance of this type of habitat in the locality, the area within the Modification Study Area is considered to be of low importance.

4.4 Species of plant recorded in Modification Study Area

A total of 77 plant species were recorded within the Modification Study Area and a full list is provided in Appendix A. Of these species, 57 (81%) were native and 20 (29%) species were introduced. The most diverse families recorded were Poaceae (grasses) and Asteraceae.

4.5 Species of animal recorded in Modification Study Area

Opportunistic species observations during the surveys were impacted by extreme heat (approximately 42°C) on some of the days. A total of 13 species of bird was recorded in the Modification Study Area of which 11 were native. No threat-listed species on the TSC Act or EPBC Act were recorded. The species recorded are provided below.

Table 4.4 Species of animal recorded in the Modification Study Area during the survey

Common name	Scientific name	Threat-listing under the TSC Act and EPBC Act
Grey Butcherbird	*Cracticus torquatus*	–
Sulphur-crested Cockatoo	*Cacatua galerita*	–
Spotted Dove*	*Spilopelia chinensis*	–
Galah	*Eolophus roseicapilla*	–
Nankeen Kestrel	*Falco cenchroides*	–
Australian Magpie	*Cracticus tibicen*	–
Magpie-lark	*Grallina cyanoleuca*	–
Noisy Miner	*Manorina melanocephala*	–
Superb Fairywren	*Malurus cyaneus*	–
Spotted Pardalote	*Pardalotus punctatus*	–
Striated Pardalote	*Pardalotus striatus*	–
Wedge-tailed Eagle	*Aquila audax*	–
Black-shouldered Kite	*Elanus axillaris*	–

(1) An (*) denotes a non-native species.

5. Species, populations and communities of conservation concern

Species, populations and communities of conservation concern are threat-listed biodiversity listed under at least one of the TSC Act, FM Act, EPBC Act or another agreement or act to which Australia are a signatory.

This section details the threat-listed biodiversity and other species of conservation concern recorded or likely to occur in the Modification Study Area, based on those found within the locality and the nature of the vegetation and habitats observed within the existing environment (Section 4).

5.1 Threat-listed ecological communities

An ecological community is a naturally occurring group of plants, animals and other organisms that are interacting in a unique habitat. Its structure, composition and distribution are determined by environmental factors such as soil type, position in the landscape, altitude, climate and water availability. Threat-listed ecological communities are listed under the TSC Act, FM Act and EPBC Act.

Based on the findings of the field surveys and desktop assessment, a total of 11 threat-listed ecological communities have the potential to occur in the Modification Study Area and the Namoi CMA (Liverpool Plains (Part B) sub-region) (Table 5.1).

Table 5.1 Threat-listed ecological communities with potential to occur within the Modification Study Area and the Namoi CMA (Liverpool Plains (Part B) sub-region)

Ecological community name TSC Act (EPBC Act)	Conservation Status			Recorded within the Modification Study Area
	TSC Act[1]	EPBC Act[2]	FM Act	
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River	–	–	E	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Artesian Springs Ecological Community *(The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin)*	E	E	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Cadellia pentastylis (Ooline) community in the Nandewar and Brigalow Belt South bioregion	E	–	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Carbeen Open Forest community in the Darling Riverine Plains and Brigalow Belt South Bioregions	E	–	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections

Ecological community name TSC Act (EPBC Act)	Conservation Status			Recorded within the Modification Study Area
	TSC Act[1]	EPBC Act[2]	FM Act	
Coolibah-Black Box Woodlands of the Northern Riverine Plains in the Darling Riverine Plains and the Brigalow Belt South Bioregions (*Coolibah Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions)*	E	E	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections.
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes: Darling Riverine Plains and Brigalow Belt South Bioregions	E	–	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Inland Grey Box Woodland in the Riverina: NSW South Western Slopes: Cobar Peneplain: Nandewar and Brigalow Belt South Bioregions *(Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands)*	E	E	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions *(Weeping Myall Woodlands)*	E	E	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Native Vegetation on Cracking Clay Soils of the Liverpool Plains *(Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld)*	E	CE	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions *(Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions)*	E	E	–	No. Not identified within the Modification Study Area either in vegetation mapping of the region or during site inspections
White Box Yellow Box Blakely's Red Gum Woodland[3] ***(White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland)***	**E**	**CE**	**–**	**Yes. White box woodland commensurate with the TSC Act listed community was identified within the Modification Study Area.**

(1) TSC Act = Threatened Species Conservation act 1995, V=Vulnerable, E= Endangered.

(2) EPBC Act = Environment Protection and Biodiversity Conservation Act1999, E= Endangered, CE=Critically Endangered

(3) The White Box Yellow Box Blakely's Red Gum Woodland identified within the Modification Study Area is commensurate with the TSC act listed community, however does not meet the EPBC Act list community (refer 5.2)

Only one Threat-listed Ecological Community was observed within the Modification Study Area:

- White Box Yellow Box Blakely's Red Gum Woodland listed under the TSC Act.

A description of this community and the impact from the proposed Modification is provided in Section 5.2.

5.2 White Box Yellow Box Blakely's Red Gum Woodland

White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: *Eucalyptus albens*, *E. melliodora* and *E. blakelyi*. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified sites include the following:

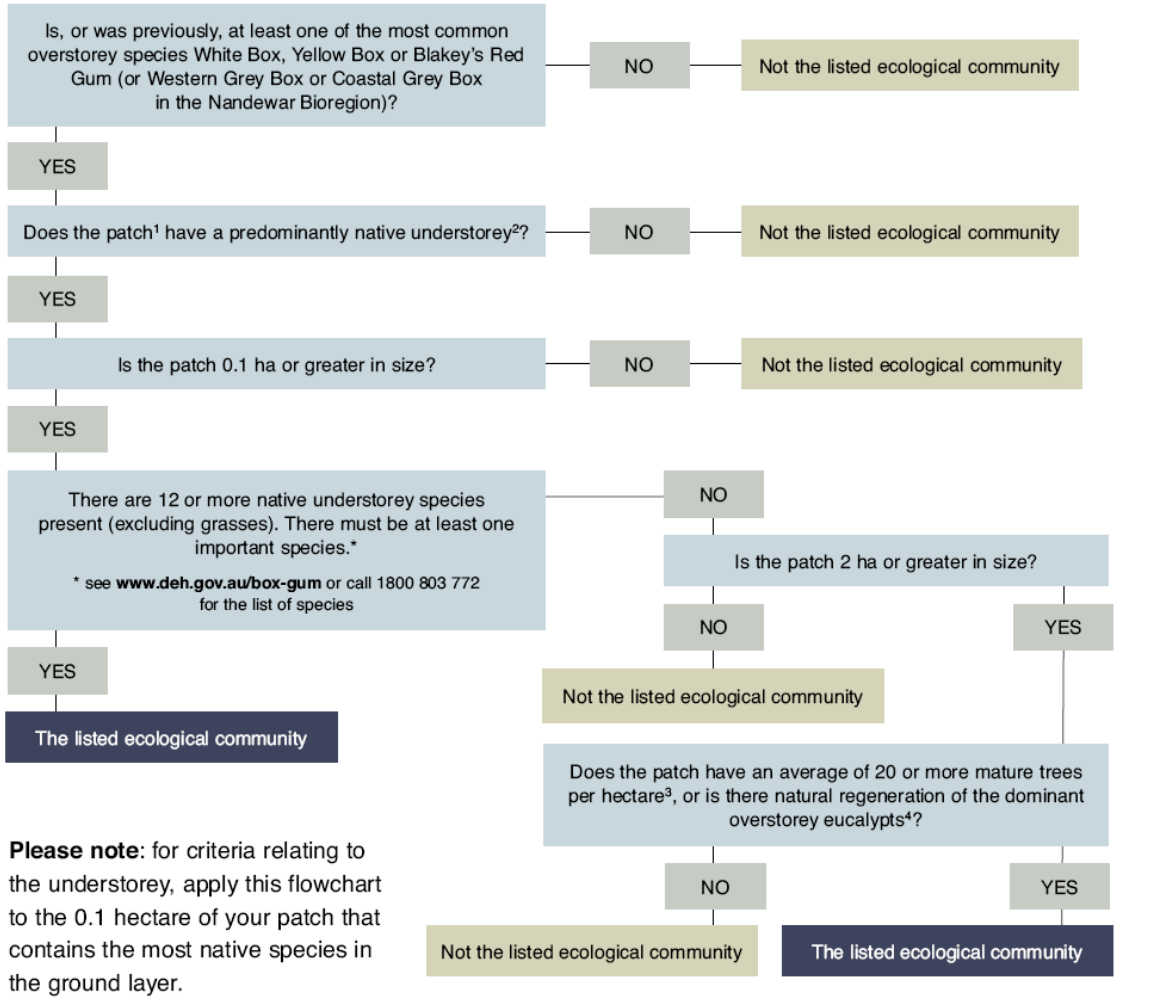
- Areas where the main tree species are present, ranging from an open woodland formation to a forest structure, and the groundlayer is predominantly composed of exotic species.
- Sites where the trees have been removed and only the grassy groundlayer and some herbs remain.

EPBC-listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing.

To be considered part of the EPBC listed ecological community remnant areas must:

- have a predominately native understorey (i.e. more than 50% of the perennial vegetative groundlayer must comprise native species)
- be 0.1 hectare (ha) or greater in size and contain 12 or more native understorey species (excluding grasses), including one or more identified important species
- be 2 ha or greater in size and have either natural regeneration of the overstorey species or an average of 20 or more mature trees per ha.

An identification guide for the EPBC Act listed community is provided in Figure 5.1 with a summary of the assessment provided in Table 5.2.



[1] Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:

- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1000m^2) or greater.

[2] A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

[3] Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

[4] Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Figure 5.1 Identification of EPBC- listed Box-Gum Woodland

Table 5.2 Summary table of EPBC determination of White Box Yellow Box Blakely's Red Gum Woodland

Step	EPBC Criteria for determining White Box Yellow Box Blakely's Red Gum Woodland	General Comment for patches within the Modification Study Area	Classification
1	Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakey's Red Gum (or Western Grey Box or Coastal Grey Box in the Nandewar Bioregion)	The dominant trees within the patch are White Box and Blakey's Red Gum.	Yes (go to 2)
2	Does the patch have a predominantly native understorey?	The EPBC Act Policy Statement (ref) indicates that a predominantly native ground layer exists where at least 50% of the perennial vegetation cover in the ground layer is made up of native species. The patch within the study site is predominantly exotic species.	No. Fails to meet criteria for the EPBC listed community.
3	Is the patch 0.1 ha or greater in size?	The area of this patch was less than 0.1 ha in size.	No. Fails to meet criteria for the EPBC listed community.

White box woodland which satisfies the criteria for the TSC act listed community, White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland was identified in the Modification Study Area within the Kamilaroi Highway Site Access. However, as the understorey within these areas was predominantly non-native, and there are fewer than 12 native species, the community does not meet the EPBC Act listing criteria (Table 5.2 and Figure 5.1).

The vegetation communities identified within the Modification Study Area that are commensurate with the TSC Act listed White Box Yellow Box Blakely's Red Gum Woodland include; White Box White Cypress Pine grassy woodland . There are no communities within the Modification Study Area commensurate with the EPBC Act listed community.

The Modification will impact 2.8 ha of this vegetation type as listed under the TSC Act and 0 ha as listed under the EPBC Act.

5.3 Threat-listed flora

Threat-listed flora are plant species listed under the TSC Act or the EPBC Act. Three threat-listed species, *Digitaria porrecta,Diuris tricolor* and *Tylophora linearis* have potential habitat within the Modification Study Area. These species are detailed in Table 5.3.

Table 5.3 Threat-listed species of plant with potential habitat to occur within the Project Boundary

Species	TSC Act[1]	EPBC Act[2]	Habitat
Digitaria porrecta	E	E	In NSW it occurs in north western slopes and north western plains subdivisions (Royal Botanic Gardens 2009) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire.
Diuris tricolor	V	V	The *Diuris tricolor* grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. The understorey is often grassy with herbaceous plants such as *Bulbine* species. Flowers from September to November or generally spring (Jones 2006).
Tylophora linearis	E	E	Grows in dry scrub in the Barraba, Mendooran, Temora and West Wyalong districts, in the NWS, CWS botanical subdivisions (Royal Botanic Gardens, 2005). Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of Eucalyptus fibrosa, E. sideroxylon, E. albens, Callitris endlicheri, C. glaucophylla and Allocasuarina luehmannii. Also grows in association with Acacia hakeoides, A. lineata, Myoporum species and Casuarina species (Department of Environment and Conservation, 2005).

(1) TSC Act – Threatened Species and Conservation Act 1995. E = Endangered

(2) EPBC Act – Environment Protection and Biodiversity Conservation Act 1999. E = Endangered

No threat-listed species of plant were recorded within the Modification Study Area.

5.4 Threat-listed fauna

Threat-listed fauna are animal species listed under the TSC Act or the EPBC Act. Potential habitat for 24 threat-listed species was observed within the Modification Study Area (Table 5.4). A full list of species considered, their preferred habitats and likelihood of occurrence is provided in Appendix D.

Table 5.4 Threat-listed species of animal with suitable habitat in the Modification Study Area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]
Birds of prey			
Circus assimilis	Spotted Harrier	V	–
Hieraaetus morphnoides	Little Eagle	V	–
Lophoictinia isura	Square-tailed Kite	V	–
Hollow dependent microchiropteran bats			
Nyctophilus timoriensis	Greater Long-eared Bat – south eastern form	V	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	–
Woodland birds			
Climacteris picumnus	Brown Treecreeper	V	–

Scientific name	Common name	TSC Act[1]	EPBC Act[2]
Melanodryas cucullata	Hooded Robin	V	–
Melithreptus gularis	Black-chinned Honeyeater	V	–
Grantiella picta	Painted Honeyeater	V	–
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	–
Pyrrholaemus sagittatus	Speckled Warbler	V	–
Stagonopleura guttata	Diamond Firetail	V	–
Daphoenositta chrysoptera	Varied Sittella	V	–
Birds – opportunistic blossom nomads			
Glossopsitta pusilla	Little Lorikeet	V	–
Neophema pulchella	Turquoise Parrot	V	–
Lathamus discolor	Swift Parrot	E	E
Polytelis swainsonii	Superb Parrot	V	V
Tyto novaehollandiae	Masked Owl	V	–
Ninox connivens	Barking Owl	V	–
Xanthomyza phrygia	Regent Honeyeater	CE	E, M
Arboreal Mammals			
Phascolarctos cinereus	Koala	V	V
Petaurus norfolcensis	Squirrel glider	V	–
Reptiles			
Hoplocephalus bitorquatus	Pale-headed Snake	V	–

(1) TSC Act – *Threatened Species Conservation act 1995,* V=Vulnerable, E= Endangered, CE= Critically Endangered.
(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act*1999, E= Endangered; M= Migratory

No threat-listed species of fauna were recorded in the Modification Study Area during the surveys for the proposed Modification.

Twenty-four threat-listed species are considered to have potential habitat within the Modification Study Area, including four matters of national environmental significance protected under the EPBC Act.

5.5 Migratory species

Migratory species are protected under international agreements to which Australia are a signatory, including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered to comprise 'Matters of National Environmental Significance' and are protected under the EPBC Act.

Based on the findings of the desk-top assessment, a total of 13 Migratory species have been recorded or have the potential to occur in the Modification Study Area locality. No Migratory species were recorded during field surveys, however, potential habitat was observed for the Fork-tailed Swift, Eastern Great Egret, Cattle Egret, White-throated Needletail, and Rainbow Bee-eater.

While terrestrial Migratory species of bird may potentially use the area, the site would not be classed as 'important habitat' as defined *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment Water Heritage and the Arts 2009a) as the site does not contain:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

As such, it is not likely that the proposed activity would significantly affect Migratory species and this group is not considered further.

5.6 State Environment Planning Policy 44 – Koala Habitat Protection

The Modification Study Area is located in the Narrabri Shire Local Government Area, which is listed as an area under which SEPP 44 applies, and is further positioned in the Western Slopes and Plains Koala Management Area (Department of Environment and Climate Change 2008b). The Modification Study Area contained two Koala feed trees, as listed under Schedule 1 of SEPP 44 (NSW Government 2000) and the Western Slopes and Plains Koala Management Area (NSW Government 2000). In all of the Modification sites, at least one secondary Koala feed tree was identified. The suite of Koala feed trees available is the most important factor influencing Koala habitat and occurrence (NSW National Parks and Wildlife Service 2002a). Primary feed trees are those tree species that exhibit a level of use that is significantly higher than that of other *Eucalyptus* species, independent of tree density, and make up the bulk of a Koala's diet (NSW National Parks and Wildlife Service 2002a). Secondary or supplementary feed trees are species that provide a seasonal or supplementary dietary resource (NSW National Parks and Wildlife Service 2002a).

While no primary feed tree species were recorded in the Modification Study Area, two secondary feed trees, *Eucalyptus populnea* and *E. albens*, were recorded therein (Table 5.5). At least one of the two secondary feed species was identified in each of the Modification Sites.

Both *E. albens* and *E. populnea* occurred as scattered trees throughout the Modification Study Area in the Poplar box Woodland, White Box Woodland and Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland as well as scattered trees in the exotic grasslands.

Impacts of the Modification on Koala have also been assessed under the TSC Act and EPBC Act threat-listed species significance assessment, refer to Section 8. The significance assessment determined that neither the Modification or Project Approval would significantly impact upon the Koala (refer Table 8.1).

Table 5.5 Koala feed tree species recorded in the Modification Study Area

Scientific name	PB verified vegetation community[1]	>15% of the total number of trees	SEPP 44[2]	Approved koala recovery plan[3]
Eucalyptus populnea	Yes. Occurred in Poplar box woodland, White Box Woodland and Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland as well as scattered trees in the exotic grasslands.	Yes	Yes	Yes (S)
Eucalyptus albens	Yes. Occurred in Poplar box woodland, White Box Woodland and Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland as well as scattered trees in the exotic grasslands.	Yes	Yes	Yes (S)

(1) Vegetation type based on surveys in the Modification Study Area.
(2) SEPP 44 – State Environmental Planning Policy No. 44 – Koala Habitat Protection.
(3) Approved Koala Recovery Plan (Department of Environment and Climate Change 2008b). S – Secondary food tree species

Habitat in the Modification Study Area is considered 'core habitat' due to:

- koala observations within the locality, and specifically along the Kamilaroi Highway
- feed tree species occurring at a density greater than 15% of the total number of trees in a vegetation community (Poplar Box Woodland and White box grassy woodland).

Furthermore, the habitat within the Modification Study Area represents remnant trees within an otherwise largely cleared landscape. This habitat is a corridor allowing koalas to move throughout the landscape.

5.7 Critical habitat

Critical habitat is listed under both the TSC Act and/or the EPBC Act. Critical habitat is the whole or any part or parts of an area or areas of land comprising habitat critical to the survival of an endangered species, population or ecological community.

There is no listed critical habitat in the Modification Study Area and none is likely to be affected by the Modification. The area to be impacted by the Modification is not considered likely to constitute critical habitat listed under either the TSC Act or the EPBC Act, or be critical to the survival of an endangered species, population or community.

6. Potential impacts

The potential impacts on biodiversity due to construction and operation of the Modification are summarised in Table 6.1 and described in detail below.

Mitigation measures to ameliorate these impacts are discussed in Section 7. Assessments of significance for threat-listed biodiversity that occur or have potential habitat in the Modification Study Area (discussed in Section 5) are provided in Appendix E and summarised in Section 8.

Table 6.1 Potential impacts associated with the Project

Potential impact	Potential phase of impact	
	Construction	Operation
Loss of vegetation (including threat-listed ecological communities/animal habitats)	●	
Loss of vegetation within a secured offset area	●	
Loss of hollow bearing trees	●	
Habitat fragmentation and barrier effects	●	●
Weeds	●	●
Potential environmental impact of noise on wildlife	●	●
Erosion and sedimentation	●	●
Changed hydrology	●	●

6.1 Loss of vegetation and habitats

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act. The construction phase of the Modification will require the removal of 47.6 ha of vegetation, including 14.0 ha of native vegetation and approximately 2.8 ha of vegetation listed under the TSC Act (Table 6.2).

The Project Boundary Modification is mostly within biodiversity offsets as described in the Boggabri Coal Mine biodiversity offsets strategy (Parsons Brinckerhoff 2010b). These impacts and the associated requirements are detailed in Section 7.2.2.

Measures to minimise impacts to threat-listed biodiversity affected by the loss of vegetation and associated habitat are described in Section 7.

Table 6.2 Potential loss of native vegetation within the Modification Study Area

Modification	Vegetation community	TSC Act listing[1]	Modification Study Area (ha)	Area within offset (ha)
Daisymede Compound	Exotic grassland	–	17.9	8.8
	Total clearing for Daisymede	–	17.9	8.8
	Total EEC clearing for Daisymede	–	0	0
Kamilaroi Highway Site Access	Exotic grassland	–	11.4	11
	Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	11.2	10.7
	White Box White Cypress Pine grassy woodland	E	2.8	2.6
	Total clearing for Kamilaroi Highway Site Access	–	25.4	24.3
	Total EEC clearing Kamilaroi Highway Site Access	–	2.8	2.6
Rock Quarry	Exotic Grassland	–	4.3	4.3
	Total clearing for Rock Quarry	–	4.3	4.3
	Total EEC clearing for Rock Quarry	–	0	0
Modification Study Area	**Total clearing for Modification**		**47.6**	**37.4**
	Total Native Vegetation clearing for Modification		**14.0**	**13.3**
	Total EEC clearing for Modification		**2.8**	**2.6**

(1) TSC Act, E = Endangered. None of the vegetation communities within the Modification Study Area are listed under the EPBC Act.
(2) For the purpose of this report, Total area (ha) outside of EA Project Boundary (PA 09_0182) = Modification Impact Area

Loss of vegetation and habitats result in a range of direct and indirect impacts to vegetation communities and species of plant and animal including:

- reduction in the extent of vegetation communities and associated habitats
- loss of local populations of species
- fragmentation of remnants of vegetation communities or local populations of individual species
- increased edge effects and habitat for invasive species
- reduction in the viability of ecological communities resulting from loss or disruption of ecological functions (e.g. increased desiccation, light penetration, herbivore, weed invasion, predation, and parasitism)
- destruction of flora and fauna habitat and associated loss of biological diversity (habitat removal may include removal of hollow bearing trees, loss of leaf litter layer, and resultant changes to soil biota)
- soil exposure and altered water flow patterns resulting in increased erosion and sedimentation.

The Modification will have an impact on fauna habitats with the removal or modification of approximately 14.0 ha of native vegetation, including six hollow bearing trees within the Kamilaroi Site Access. There is potential for some of these hollow-bearing trees to be retained, however, these trees have been included in impact assessments as a precautionary measure.

The impact assessments confirm that the removal of 14.0 ha of native vegetation and up to six hollow bearing trees is unlikely to have a significant impact upon any threat-listed species, population or community.

6.2 Direct loss of species

Fauna injury or death could occur as a result of the proposed activities during the construction phase, particularly when vegetation and habitats are being cleared. The risk of vehicle collision is also present during the operation of the Modification.

While some mobile species, such as birds, have the potential to move away from the path of clearing, other species that are less mobile, or those that are nocturnal and restricted to tree hollows, may have difficulty moving over relatively large distances. Species of animal that may be affected by vegetation clearing include small terrestrial and arboreal mammals, microchiropteran bats, reptiles and frogs. Although the relatively small patch of woodland habitat in the Modification Study Area is effectively isolated from other such areas, the senescent nature of many individual *Eucalyptus populnea* and *Eucalyptus albens* provided numerous tree hollows, which potentially provide roosting habitat or nesting dens for species of animal. In order to limit potential for animals to be injured during vegetation removal, the procedures and strategies developed for the Boggabri coal, Biodiversity Management Plan (Parsons Brinckerhoff 2012) should be adhered to. A summary of these measures is provided in Table 7.1.

Vehicle strike during construction, operation and maintenance works is not considered to be significant and is not likely to significantly increase as a result of the proposed Modification.

Measures would be in place to minimise the likelihood of death or injury of wildlife, however, these cannot prevent such losses. The impact of such losses in relation to threat-listed species was considered in the assessments of significance (Appendix E).

6.3 Loss of hollow bearing trees

The proposal will require the removal of up to six hollow bearing trees. Tree hollows are cavities formed in the trunk or branches of a living or dead tree. The loss of hollow bearing trees is listed as a Key Threatening Processes under the TSC Act. Many native birds and mammals, including threat-listed species utilise hollows and hollows are often a limiting resource within a landscape. During the planning stage of the Modification, steps were taken to minimise impacts to native vegetation and hollow bearing trees. Although up to six hollow bearing trees will be removed as a result of the Modification, a significant number of existing hollow bearing trees will remain in the areas surrounding the Modification Study Area. Therefore the loss of six hollow bearing trees is considered unlikely to result in a significant impact to any threat-listed fauna species.

6.4 Habitat fragmentation and barrier effects

Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with the occurrence of a new habitat type in the area between the fragments. This new dividing habitat type is often artificial and inhospitable to the species remaining within the fragments (Bennett 1990, 1993; Johnson *et al.* 2007).

In addition to the loss of total habitat area, the process of fragmentation can affect species within the newly created fragments in a number of ways, including barrier effects, genetic isolation, and edge effects. The degree to which these potential impacts affect the flora and fauna within the newly created fragments depends on a number of variables, including distance between the fragments, local environmental conditions, the species present and any proposed mitigation measures. Some of the potential impacts are summarised below. Barrier effects.

Barrier effects occur where particular species are either unable or are unwilling to move between suitable areas of fragmented habitat due to the imposition of a ‘barrier’ (e.g. a newly created inhospitable habitat type). This could result in either a complete halt to species movement or a reduced level of species movement between fragments. Species most vulnerable to barrier effects include rare species (where even a small reduction in movements can reduce genetic continuity within a population, hence reducing the effective population size), smaller ground-dwelling species and relatively sessile species with low mobility. Species least vulnerable to barrier effects tend to be those that are highly mobile (e.g. birds), although even these species can vary in their response to barriers.

Genetic isolation occurs where individuals from a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments. Genetic isolation can lead to problems with inbreeding and genetic drift for populations isolated within a fragment. This may lead to reduced fitness (in the form of inbreeding depression resulting from expression of deleterious recessive genes in offspring) and consequently reduced viability of populations that are isolated in habitat fragments as a result of the proposed activity.

Vegetation in the Modification Study Area generally occurs as fragmented and isolated remnants resulting from extensive agricultural and mining developments in the locality. Habitat fragmentation may result from the Kamilaroi Highway Site Access where the road intersects habitat. However in general, the habitat intersected is already in a fragmented state, and exists as scattered trees within an otherwise disturbed landscape. As such the additional fragmentation is not considered likely to impact significantly upon the current situation.

The other Modifications are either very small areas, where most animal movements or seed dispersal for plants would not be impeded.

The barrier effects associated with the Modification are not considered likely to have a significant impact upon any species, population or community listed under the TSC Act or EPBC Act.

6.4.1 Edge effects

Edge effects are zones of changed environmental conditions (e.g. altered light levels, wind speed, temperature) occurring along the edges of habitat fragments. These new environmental conditions along the edges can promote the growth of different vegetation types (including weeds), promote invasion by pest animals specialising in edge habitats, or change the behaviour of resident animals (Moenting & Morris 2006). Edge zones can be subject to higher levels of predation by introduced mammalian and native avian predators. The distance of edge effects influence can vary, with edge effects in roads having been recorded greater than 1 km (Forman *et al.* 2000) and as little as 50 m away (Bali 2000; 2005).

Vegetation and fauna habitats in the Modification Study Area are fragmented and isolated by existing linear infrastructure and extensive agricultural developments, and as a result is already subject to edge effects.

Furthermore, given the highly modified nature of the surrounding landscape, the Modification are not likely to increase edge effects on vegetation and habitats remaining post construction. As such, edge effects as a result of the Modification are not considered likely to have a significant impact upon any threat-listed species, population or community.

6.5 Weeds

The invasion of exotic perennial grasses, such as *Chloris gayana* which was recorded abundantly within the Modification Study Area, is recognised as a Key Threatening Process under the TSC Act. The Project has the potential to result in further spread of this species.

During construction phase has the potential to disperse weeds into areas where weed species do not currently occur. The most likely causes of weed dispersal associated with the Modification would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. This may, in turn, reduce the habitat quality of the sites for threat-listed species, such as woodland species of bird (Robinson, D. *et al.* 2001). Spread of weeds during the operation phase would relate generally to maintenance activities. Given the high level of weed invasion, and the presence of two noxious weeds, construction and to a lesser extent, operation phase, has the potential to spread weeds from the Modification Study Area to other sites. Therefore mitigation measures relating to weed control have been outlined in Section 7 of this report.

6.6 Potential environmental impact of noise on wildlife

Many animals detect and depend on sound to communicate, navigate, evade danger and find food, but human-made noise can alter the behaviour of animals or interfere with their normal functioning (Bowles 1997). In some cases it can harm their health, reproduction, survivorship, habitat use, distribution, abundance, or genetic composition (Forman *et al.* 2000).However, variation in ambient noise, such as from wind or other animals, is part of the natural environment (Eve 1991) and many animals display behavioural adaptations to this variation. For example, certain species of frogs avoid vocalising during loud calling by cicadas (Paez *et al.* 1993) or other frogs (Matsui *et al.* 1993), and some species will time their calls during brief periods of silence (Schwartz & Henderson 1991).

During construction, noise levels will increase in the Modification Study Area and surrounds due to ground disturbance, machinery operation and vehicle movements and vegetation clearing. This may cause disturbance for some fauna. A number of factors are thought to influence the reaction of animals to noise including the volume, the frequency and the characteristic of the noise (e.g. short and percussive versus long and constant).

The Modification Study Area is already affected by noise levels associated with the approved mine operations, existing haul road and vehicle movements on the surrounding public road network. How fauna occupying the local area will respond to increased noise is not known, but given the degree of current noise levels, it is not likely to be significant.

6.7 Erosion and sedimentation

Excavation and earthworks undertaken during the construction phase would expose soils that have the potential to enter surrounding areas of vegetation and waterways, possibly resulting in sedimentation and dispersal of weeds. Erosion during the operation stage, relates to maintenance activities and is likely to be minor. Section 7 of this report provides a number of mitigation measures, and if properly adhered to, the impacts associated with the Modification are not considered significant.

6.8 Changed hydrology

Excavation and earthworks undertaken during the construction phase will remove vegetation and change the landscape, potentially influencing surface water flow. During operation the Kamilaroi Highway access and other roads and paved areas will generate minor increases in runoff while changing the hydrological flow of surface water if not properly managed. Proper drainage within the design, should result in the negative impacts associated with changed hydrology being managed, and therefore the impacts are likely to be minor. The management and mitigation measures in Section 7 should be adhered to.

6.9 Key Threatening Processes

Key Threatening Processes are listed under Schedule 3 of the TSC Act and FM Act and also under the EPBC Act. A process is defined as a key threatening process if it threatens or may threaten the survival, abundance, or evolutionary development of a native species or ecological community. A process can be listed as a key threatening process if it could cause a native species or ecological community to become eligible for adding to a threatened list (other than conservation dependant), or cause an already threat-listed species or community to become more endangered, or if it adversely affects two or more threat-listed species or ecological communities.

The proposed Modification has the potential to contribute to the following threatening processes:

- TSC Act Key Threatening Processes:
  - Invasion of native plant communities by exotic perennial grasses (refer Section 6.5).
  - Clearing of native vegetation (refer Section 6.1).
  - Loss of hollow-bearing trees (refer Section 6.3).

- EPBC Act Key Threatening Processes:
  - Land clearance (refer Section 6.9).
  - Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (refer Section 6.5).

The proposed Modification will result in the loss of native vegetation including hollow bearing trees and thus contribute to two key threatening processes, clearing of native vegetation and land clearance and loss of hollow bearing trees. The proposed Modification is not likely to significantly increase the introduction or spread of exotic weed species, if undertaken in accordance with mitigation measures provided in Section 7.

7. Management and mitigation measures

This section identifies appropriate management and mitigation measures that build upon the strategies currently employed as part of the Boggabri Coal Mine Flora and Fauna Management Sub Plan. The relevant management and mitigation measures previously identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) should also be followed for works associated with the proposed Modification.

The general principle to minimise impacts to biodiversity, should in order of consideration, endeavour to:

- avoid impacts on habitat, through the planning process
- minimise impacts on habitat, through the planning process
- mitigate impacts on habitat, though the use of a range of mitigation measures including securing offset areas.

7.1 Detailed mitigation measures

Detailed mitigation measures for the BCEP Project are shown in Table 7.1. These are applicable for the proposed Modification. The mitigation measures are presented for both the construction and operational phases of the Project. Mitigation measures should be incorporated into the mine operational plan and existing measures that have produced favourable outcomes incorporated where possible. This biodiversity management plan should be an important document for the environmental field supervisor or ecologist in enacting the 'avoid and mitigate' principles during the construction phase. The biodiversity management plan should include detailed information such as protocols for vegetation clearing, feral animal and pest control, rehabilitation objectives, monitoring activities and further detailed design measures (7.1).

Table 7.1 Detailed mitigation measures as described in the Boggabri Coal - Biodiversity Management Plan (Parsons Brinckerhoff 2012)

Impact	Mitigation
Construction	
Vegetation and habitat loss	■ Limit disturbance of vegetation to the minimum necessary for each stage of the clearing. ■ Implement a two stage clearing protocol for all hollow-bearing tree clearing. ■ Mark all hollow-bearing trees to be felled and catalogue their species and approximate dimensions so that hollows or nest boxes can be affixed to similar standing trees. ■ Attach salvaged sections of hollows or nest boxes to trees in a way that allows for tree expansion and does not poison the tree. Hollows or nest boxes should be attached to trees with consideration of aspect, height and location appropriate for the target fauna species. The location of each relocated hollow or nest box should be recorded using GIS equipment during installation. ■ Collect native seed prior to clearing, for use in the revegetation of disturbed areas. ■ Landscaping should include:

Impact	Mitigation
	▸ Planting of a range of native shrubs, trees and groundcover plants. ▸ Incorporation of existing natural vegetation where possible. ▸ Linking of bushland remnants. ▸ Maintenance of plantings through a landscaping plan. ■ Mark the limits of clearing and install fencing around the construction footprint area prior to construction activities commencing to avoid unnecessary vegetation and habitat removal. ■ Restrict equipment and stockpiling of resources to designated areas in cleared land to minimise the overall impact of the construction. ■ Place transportable habitat features such as large logs and boulders, in adjacent retained areas where possible to allow their continuation as potential fauna refuge sites. ■ Progressively revegetate disturbed areas. ■ Locate sediment ponds in existing cleared areas where possible to minimise the loss of habitat.
Weeds	■ A weed management plan should be developed to manage weeds during the construction phase. ■ Undertake ongoing management and monitoring of weed invasion through the weed management plan.
Habitat fragmentation and barrier effects	■ Maintain where possible linkages and or crossing zones between isolated vegetation remnant patches within Leard State Forest.
Changed hydrology	■ Design and construct Namoi River crossings in accordance with the I & I NSW *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull & Witheridge 2003). ■ Prepare a progressive erosion and sediment control plan following best practice. Design temporary scour protection and energy dissipation measures to protect receiving environment from erosion. ■ Revegetate riparian zones affected by the Project with native species.
Success of mitigation	■ Undertake monitoring in line with current monitoring programs.
Cumulative loss of habitat	■ Offset any residual biodiversity impacts.
Operation	
Weeds	■ Undertake ongoing management and monitoring of weed invasion within the Project Boundary during the life of the Projects operation.
Ecological Monitoring	■ A flora and fauna monitoring program for the Project should be developed and implemented aimed at achieving a better understanding of impacts and rehabilitation actions to flora and fauna throughout the Project Boundary. ■ The monitoring plan should consider and develop the existing monitoring plan in place as part of the MOP for existing operations. ■ Monitoring should also include exotic weeds and feral animals. The plan should be adaptive and identify trigger points and responses for ongoing impacts to flora and fauna. ■ The monitoring should include consideration of the observed microbat roost site in close proximity to the haul route.

Impact	Mitigation
Rehabilitation	Areas not required for mining purposes or activities should be revegetated following a revegetation/rehabilitation plan. This plan should include: ■ Planting of a range of locally occurring native shrubs, trees and groundcover plants, in keeping with the former vegetation types present. Choice of species should be in consultation with the relevant regulators NSW and should include Acacia, Eucalyptus species to compensate for any impacts to habitat of the koalas and hollow dependent species. ■ Incorporating existing natural vegetation where possible. ■ Linking vegetation remnants. ■ Focusing on riparian vegetation to protect waterways. ■ Excluding stock from areas rehabilitated for nature conservation objectives.
Vehicle strike and direct mortality	■ Locate revegetation works to increase fauna habitat linkages. ■ Design drainage structures to incorporate fauna movement. ■ Reduce the median width to the minimum necessary for safe operation of the road in fauna crossing zones.
Changed water quality	■ Plant macrophytes along the stream banks of the Namoi River to filter flow and enhance bank stability. ■ All water discharge into streams should be guided by the ANZECC Water Quality Guidelines (2000).

7.2 Biodiversity offsets

7.2.1 Background

Whilst the majority of the impacts associated with the proposed Modification can be mitigated, the loss of vegetation cannot be adequately ameliorated in the absence of a biodiversity offset strategy.
Boggabri Coal has developed a robust Biodiversity Offset Strategy for the Continuation of Boggabri Coal Mine Project (Boggabri EA Offset Strategy) (Parsons Brinckerhoff 2010b, 2011c) which is currently being assessed by the NSW Government. Impacts associated with the proposed Modification that are within the Project Boundary Modification, were not considered in the development of the Biodiversity Offset Strategy for the Continuation of Boggabri Coal Mine Project (Boggabri EA Offset Strategy) (Parsons Brinckerhoff 2010b, 2011c).

7.2.2 Impacts to offset area

The Modification includes areas to be impacted within previously identified offsets, as described in the Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy (Parsons Brinckerhoff 2010b). In some cases, these impacts are within potential habitat for threatened species listed under the EPBC Act and as such are considered Matters of National Environmental Significance (MNES). These species are; Koala, Superb Parrot, Swift Parrot, Regent Honeyeater and the Greater Long-eared Bat. The impacts to these species are discussed in greater detail in the significance assessment presented in Appendix E. The extent of the Modifications impact on these offsets is presented in Table 7.2.

Table 7.2 Vegetation clearing and associated offset requirements

Modification	Vegetation community	TSC Act listing[1]	Area within offset (ha)
Kamilaroi Highway Site Access	Exotic grassland[2]	–	11
	Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	10.7
	White Box – White Cypress Pine Grassy Woodland	E	2.6
Rock Quarry	Exotic Grassland[2]	–	4.3
Daisymede Compound	Exotic Grassland	–	8.8
Total (ha) (including EEC)	Total (ha)		37.4
Total EEC (ha)	**Total EEC (ha)**		**2.6**

(1) TSC Act, E = Endangered. None of the vegetation communities within the Modification Study Area are listed under the EPBC Act.

8. Impact significance assessments

The Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) completed significant assessments for the affected threat-listed biodiversity within the Boggabri EA Project Boundary. The Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) provides a list of the threat-listed biodiversity that have been recorded and/or have potential habitat within the Project Boundary. The findings of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) significance assessments, found that Box Gum Woodland, woodland birds, hollow-dependent microchiropteran bats and the Regent Honeyeater would be significantly affected as a result of the Continuation of Boggabri Coal Mine Project.

The previous assessments of the Project Boundary do not include the Project Boundary Modification assessed in this report. Therefore, additional significance assessments have been completed to consider cumulative impacts of works associated with the Modification. While no threat-listed species of plant or animal were recorded during surveys within the Modification Study Area, a small area of one threat-listed ecological community (Box Gum Woodland) and potential habitat for three threat-listed species of plant and 24 species of animal, including four listed under the EPBC Act was identified therein.

The threat-listed ecological communities and threat-listed species listed in Table 8.1 have had assessments of significance completed for this report. These assessments consider cumulative impacts from the incremental addition of vegetation and habitat loss associated with the construction and operation of the proposed Modification. The findings of the significance assessments completed for this proposal are that the additional incremental impacts are unlikely to alter the previous significance assessment findings reported in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

The significance assessments are included as Appendix E.

Table 8.1 Significance assessments completed

Threat-listed biodiversity	Potential habitat in the Modification Study Area	Recorded in the Modification Study area	Recorded in Approved Project Boundary	TSC Act[1]	EPBC Act[2]	Likely significant impact (Boggabri EA)	Likely to be significantly affected by Modification
Endangered Ecological Communities							
Box Gum Woodland	Yes	No	Yes	E	CE	Yes	No
Threatened plants							
Digitaria porrecta	Yes	No	No	E	E	No	No
Diuris tricolor	Yes	No	No	V	V	No	No
Tylophora linearis	Yes	No	No	E	E	No	No
Threat-listed Birds of Prey							
Spotted Harrier	Yes	No	Yes	V	–	No	No
Little Eagle	Yes	No	Yes	V	–	No	No
Square-tailed Kite	Yes	No	No	V	–	No	No
Hollow dependent microchiropteran bats							
Greater Long-eared Bat – south eastern form	Yes	No	Yes	V	V	Yes	No
Eastern False Pipistrelle	Yes	No	Yes	V	–	Yes	No
Yellow-bellied Sheathtail Bat	Yes	No	Yes	V	–	Yes	No

Threat-listed biodiversity	Potential habitat in the Modification Study Area	Recorded in the Modification Study area	Recorded in Approved Project Boundary	TSC Act[1]	EPBC Act[2]	Likely significant impact (Boggabri EA)	Likely to be significantly affected by Modification
Woodland birds							
Brown Treecreeper	Yes	No	Yes	V	–	Yes	No
Grey-crowned Babbler	Yes	No	Yes	V	–	Yes	No
Speckled Warbler	Yes	No	Yes	V	–	Yes	No
Diamond Firetail	Yes	No	Yes	V	–	Yes	No
Varied Sittella	Yes	No	Yes	V	–	Yes	No
Birds – opportunistic blossom nomads							
Little Lorikeet	Yes	No	Yes	V	–	No	No
Turquoise Parrot	Yes	No	Yes	V	–	No	No
Swift Parrot	Yes	No	Yes	E	E	No	No
Masked Owl	Yes	No	Yes	V	–	No	No
Barking Owl	Yes	No	Yes	V	–	No	No
Superb Parrot	Yes	No	No	V	–	No	No
Regent Honeyeater	Yes	No	Yes	CE	E, M	Yes	No
Arboreal Mammals							
Koala	Yes	No	Yes	V	V	No	No
Squirrel glider	Yes	No	Yes	V	–	No	No

Threat-listed biodiversity	Potential habitat in the Modification Study Area	Recorded in the Modification Study area	Recorded in Approved Project Boundary	TSC Act[1]	EPBC Act[2]	Likely significant impact (Boggabri EA)	Likely to be significantly affected by Modification
Reptiles							
Pale-headed Snake	Yes	No	**Yes**	E	E	No	No

(1) TSC Act,V = vulnerable, E = endangered. CE = critically endangered,

(2) EPBC Act. ,V = vulnerable, E = endangered, CE = critically endangered, M = migratory

9. Likely Impacts on Matters of National Environmental Significance under the EPBC Act

The likely broad potential impacts of the Modification on Matters of National Environmental Significance include:

- impacts on a remnant patch of vegetation considered to be important to the ecology of the local area, including the *Environment Protection and Biodiversity Conservation Act 1999* listed Threatened and/or Migratory species, Regent Honeyeater, Swift Parrot and Greater Long-eared Bat
- impacts on 13.4 ha of known and/or potential habitat for Threatened and/or Migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

The greatest impact by the Modification will be the loss of vegetation and habitat for Matters of National Environmental Significance. This clearing will result in a total of 13.4 ha of native vegetation and habitat for Matters of National Environmental Significance being removed.

9.1 The significance of the impacts

Impacts on Threatened and/or Migratory species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* are required to be assessed following the *Significant Impact Guidelines* (Department of the Environment Heritage water and the Arts 2009). Significance Assessments for species listed under the *Environment Protection and Biodiversity Conservation Act 1999* that have a moderate or high likelihood of occurrence within the Modification are presented in full in appendices C and D.

The findings of the significance assessments completed for the Modification are that the additional incremental impacts are unlikely to alter the previous significance assessment findings reported in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

10. Conclusions

This report assessed the ecological impacts associated with proposed Modification to the Boggabri Coal Project Approval (09_0182). Specifically the Modification includes:

- construction of permanent mine access from the Kamilaroi Highway
- temporary storage of processed mine overburden material at the existing Rock Quarry and the reuse of this material during the construction of the rail spur embankments
- reuse of the existing Daisymede laydown compound.

The proposed Modification includes the removal of vegetation outside of the previously approved Project Boundary. The previously unassessed area to be impacted forms the Project Boundary Modification.

The Project Boundary Modification covers 47.6 ha, which includes 14.0 ha of native vegetation, of which 2.8 ha is listed as a threatened ecological community under the TSC Act.

The native vegetation removed is considered potential habitat for three threat-listed plants and 24 threat-listed animals, including four species listed under the EPBC Act and would add to the cumulative removal of vegetation for the expansion of Boggabri Mine. In addition to the loss of vegetation up to six hollow bearing trees will be removed due to the proposed Modification, all within the Kamilaroi Highway Site Access.

Significance assessments have been completed in accordance with TSC Act and EPBC guidelines for the threat-listed community and species with potential to occur within, or utilise the Modification Study Area. The significance assessments concluded that the incremental increase in habitat loss associated with the proposed Modification is unlikely to impact significantly upon the findings reported in the Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a).

Whilst the majority of impacts associated with the proposal are able to be ameliorated, amendment of the existing draft Biodiversity Offset Strategy will be required to offset the impacts upon land previously secured as offsets for the Boggabri Project.

In total, 13.3 ha of native vegetation considered to be potential roosting or foraging habitat for species of MNES will be removed from within the previously secured, Namoi River offset.

In consideration of the ecological and significance assessments completed, it is concluded that, if the relevant management and mitigation measures identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010a) and the additional measures outlined in Section 7 of this report are adhered to, significant impact upon any threat-listed community, population or species as a result of the proposed Modification is unlikely. Identification of additional offsets twenty times greater than the impact areas will result in a net gain of protected habitat for the threat-listed species and communities.

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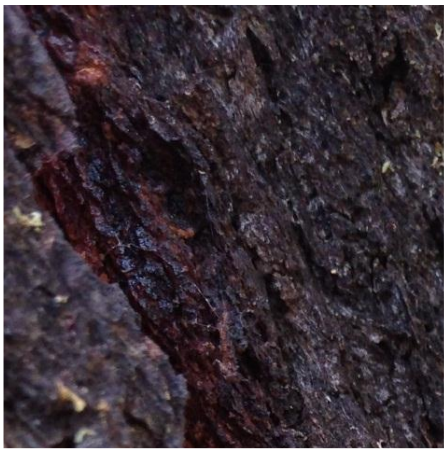


Appendix A

Plant species

Appendix A – list of plans

Table A.1 Plant species recorded in the Study area

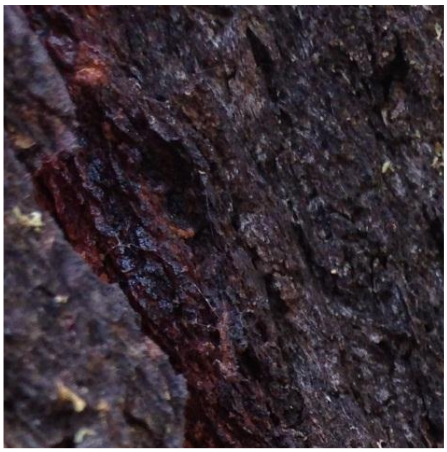
Family Name	Scientific Name	Common Name
Acanthaceae		
	Brunoniella australis	Blue Trumpet
Adiantaceae		
	Cheilanthes sieberi	Mulga Fern
Aizoaceae		
	*Galenia pubescens**	Galenia
Apocynaceae		
	Alstonia constricta	Quinine Bush
	Parsonsia eucalyptophylla	Gargaloo
Asteraceae		
	*Arctotheca calendula**	Capeweed
	*Bidens pilosa**	Cobbler's Pegs
	Calotis cuneifolia	Purple Burr-Daisy
	Calotis sp.	
	Chrysocephalum apiculatum	Common Everlasting
	*Cirsium vulgare**	Spear Thistle
	*Conyza bonariensis**	Flaxleaf Fleabane
	Olearia elliptica	Sticky Daisy Bush
	*Senecio madagascariensis**	Fireweed
	*Silybum marianum**	Variegated Thistle
	*Sonchus oleraceus**	Common Sowthistle
Boraginaceae		
	*Heliotropium amplexicaule**	Blue Heliotrope
Brassicaceae		
	*Brassica sp.**	
	Lepidium sp.	
Cactaceae		
	*Opuntia stricta**	Prickly Pear
Campanulaceae		
	Wahlenbergia sp.	Bluebell
Casuarinaceae		
	Allocasuarina luehmannii	Bulloak
Chenopodiaceae		
	Maireana sp.	
	Sclerolaena birchii	Galvinized Burr
	Sclerolaena muricata	Black Rolypoly
Convolvulaceae		
	Convolvulus erubescens	
	Dichondra repens	Kidney Weed
Cupressaceae		
	Callitris glaucophylla	White Cypress Pine
Fabaceae (Faboideae)		
	*Medicago polymorpha**	Burr Medic
	*Trifolium arvense**	Haresfoot Clover
	*Trifolium repens**	White Clover
Fabaceae (Mimosoideae)		

	Acacia dealbata ssp. dealbata	Silver Wattle
	Acacia ssp.	
Geraniaceae		
	Geranium solanderi	Native Geranium
Juncaceae		
	Juncus continuus	
	Juncus sp.	
Lomandraceae		
	Lomandra sp.	
Loranthaceae		
	Amyema miquelii	Box Mistletoe
Malvaceae		
	Sida corrugata	Vaiable Sida
	*Sida rhombifolia**	Paddy's Lucerne
Myrtaceae		
	Angophora floribunda	Rough-barked Apple
	Eucalyptus albens	White Box
	Eucalyptus blakelyi	Blakely's Red Gum
	Eucalyptus crebra	Narrow-leaved Ironbark
	Eucalyptus fibrosa ssp. nubila	
	Eucalyptus melanophloia	Silver-leaved Ironbark
	Eucalyptus melliodora	Yellow Box
	Eucalyptus microcarpa	Western Grey Box
	Eucalyptus pilligaensis	Narrow-leaved Grey Box
	Eucalyptus populnea	Bimble Box
Oleaceae		
	Notelaea microcarpa var. microcarpa	
Pittosporaceae		
	Bursaria spinosa	Native Blackthorn
Poaceae		
	Aristida ramosa	
	Aristida sp.	
	Aristida vagans	Threeawn Speargrass
	Austrodanthonia setacea	
	Austrodanthonia sp.	
	Austrostipa aristiglumis	Plains Grass
	Austrostipa scabra	Speargrass
	Austrostipa verticillata	
	*Avena fatua**	Wild Oats
	Bothriochloa decipiens	Red Grass
	Bothriochloa macra	Red Grass
	*Chloris gayana**	Rhodes Grass
	Chloris truncata	Windmill Grass
	Cynodon dactylon	Common Couch
	Dichanthium sericeum	Queensland Bluegrass
	Digitaria divaricatissima	Umbrella Grass
	*Eleusine indica**	Crowsfoot Grass
	Eragrostis sp.	
	Panicum simile	Two-colour Panic

	*Paspalum dilatatum**	Paspalum
	Sporobolus sp.	
	Themeda australis	Kangaroo Grass
Rutaceae		
	Geijera parviflora	Wilga
Solanaceae		
	Solanum sp.	
	Solanum nigrum	Black-berry Nightshade
Verbenaceae		
	*Verbena bonariensis**	Purpletop

Notes: [1] * denotes a non-native species

[2] No threat-listed species under either the TSC Act or the EPBC Act were identified in the study area.



Appendix B

Animal species

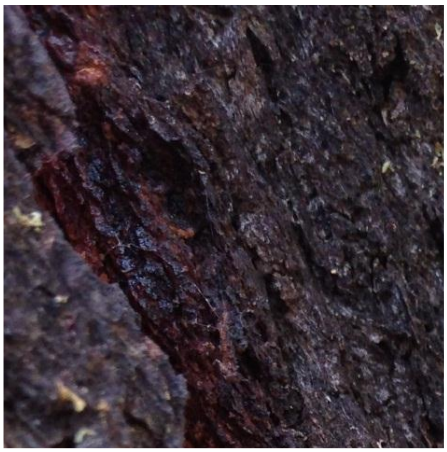
Appendix B – List of animals

Table B.1 Species of animal recorded in study area

Common name	Scientific name
Grey Butcherbird	*Cracticus torquatus*
Sulphur-crested Cockatoo	*Cacatua galerita*
Spotted Dove*	*Spilopelia chinensis*
Galah	*Eolophus roseicapilla*
Nankeen Kestrel	*Falco cenchroides*
Australian Magpie	*Cracticus tibicen*
Magpie-lark	*Grallina cyanoleuca*
Noisy Miner	*Manorina melanocephala*
Superb Fairywren	*Malurus cyaneus*
Spotted Pardalote	*Pardalotus punctatus*
Striated Pardalote	*Pardalotus striatus*
Wedge-tailed Eagle	*Aquila audax*
Black-shouldered Kite	***Elanus axillaris***

Notes: [1] No threat-listed species under either the TSC Act or the EPBC Act were identified in the study area.

- Denotes a non-native species



Appendix C

Threatened species of plant

Appendix C

Threatened Species of flora

Species Name	Common Name	EPBC Act Listing[1]	TSC Act Listing[2]	Habitat	Likelihood of Occurrence[3]	Impact Assessment required?
Bothriochloa biloba		V	V	Has a widespread distribution and grows in woodland on poorer soils (Harden 1993). Occurs on basaltic hills and grassland on drainage slopes on a variety of soils in association with *Eucalypus punctata, E. albens, E.camaldulensis E. tereticornis, E. populnea ssp bimbil and Angophora floribunda* (Office of Environment and Heritage 2012).	**Low.** There is marginal potential habitat for the species.	No
Cadellia pentastylis	Ooline	V	V	Occurs west from near Tenterfield and north from Terry Hie Hie (Royal Botanic Gardens 2005). Grows mainly in vine thickets or dry rainforest, and more rarely occurs in woodlands. It is a relict rainforest species and tends to favour upper and mid slope positions, often with a northerly aspect. It commonly occurs on sandy-loam to clay soils of low to medium fertility. It can occur in pure stands or in a mixed community on the slopes of residual sandstone ranges and scarps (Department of Environment and Conservation 2006).	**Low.** There is marginal potential habitat for the species.	No
Cyperus conicus	-		E1	Occurs rarely in the Pilliga area of NSW and is also found in Victoria, Qld, the NT and WA. It grows in open woodland on sandy soil. In central Australia, the species grows near waterholes and on the banks of streams in sandy soils. In Qld the species usually found on heavy soils. Recorded from Callitris forest in the Pilliga area, growing in sandy soil with *Cyperus gracilis, C. squarrosus and C. fulvus*. Often associated with other sedge species including *C. victoriensis, C. difformis, C. iria, C. compressus, C. nervulosus, C. dactylotes, Fimbristylis and Eleocharis species. Cyperus conicus* has been recorded as very rare and occasional, to common and abundant in populations. Interstate habitats include floodplains, creek beds and banks, swamps, run-on areas and various watercourses, near or in dams and bores, and in vegetation communities such as Melaleuca swamps, open Box woodland and sedgelands. Soils are usually sandy or silty and damp to wet (Department of Environment and Conservation 2005).	**Low.** There is marginal potential habitat for the species.	No
Dichanthium setosum	Bluegrass	V	V	Grows in woodland and grassland (Harden 1993). On the New England Tablelands and North West Slopes it grows on stony red-brown hard-setting soils over basalt, or on black soil (Department of Environment and Conservation 2006).	**Low.** There is marginal potential habitat for the species.	No
Diuris tricolor (Syn Diuris sheaffiana)	**Donkey Orchid**	**V**	**V**	**Grows in sclerophyll forest among grass, often with Callitris (Royal Botanic Gardens 2005). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Soils include gritty orange-brown loam on granite, shallow red loamy sand on stony porphyry, skeletal lateritic soil and alluvial grey silty loam. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats(Department of Environment and Conservation 2005). Within the Upper Hunter it is known to occur in *Eucalyptus albens/Eucalyptus crebra/Eucalyptus blakelyi/Corymbia maculata* woodland complexes and grasslands (Parsons Brinckerhoff 2004).**	**Moderate. Potential habitat exists within the woodland areas.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Digitaria porrecta	**Finger Panic Grass**	**E**	**E1**	**In NSW it occurs in north western slopes and north western plains subdivisions (Royal Botanic Gardens 2004) where it grows in native**	**Moderate. The woodlands and**	**Yes – as potential habitat was recorded an impact**

				grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Department of Environment and Conservation 2006).	**derived native grasslands within the Study area provide potential habitat for the species. It was not recorded during the survey.**	**assessment has been undertaken in Appendix E**
Homopholis belsonii		V		Occurs north from the Warialda district. It grows in dry woodland on poor soils such as belah (Department of Environment and Conservation 2006; Royal Botanic Gardens 2005)	**Low.** There is marginal potential habitat for the species.	No
Lepidium aschersonii	Spiny Peppercress	V	V	Not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains). A recent survey has located several populations at Narrabri, from where the species had last been recorded in 1899. Also known from the West Wyalong, Barmedman and Temora areas, although most records are old. Approximately 50% of the total *Lepidium aschersonii* recorded for Australia occurs in NSW. Found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), with Austrodanthonia and/or Austrostipa species in the understorey. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense Brigalow, with sparse grassy understorey and occasional heavy litter. Flowers from spring to autumn. Plants in the Narrabri population have been observed producing abundant seed, and as the species is believed to be short-lived and large numbers of plants were present at the site, Lepidium aschersonii appears to be successfully reproducing. Populations have been known to immediately disappear following inundation by flooding, reappearing several seasons later. An apparent increase in numbers during drought conditions has also been observed. The species is reported to be salt tolerant and also grows well under dry conditions. Recorded population sizes vary from 10 to 2000+ plants. Plant numbers decrease with increasing overstorey density, and plants were not found where the Brigalow canopy cover exceeded about 60%. The species is often described as a “weed” where it dominates paddocks (Royal Botanic Gardens 2007).	**Low.** There is marginal potential habitat for the species.	No
Philotheca ericifolia	-	V		Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies, in the upper Hunter Valley and Pilliga to Peak Hill district (Royal Botanic Gardens 2004). It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include Melaleuca uncinata, Eucalyptus crebra, E. rossii, E. punctata, Corymbia trachyphloia, Acacia triptera, A. burrowii, Beyeria viscosa, Philotheca australis, Leucopogon muticus and Calytrix tetragona. Noted as being a moisture-loving plant, with plants common on the sides of a particular spur of the Hervey Ranges where soakage from the high background provides sufficient moisture for the plants (Department of Environment and Conservation 2005).	**Low.** There is marginal potential habitat for the species.	No
Pomaderris queenslandica	Scant Pomaderris		E1	Widely scattered but not common in north-east NSW and in Queensland. It is only known from a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai, and also from several locations on the NSW north coast (Department of Environment and Conservation 2005). It grows in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks (Department of Environment and Conservation 2005).	**Low.** There is marginal potential habitat for the species.	No
Swainsona murrayana	Slender Darling Pea	V	V	Often grows with Maireana species on heavy soils, especially in depression (Royal Botanic Gardens 2005). Found throughout NSW, it has been recorded	**Low.** There is marginal potential habitat for the	No

				in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. It grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated (Department of Environment and Conservation 2005).	species.	
Thesium australe	Austral Toadflax	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be Themeda australis and Poa spp. (Department of Environment and Climate Change 2008; Harden 1992).	**Low.** There is marginal potential habitat for the species.	No
Tylophora linearis		**E**	**V**	**Grows in dry scrub in the Barraba, Mendooran, Temora and West Wyalong districts, in the NWS, CWS botanical subdivisions (Royal Botanic Gardens 2005). Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, E. sideroxylon, E. albens, Callitris endlicheri, C. glaucophylla* and *Allocasuarina luehmannii*. Also grows in association with *Acacia hakeoides, A. lineata, Myoporum species* and *Casuarina* species (Department of Environment and Conservation 2005; Department of Environment Water Heritage and the Arts 2008; NSW Scientific Committee 2008).**	**Moderate. There is potential habitat for the species in the form Woodlands vegetation. This species was not recorded during the field surveys.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**

Note:

1: V = Vulnerable, E = Endangered as listed on the *Environment Protection and Biodiversity Conservation Act 1999*.

2: V = Vulnerable, E1 = Endangered as listed on the *Threatened Species Conservation Act 1995*.

3: Likelihood of occurrence is based on field surveys and database searches. Any species with a likelihood of occurrence of moderate or greater has been asses for significance impact assessments.

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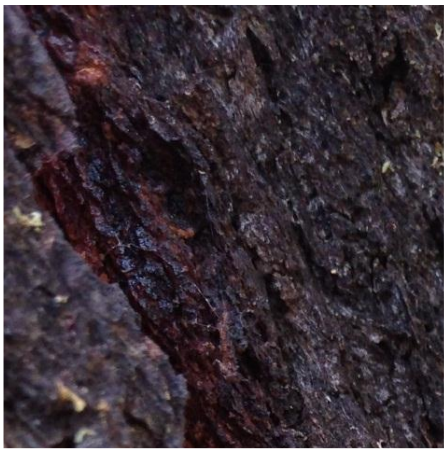

Appendix D

Threatened species of animal

Appendix D

Threatened Species of animal in the locality

Scientific name	Common Name	EPBC Act Listing[1]	TSC Act Listing[2]	Habitat	Likelihood of Occurrence[3]	Impact Assessment required?
Birds						
Alectura lathami	Australian Brush-turkey		E2	Has a largely coastal distribution from Cape York south as far as the Illawarra in NSW (Barrett, G.W. *et al.* 2003; Marchant & Higgins 1993). It occurs in forested and wooded areas of tropical and warm-temperate districts, particularly above 300 m to at least 1200 m altitude. The species is commonly associated with closed forest, including rainforest and vine thickets, as well as dense woodland habitats. More open dry woodland habitats are also used including open woodland dominated by Spotted Gum, Corymbia maculata, Brigalow, Acacia harpophylla, and Belah, Casuarina cristata (Marchant & Higgins 1993). In NSW the inland vegetation type preferred by the Australian Brush-turkey is a dry rainforest community that is found within the Semi-evergreen Vine Thicket in the Brigalow Belt South and Nandewar Bioregions Endangered Ecological Community (NSW Scientific Committee 2005). The population in the Nandewar and Brigalow Belt South bioregions of NSW is listed as an Endangered population.	**Low**. There is no preferred habitat	No
Anseranas semipalmata	Magpie Goose		V	Occurs in shallow wetlands such as large swamps and dams, especially with dense growth of rushes or sedges, and with permanent lagoons and grassland nearby. Feeds on seeds, tubers and green grass. Form large nesting colonies during the wet season. During the dry season this species migrates hundreds of kilometres to perennial swamps (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002a).	**Low**. There is no preferred habitat	No
Anthochaera phrygia (syn. Xanthomyza phrygia)	**Regent Honeyeater**	**EM**	**CE**	**Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box), E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum) (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Ardeotis australis	Australian Bustard		E1	The ground-dwelling bird mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones	**Low**. There is no preferred habitat	No

				between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas (Marchant & Higgins 1993).		
Botaurus poiciloptilus	Australasian Bittern	E	E1	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002a).	**Low**. There is no preferred habitat	No
Burhinus grallarius	Bush Stone-curlew		E1	Inland habitat consists of open forest and woodlands with few, if any, shrubs, and short, sparse grasses of less than 15cm in height, with scattered fallen timber, leaf litter and bare ground present (Department of Environment and Conservation 2006). In coastal areas, structurally similar elements of tidal and estuarine communities (Casuarina woodlands, saltmarsh and mangroves) provide suitable habitat (Price 2004). Nesting sites are frequently located in relatively open areas, where ground cover is extremely low and/or sparse including native vegetation and mown lawns, ploughed paddocks and paddocks cut for hay, dirt and gravel roads, seaweed on sand beach, playing fields, vacant lots (Department of Environment and Conservation 2006).	**Low**. There is no preferred habitat	No
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	Occurs in eucalypt woodland and forest with Casuarina/Allocasuarina spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key Allocasuarina species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 1999a).	**Low**. There is no preferred habitat	No
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	**Speckled Warbler**		**V**	**Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett & Crowley 2000). The species has been shown to decrease in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100ha remain (Barrett, G.W *et al.* 1994). Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term (NSW Scientific Committee 2001b).**	**HIgh. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Circus assimilis	**Spotted Harrier**		**V**	**The Spotted Harrier occurs throughout the Australian mainland in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant & Higgins 1993). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The diet of**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**

				the Spotted Harrier includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Department of Environment Climate Change and Water 2010).		
Climacteris picumnus victoriae	**Brown Treecreeper (eastern subspecies)**		**V**	**Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly in habits woodlands dominated by stringybarks or other rough-barked eucalypts. Nesting occurs in tree hollows (Department of Environment and Conservation 2005a).**	**High. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Daphoenositta chrysoptera	**Varied Sittella**		**V**	**The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Department of Environment Climate Change and Water 2010).**	**High. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Ephippiorhynchus asiaticus	Black-necked Stork		E1	Feed in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No
Epthianura albifrons	White-fronted Chat		E2	The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level (North 1904; Higgins et al. 2001; Barrett et al. 2003). In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins et al. 2001). Along the coastline, White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas. (North 1904; Higgins et al. 2001; Barrett et al. 2003). The population in the Sydney Metropolitan Catchment Management Authority region is listed as Endangered (Office of Environment and Heritage 2012).	**Low**. There is no preferred habitat	No
Falco hypoleucos	Grey Falcon		E1	Generally centred on inland drainage systems where the average rainfall is less than 500 millimetres. It is found in timbered lowland plains that are crossed by tree-lined water courses. Nests in the old nests of other birds, particularly raptors (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No
Glossopsitta pusilla	**Little Lorikeet**		**V**	**The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins 1999).**	**High. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**

Grantiella picta	**Painted Honeyeater**		**V**	**Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Grus rubicunda	Brolga		V	Occurs in well vegetated shallow freshwater wetlands, small isolated swamps in eucalypt forests, floodplains, grasslands, paddocks, ploughed fields, irrigated pastures, stubbles, crops, desert claypans, bore drains, tidal areas, mangroves, beach wastes. Roosts in shallow, bare swamps and nests on small islands in wetland or standing in shallow water, eggs are occasionally laid on bare ground (Pizzey & Knight 2007).	**Low**. There is no preferred habitat	No
Hamirostra melanosternon	Black-breasted Buzzard		V	Distributed throughout most of inland Australia and prefers arid scrubland, and open woodlands. Feeds on small mammals and birds (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No
Hieraaetus morphnoides	**Little Eagle**		**V**	**The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant & Higgins 1993).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Lathamus discolor	**Swift Parrot**	**E**	**E1**	**Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett & Crowley 2000),(Swift Parrot Recovery Team 2001).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Leipoa ocellata	Malleefowl	VM	E1	Ground-dwelling bird found in mallee woodland and other dry scrub in the semi-arid zone of inland Australia. Restricted to semi-arid rangelands and small habitat remnants in the dryland cropping zone of the southwest and centre of NSW.	**Low**. There is no preferred habitat	No

				Prefers well drained, light sandy or loamy soils. Habitat usually contains dense but discontinuous canopy which provides abundant leaf litter and dense, varied shrub and herb layers containing food plants, particularly Acacia, Cassia, Bossiaea, Beyeria and some open ground for ease of movement (NSW National Parks and Wildlife Service 1999c).		
Limosa limosa	Black-tailed Godwit	M	V	A coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey & Knight 2007).	**Low**. There is no preferred habitat	No
Lophoictinia isura	**Square-tailed Kite**		**V**	**This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Melanodryas cucullata cucullata	**Hooded Robin (South-Eastern)**		**V**	**Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Garnett & Crowley 2000; Traill & Duncan 2000). The species appears unable to survive in remnants smaller than 100-200ha (NSW Scientifc Committee 2001).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Melithreptus gularis gularis	**Black-chinned Honeyeater (eastern subspecies)**		**V**	**Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett & Crowley 2000). It occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, Blakely's Red Gum and Forest Red Gum. Also inhabits open forests of smooth-barked gums, stringybarks, river sheoaks (nesting habitat) and tea-trees. Feeding territories are large making the species locally nomadic. It tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares (Office of Environment and Heritage 2012b).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Neophema pulchella	**Turquoise Parrot**		**V**	**The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby understorey, often in undulating or rugged country, or on footslopes. It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath. The Turquoise Parrot requires live or dead trees, stumps and logs for nesting, trees and shrubs for shelter, and seeding grasses and forbs (often beneath trees) for food. The Turquoise Parrot's nest is a cavity in a live or dead tree, stump or log, or even fence post often within 1-2 m of the ground. Hollows average about 0.5 m deep, with an entrance hole of 10 x 7 cm, and a nest chamber 12 x 9 cm in diameter (Garnett & Crowley 2000; Higgins 1999).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**

Ninox connivens	**Barking Owl**		**V**	**Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Ninox strenua	**Powerful Owl**		**V**	**A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Oxyura australis	Blue-billed Duck		V	Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, Lignum Muehlenbeckia cunninghamii and paperbark Melaleuca (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No
Petroica boodang	Scarlet Robin		V	In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Higgins & Peter 2002; NSW Scientific Committee 2010b). The species has been found to be absent from remnants surrounded by cereal cropping, less common in isolated patches of 30 ha or less (where there was no tree cover within 200 m and less than 20% cover within 1 km), less common in sites surrounded by cattle grazing and more common in sites with native versus exotic grasses if ungrazed for more than 10 years (Barrett, G.W. *et al.* 2003).	Low. There is no preferred habitat	No
Petroica phoenicea	Flame Robin		V	In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins & Peter 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (NSW Scientific Committee 2010a).	**Low**. There is no preferred habitat	No

Polytelis swainsonii	**Superb Parrot**	**V**	**V**	**Mainly found in the Riverina where they nest in loose colonies in riparian woodland on River Red Gum. On the inland slopes, Superb Parrots both forage and feed within box woodland, mostly nesting in dead trees (Garnett & Crowley 2000).**	**Moderate. Whilst generally condiered outside of the distribution range for this species, potential habitat was available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Pomatostomus temporalis temporalis	**Grey-Crowned Babbler (Eastern subspecies)**		**V**	**The eastern form of the species formerly ranged throughout eastern Australia from South Australia, through Victoria and broadly through NSW and central Queensland but is now extinct in South Australia, coastal Victoria and the ACT. In NSW, it occurs on the western slopes and plains but is less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers *et al.* 1984; Schodde & Mason 1999).Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson & Robinson 1992).Grey-crowned Babblers are insectivorous and forage in leaf litter and on bark of trees (NSW Scientific Committee 2001a).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Rostratula australis (syn. R. benghalensis)	Australian Painted Snipe (Painted Snipe)	VM	E1	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudlflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No
Stagonopleura guttata	**Diamond Firetail**			**Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers *et al.* 1984; Schodde & Mason 1999). Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range (Garnett & Crowley 2000). Firetails nest in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers *et al.* 1984; Read 1994).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Stictonetta naevosa	Freckled Duck		V	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests (Garnett & Crowley 2000).	**Low**. There is no preferred habitat	No

Tyto novaehollandiae novaehollandiae	**Masked Owl (southern mainland)**		**V**	**Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Mammals						
Aepyprymnus rufescens	Rufous Bettong		V	Distribution: From Cooktown in north Queensland, to north-east NSW, where it occurs east of the Dividing Range. In Queensland, it still occurs on both sides of the Great Divide. Macrohabitat: Found in a variety of forest types from wet sclerophyll to dry open woodland, where grass tussocks or fallen timber are present. Also known to occupy a mosaic of open forest and grasslands. Microhabitat: It appears to prefer a more open forest structure, with an sparse shrub layer and a diverse ground cover. Builds nests in grass tussocks and under logs. Strongly associated with dry sclerophyll forest particularly those dominated by Spotted Gum (NSW National Parks and Wildlife Service 1999f).	**Low**. There is no preferred habitat	No
Cercartetus nanus	Eastern Pygmy-possum		V	Found in a range of habitats from rainforest through sclerophyll forest to tree heath. It feeds largely on the nectar and pollen of banksias, eucalypts and bottlebrushes and sometimes soft fruits. It nests in very small tree holes, between the wood and bark of a tree, abandoned birds' nests and shredded bark in the fork of trees (Turner & Ward 1995).	**Low**. There is no preferred habitat	No
Chalinolobus dwyeri	**Large-eared Pied Bat**	**V**	**V**	**Occurs in moderately wooded habitats, mainly in areas with extensive cliffs and caves and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Churchill 1998; Office of Environment and Heritage 2011). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage 2011). Thought to forage below the forest canopy for small flying insects (Churchill 1998).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Chalinolobus picatus	Little Pied Bat		V	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria and has been recorded in dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and mallee (Churchill 1998; Office of Environment and Heritage 2011). The species roosts and breeds in tree hollows, fissures or cracks, buildings, powerpoles, fenceposts, caves, cliff crevices, mine shafts and tunnels. Roost sites in caves are usually warm and dry but the species can tolerate roost temperatures of more than 40 degrees Celsius (Office of Environment and Heritage 2011).	**Low**. There is no preferred habitat	No
Dasyurus maculatus maculatus	Spotted-Tailed Quoll (Southern Subspecies)	E	V	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999f). Occurs in wide range of forest types, although appears to prefer moist	**Low**. There is no preferred habitat	No

				sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service 1999d, 1999f).		
Macropus dorsalis	Black-striped Wallaby		E1	The preferred habitats for the species is forested country with a dense shrub layer including rainforest margins; Brigalow scrub, particularly in a phase of regrowth; open forest with a thick acacia or other shrub understorey; and lantana thickets (Strahan 1995).	**Low**. There is no preferred habitat	No
Nyctophilus corbeni (syn. N. timoriensis)	**South-eastern Long-eared Bat (Greater Long-eared Bat)**	**V**	**V**	**The species has a limited distribution that is restricted around the Murray-Darling Basin in south-eastern Australia (Turbill & Ellis 2006). It occurs in far eastern South Australia, in areas north of the Murray River (Turbill *et al.* 2008). It occurs in a range of inland woodland vegetation types being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (Dominelli 2000; Ellis *et al.* 1999; Lumsden & Bennett 1995; Parnaby 1995; Turbill & Ellis 2006). Roosting and breeding habitat includes in tree hollows and under loose bark in arid and semi-arid Australia (Strahan 1995) and forages in the understorey of woodlands and open savannah and swamps (Churchill 1998).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Petaurus australis	Yellow-bellied Glider		V	Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999g, 2003c).	**Low**. There is no preferred habitat	No
Petaurus norfolcensis	**Squirrel Glider**		**V**	**The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. In NSW it is found in dry sclerophyll forest and woodland but not found in dense coastal ranges, inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. It is associated with mixed tree species stands with a shrub or Acacia midstorey. It requires abundant tree hollows for refuge and nest sites and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999e).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E1	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used	**Low**. There is no preferred habitat	No

				for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003a).		
Phascogale tapoatafa	Brush-tailed Phascogale		V	Largely arboreal it occurs in a range of habitats which have reliable rainfall (500-2000mm), but has preference for open dry sclerophyll forest on ridges (up to 600 m alt) with little/sparse ground cover. It nests in tree hollows and feeds at dusk on arthropods and small vertebrates (Strahan 1995).	**Low**. There is no preferred habitat	No
Phascolarctos cinereus	**Koala (NSW, ACT & QLD - excluding SE QLD)**	**V**	**V**	**Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata, Monkey Gum E. cypellocarpa and Ribbon Gum E. viminalis. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured (NSW National Parks and Wildlife Service 1999b, 2003b). Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW TSC Act.**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Pseudomys pilligaensis	Pilliga Mouse	V	V	Restricted to unique habitat known as Pilliga scrub, which occurs on deep, low nutrient sand in the Pilliga region of NSW (south of Narrabri). Specifically, Pilliga mouse has been found in areas dominated by broombush, or with Acacia burrowii shrub layer and Corymbia trachyphloia overstory. Both of these habitats had relatively high species richness with moist groundcover and medium to high shrub cover. An additional habitat for the Pilliga Mouse is recently burnt moist gullies with high cover of low grasses and sedges, yet low cover of shrubs (Department of Environment and Climate Change 2007).	**Low**. There is no preferred habitat	No
Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**		**V**	**This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders (Churchill 2008).**	**Moderate. Suitable habitats are available for this species.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in Appendix E**
Sminthopsis macroura	Stripe-faced Dunnart		V	The species are found in many habitats in the arid and semi-arid parts of Australia; they occur in low shrublands of saltbush and bluebush, in tussock grasslands on clay, sandy or stony soils, among sparse shrublands and on low, shrubby, rocky ridges. Dense populations occur in tussock grasslands. The species shelters in cracks in the soil or under rocks and logs, probably in nests (Strahan 1995).	**Low**. There is no preferred habitat	No

Vespadelus troughtoni	Eastern Cave Bat		V	A cave-dwelling species found in eastern Australia from Cape York to NSW. They inhabit tropical mixed woodland and wet sclerophyll forests on the coast and the dividing range, but extend into drier forests on the western slopes (Churchill 1998). Breeding habitat includes caves, rocky outcrops, cliffs, scarps and old mine workings. Roosting habitat includes breeding habitat types and very small crevices in rocky areas or boulder piles or old mine workings and Fairy martin nests. Foraging habitat includes suitable native vegetation within 5km of breeding habitat (Office of Environment and Heritage 2011).	**Low**. There is no preferred habitat	No
Reptiles						
Aprasia parapulchella	Pink-tailed Worm Lizard (syn. Pink-tailed Legless Lizard)	V	V	This lizard is known from four sites in eastern Australia: near Canberra in the ACT, Tarcutta and Bathurst in NSW, and near Bendigo in Vic. In general, lizards occur in open grassland habitats that have a substantial cover of small rocks (Osbourne & Jones 1995). Lizards also show a preference for sunny aspects, avoiding S facing slopes. Some specimens have been collected from grassland sites that appear not to support any native grasses and several animals have been found on the edge of Callitris enlicheri woodland and Eucalyptus macrorhyncha woodland (Barrer 1992). A burrowing species, it is usually found under rocks on well-drained soil and in ant nests, occasionally with several individuals found under the same rock (Swan *et al.* 2004).	**Low**. There is no preferred habitat	No
Hoplocephalus bitorquatus	**Pale-headed Snake**		**V**	**A partly arboreal, nocturnal species found in a range of habitats from rainforest and wet sclerophyll forest to the drier eucalypt forests of the western slopes. Feeds largely on frogs and lizards (Cogger 2000).**	**Moderate. Suitable habitats are available for this species, in the woodland vegetation and in the form of hollow-bearing trees.**	**Yes – as potential habitat was recorded an impact assessment has been undertaken in App**
Underwoodisaurus sphyrurus	Border Thick-tailed Gecko	V	V	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. It is found on rocky hills with dry open eucalypt forest or woodland. It favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter (Department of Environment and Conservation 2005b; NSW National Parks and Wildlife Service 2002b; Royal Botanic Gardens 2005).	**Low**. There is no preferred habitat	No

Note:

1: V = Vulnerable, E = Endangered, M = Migratory as listed on the *Environment Protection and Biodiversity Conservation Act 1999*.

2: V = Vulnerable, E1 = Endangered, E2 = Endangered Population as listed on the *Threatened Species Conservation Act 1995*.

3: Likelihood of occurrence is based on field surveys and database searches. Any species with a likelihood of occurrence of moderate or greater has been asses for significance impact assessments.

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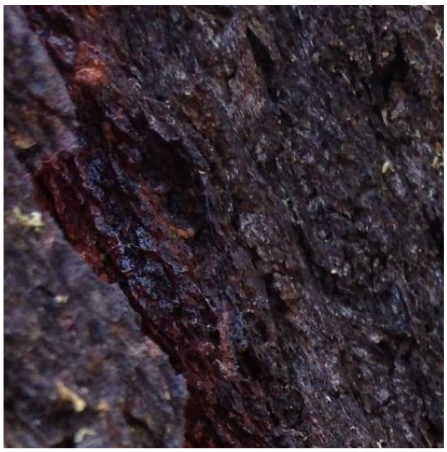

Appendix E

Significance assessments

Appendix E

Significance assessments

Significance assessments

Idemitsu Boggabri Coal Pty Limited (Boggabri Coal) is applying for a S75W Modification to its current approval PA 09_0182. Approval is being sought for the following amendments to the infrastructure layout and design (proposed Modification):

- Construction of permanent mine access from the Kamilaroi Highway.
- Temporary storage of processed mine overburden material at the existing Rock Quarry and the reuse of this material during the construction of the rail spur embankments; and
- Reuse of the existing Daisymede laydown compound.

Section 5A of the EP&A Act requires that a 7 part test is undertaken to assess the likelihood of significant impact upon threat-listed species, populations or ecological communities under the *Threatened Species Conservation Act 1995* (TSC Act 1995) (Department of Environment and Climate Change 2007).

For threat-listed biodiversity under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) significance assessments have been completed in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines 1.1* (Department of the Environment Water Heritage and the Arts 2009). Species listed under both the TSC Act and the EPBC Act have been assessed using both assessment guidelines separately.

The following assessments were undertaken to consider impacts of works associated with the proposed Modification upon species, populations or communities with a moderate or greater likelihood of occurring within the Modification Study Area. In total the Modification requires 14.00 ha of native vegetation clearing, including13.4ha within the Project Boundary Modification, which are areas outside the previously approved Project Boundary.

While no threat-listed species of plant or animal were recorded during the site inspections, the Modification Study Area contained one-threat listed ecological community (Box-Gum Woodland) and potential habitat for three threat-listed species of plant and 24 species of animal.

Contents

1. Box-Gum Woodland

Status

White Box-Yellow Box-Blakely's-Red Gum grassy woodlands and derived native grasslands is an ecological community listed as critically endangered under the *EPBC Act 1999* and White Box-Yellow Box-Blakely's-Red Gum woodland is listed as an Endangered Ecological Community (EEC) under the *TSC Act 1995.*

Two vegetation communities occurring within the Modification Study Area, White Box – White Cypress Pine Grassy woodland, White Box – White Cypress Pine grassy Woodland (low condition), have been identified as being commensurate with the NSW listing of Box-gum woodlands and would be directly affected by the proposed Modification. As the understorey is not predominantly native and there are fewer than 12 native species, the community fails to meet the federal listing criteria.

Distribution, habitat and ecology

This community occurs along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria (Threatened Species Scientific Committee 2006). The community is generally found on moderate to highly fertile soils on tablelands and the western slopes of NSW (NSW Scientific Committee 2002).

This community canopy layer is dominated by one or more of *Eucalyptus albens* (White Box) *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Vegetation communities where the canopy layer of the aforementioned eucalypts has been removed and the grassy native understorey is present are also considered to be included as the Threatened community in both the federal and state listings. Therefore the structure of this community can be variable from grassy woodland to derived grasslands and the structure will often be a result of past land use practices. In western NSW the community intergrades with *Eucalyptus microcarpa* (Western Grey Box) or *Eucalyptus moluccana* (Grey Box) without the three aforementioned canopy trees present. The federal listing includes these vegetation assemblages as part of the Critically Endangered Community, where they occur within the Nandewar Bioregion only. The dominant understorey species of herbs and grasses vary across the range of the community due to latitudinal and climatic conditions. However, *Themeda australis* (Kangaroo Grass) and *Poa sieberiana* (Snow Grass) were originally dominant across a large part of the community's range, but these species are sensitive to grazing pressure and have declined in recent years (Cole & Lunt 2005).

Threats

Threats for this EEC include (Office of Environment and Heritage 2012):

- clearing, degradation and fragmentation of remnants for agriculture, forestry, infrastructure and residential development
- heavy grazing and trampling by grazing stock
- invasion of remnants by non-native plant and animal species
- disturbance and clearance during road, rail and infrastructure maintenance and upgrades

- collection or harvesting of woody-debris for firewood or ‘clean-up’.

Specific impacts

During field surveys associated with the proposed Modification, vegetation was identified within the Modification Study Area which is commensurate with the White Box-Yellow Box-Blakely’s-Red Gum grassy woodlands EEC.

Vegetation communities commensurate with the TSC Act listed EEC, which are present within the Modification Study Area, are:

- Yellow Box – Blakely's Red Gum grassy woodland.
- White Box Grassy Woodland (Low Condition).
- White Box White Cypress Pine grassy woodland.

In total, 14.4 ha of this community will be removed or modified as part of the proposed Modification. Whilst this is a small area in comparison to the area of this community mapped in the Leard State Forest (3,214 ha), and alone is not considered a significant impact, the BCEP as a whole will impact upon 628.3 ha of this EEC and this is considered a significant impact as reported in Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010).

1.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

The proposed Modification will result in a reduction in the overall extent of Box-Gum woodland by 2.8 ha. A further area may be affected by indirect edge effects. This is in addition to the 628.3 ha to be removed for the mine expansion and rail corridor works for the BCEP.

The cumulative impact on extent from the proposed Modification and the associated Boggabri Coal Expansion Project (BCEP) is considered significant as reported in Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010b), but unlikely to place the local occurrence at risk of extinction, as a large area of important Box-gum Woodland will remain in Leard State Forest. Previous studies have mapped approximately 3,214 ha of this community within the Leard State Forest.

The proposed Modification is not considered significant and is unlikely to place a local occurrence at risk of extinction.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

It is unlikely that the composition will be substantially or adversely modified as a result of the proposed Modification. Management and mitigation measures outlined in the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff 2010b), if adhered to, should minimise any impacts to abiotic characteristics that affect composition.

Connectivity will remain relatively unchanged within the locality - continuing current genetic flow and dispersal mechanisms.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

Approximately 2.8 ha of this EEC would be removed or modified. This is in addition to the area being removed for the mine expansion (BCEP). Previous studies have mapped approximately 3,214 ha of this community within the Leard State Forest, adjacent to the proposed Modification.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Box-gum Woodlands EEC is highly fragmented across its former extent. Patches of Box-gum woodland, such as that in the Modification Study Area, are important in maintaining linkages for both flora and fauna movement and genetic exchange across modified landscapes (Gibbons & Boak 2002).

Whilst the proposed removal of 2.8 ha will reduce the occupancy area of the EEC it is unlikely to contribute significantly to the fragmentation currently experienced by the EEC. This is because the areas to be removed are largely on the edge of larger stands of bushland.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposed Modification will remove 2.8 ha of low condition EEC and is considered unlikely to cause significant fragmentation or isolation. This habitat is not considered to be important to the long-term survival of the EEC in the locality with 3,214 ha remaining within the Leard State Forest of equal or greater value.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The Office of Environment and Heritage maintains a register of critical habitat. The land within the subject site is not listed as a critical habitat and it is not considered to be critical to the survival of Box-gum Woodlands.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has not been prepared for Box-Gum Woodland; however, recovery actions have been identified by Office of Environment and Heritage. The proposed Modification will not interfere significantly with any of the identified recovery actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification constitutes key threatening processes: clearing on native vegetation and loss of hollow-bearing trees. It may also encourage the invasion of native plant communities by exotic perennial grasses. The proposed Modification has been designed to avoid existing trees and stands of vegetation, existing trees will be retained, were possible.

Conclusion

The proposed Modification will result in the clearing of 2.8 ha of low condition Box-gum Grassy Woodland EEC. A large, important stand of 3,214 ha will remain in the locality within Leard State Forest. Whilst the overall occupancy area will be reduced, it is unlikely that removal of this small patch will contribute significantly to fragmentation or modify the composition so that the EEC is placed at risk of extinction. It will however, add incrementally to loss of this EEC.

2. *Digitaria porrecta*

Status

Digitaria porrecta (Finger Panic Grass) is listed as Endangered under the *EPBC Act 1999* and Endangered under the *TSC Act 1995*.

Description

The species has grey leaves which are 2-3 mm wide with sharp hairs along the middle of the leaf blade. Flowers are clustered together along a stalk in a cylinder shape (Department of Environment and Climate Change 2009). Flowering occurs in summer (Jan-Feb), inflorescences are exerted with racemes stiffly spreading at maturity, the lower flowers arranged whorls of four to six (Wheeler *et al.* 2002).

Distribution, habitat and ecology

Digitaria porrecta populations occur on the North Western Slopes and Plains from near Moree south to Tambar Springs and from Tamworth to Coonabarabran in NSW (Department of Environment Water Heritage and the Arts 2008a) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Office of Environment and Heritage 2011).

Most frequency recorded associated with over storey trees such as *Eucalyptus albens* and *Acacia pendula.* Common associated understorey species include *Austrostipa aristiglumis, Enteropogon acicularis, Cyperus bifax, Hibiscus tronum* and *Neptuna gracilis.*

Threats

Threats include grazing, urban expansion, clearing of native habitat for cropping and pastures, destruction and disturbance of habitat for roadside maintenance, competition from introduced grasses such as *Chloris gayana* (Rhodes Grass) and *Urochloa panicoides* (Liverseed Grass) and frequent fires (Department of Environment Water Heritage and the Arts 2008a).

Specific impacts

No *Digitaria porrecta* was located during surveys, however habitat for *Digitaria porrecta* within the Modification Study Area was identified in the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

A total of 14.0 ha of potential habitat will be removed as a result of the proposed Modification.

2.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The lifecycle of *Digitaria porrecta* within the Modification Study Area is unlikely to be affected by the proposed Modification. While the pollination mechanisms of *Digitaria porrecta* have not been identified, like other stoloniferous or rhizomatous grasses, it is likely to be reliant on wind pollination for cross or self-pollination and asexual (vegetative) reproduction. The species small, light seeds are also likely to be dispersed by wind or by attachment to fauna. As the proposed Modification is unlikely to affect wind conditions in the area, or greatly affect the distance between individuals, it is considered unlikely to result in the loss of pollinators or disruption of seed dispersal mechanisms.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

Digitaria porrecta is a tufted grass that occurs on rich soils of basaltic geologies within grassy woodlands and grassland communities (Department of Environment and Climate Change 2009). The proposed Modification will remove 14.0 ha of potential habitat for this species. This is in addition to the 651.6 ha of vegetation being removed by the BCEP. This is not considered a significant proportion of the habitat available within the region.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. Reproduction of *Digitaria porrecta*, like many other grasses, is likely to involve a combination of vegetative reproduction and cross or self-pollination. Pollination vectors are unknown for this species, but other species of *Digitaria* utilise wind pollination. The species is most likely to rely on a combination of wind dispersal and attachment to fauna for seed dispersal. As these processes are unlikely to be significantly affected by the proposed Modification it is considered that habitat connectivity for *Digitaria porrecta* in the wider region would not be significantly affected.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

14.0 Ha of native grassland and grassy woodland will be removed as a result of the proposed Modification, resulting in a small incremental loss of potential *Digitaria porrecta* habitat. This habitat is not considered to be important in terms of the long-term survival of the species due to the extent of similar or greater quality habitat in the surrounding landscape.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species. The habitat within the boundaries of the proposed Modification is not considered to be critical to the survival of this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for *Digitaria porrecta*, however, priority actions for the recovery of this species have been identified by Office of Environment and Heritage (Department of Environment Water Heritage and the Arts 2008). The proposed Modification will not interfere with any of the identified recovery actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification will directly involve one Key Threatening Process for this species: clearing of native vegetation. Invasion of habitat by exotic perennial grasses may also occur unless weed control measures are implemented during construction.

Conclusion

No *Digitaria porrecta* were observed during site inspections, however 14.0 ha of potential habitat was identified in the following vegetation communities:

- Pilliga Box - Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

The proposed Modification is unlikely to have an adverse effect on the lifecycle of a viable local population so that *Digitaria porrecta* is placed at risk of extinction. The proposed Modification is unlikely to affect pollination or seed dispersal mechanisms, because the areas to be removed are largely on the edge of larger stands of bushland and as such the edge effect and barrier effects will not be significantly altered from current regimes. The importance of the habitat to be removed by the proposed Modification, in terms of the long-term survival of *Digitaria porrecta* in the locality, is likely to be low. Consequently, a significant impact to *Digitaria porrecta* is considered unlikely to occur as a result of the proposed Modification.

2.2 EPBC Act significance assessment

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following.

Will the action lead to a long-term decrease in the size of a population?

No *Digitaria porrecta* were observed within subject site. Any potential populations is unlikely to decrease in size over the long-term as a result of the proposed Modification because of the minimal disturbance (14.0 ha) and the extent of similar or greater quality habitat in the surrounding landscape.

Will the action reduce the area of occupancy the species?

Approximately 14.0ha of potential habitat for *Digitaria porrecta* would be affected by the proposed Modification. As the vegetation to be cleared is relatively small in terms of the extent of similar or greater quality habitat available in the surrounding landscape, the proposed Modification will not significantly reduce the area of occupancy for the species.

Will the action fragment an existing population into two or more populations?

No *Digitaria porrecta* population or individuals were identified within the Modification Study Area. Further, the proposed Modification would not fragment an existing population into two or more populations. Existing potential habitat is fragmented as a consequence of existing land use practices, therefore the proposed Modification is not expected to increase fragmentation or isolation.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat has been listed for the species under the EPBC Act. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

The potential habitat affected as a result of the proposed Modification is unlikely to be important for the long-term survival of *Digitaria porrecta*, important for genetic diversity, or important for re-introductions as this patch of habitat is small and generally low condition.

Will the action disrupt the breeding cycle of a population?

Reproduction of *Digitaria porrecta*, like many other grasses, is likely to involve a combination of vegetative reproduction and cross or self-pollination. Pollination vectors are unknown for this species, but other species of *Digitaria* are known to utilise wind pollination. *Digitaria porrecta* most likely relies on a combination of wind dispersal and attachment to fauna for seed dispersal. As these processes is unlikely to be significantly affected by the proposed Modification it is conceded that the breeding cycle for *Digitaria porrecta* population would not be significantly affected.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposed Modification will impact 14.0 ha of habitat for *Digitaria porrecta* via the direct removal of suitable habitat. However, this does not constitute a significant proportion of the habitat available within the region, and as such is unlikely to result in a decline in the species.

Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The area of potential habitat which surrounds the proposed Modification is already disturbed from past land use practices and exotic species invasion; weeds occur commonly throughout all vegetative communities in the Modification Study Area. The proposed Modification is unlikely to significantly increase the spread of existing invasive species or contribute to the introduction of new species that are harmful to *Digitaria porrecta,* particularly if appropriate weed control management plans are implemented, impacts to potential habitat or any populations that are potentially present can be minimised.

Will the action introduce disease that may cause the species to decline?

There are no diseases known to affect this species and the proposed Modification is unlikely to introduce plant pathogens to the area.

Will the action interfere with the recovery of the species?

A recovery plan has not been prepared for the species, however, recovery actions have been identified by Office of Environment and Heritage. The proposed Modification will not interfere significantly with any of the identified recovery actions.

Conclusion

The proposed Modification will require the removal of 14.0 ha of potential habitat identified in the following vegetation communities present within the Modification Study Area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

Based on the relatively small area of habitat, this species is unlikely to be significantly affected by the proposed Modification. Overall, the potential impact from the proposed Modification on the species is not considered significant.

3. *Diuris tricolor*

Status

Diuris tricolor (Pine Donkey Orchid) is listed as Vulnerable under the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999.*

Distribution, habitat and ecology

Diuris tricolor (formerly known as Diuris sheaffiana) is a terrestrial species (it grows from the ground rather than from rocks or vegetation).

Diuris tricolor grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta,* Ironbark and Acacia Shrubland (Jones 2006). The understorey is often grassy with herbaceous plants such as *Bulbine* species. Flowers from September to November or generally spring (Jones 2006).

Threats

Threats for this species include habitat clearing and Modification, difficulty of detection due to short flowering period, impacts by feral animals, and competition from weed species (OEH 2012).

Specific impacts

No *Diuris tricolor* was observed during survey in May 2013, however this is outside of the flowering period, between September and November, and as such the species is unlikely to have been detected even if present.

No *Diuris tricolor* was located during surveys, however habitat for *Diuris tricolor* within the Modification Study Area was identified in the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

A total of 14.0 ha of potential habitat will be removed as a result of the proposed Modification.

3.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Diurus tricolor (Pine Donkey Orchid) is likely to be pollinated through a process called pseudocopulation (Jones 1988). The glands on the perianth segments are a source of the sexual attractants for the pollinators, male thynnine wasps are drawn to the flowers by scent mimicking the female thynnine wasp pheromone. Once in sight of the flower, the male attempts to copulate with the labellum of the flower, mistaking it for a female wasp, and effects pollination. Habitat for these pollinators is vital for the continuation of the life cycle of this cryptic orchid. Removal of 14.0 ha of potential habitat is unlikely to have a significant impact to these processes considering the areas to be removed are largely on the edge of larger stands of bushland, reducing the in areas already impacted by edge effect and weed invasion.

The lifecycle of *Diurus tricolor* within the Modification Study Area is unlikely to be significantly impacted.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed Modification will remove 14.0 ha of potential habitat. This is in addition to the 628.3 ha of vegetation being removed by the BCEP. As a large area of potential habitat remains in the locality, this is not considered a significant proportion of the habitat available within the region.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. As previously mentioned the proposed Modification is unlikely to affect the mechanisms by which this species cross-pollinates or disperses.

The removal of 14.0 ha of potential habitat is unlikely to further fragment the population significantly.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Due to the small size and relatively degraded nature of the habitat to be removed, it is not considered to be important to the long-term survival to either of the species in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species. Nor is the habitat present considered critical to the survival of the species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for *Diuris tricolor*, However, ten priority actions for the recovery of this species have been identified by Office of Environment and Heritage. The proposed Modification will not interfere with any of the identified recovery actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification involves the clearing of native vegetation, a known threating process for this species. As the area proposed to be removed is small (14.0 ha) and of limited quality it is not considered to significantly contribute to this key threatening process. It will however add incrementally to the process.

Conclusion

Approximately 14.0 ha of potential habitat will be removed by the proposed Modification. This includes the following vegetation communities identified within the Modification Study Area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

It is unlikely that removal of this small amount of habitat would have a significant impact upon the species, however it contributes to the cumulative removal of known habitat for the BCEP proposed Modification.

3.2 EPBC Act significance assessment

Diuris tricolor is listed as a Vulnerable under the *EPBC Act 1999*. The following assessment has been undertaken following the *Principal Significant Impact Guidelines 1.1* (Department of the Environment and Heritage 2006). Under the *EPBC Act 1999*, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

If present, the population of *Diuris tricolour* within the boundaries of the proposed Modification would not be considered an important population. As any population, if present, would be small in size and not crucial to the maintaining genetic diversity or breeding.

Will the action lead to a long-term decrease in the size of an important population of a species?

Any population, if present, is small in size and not considered to be an important population. The proposed Modification will lead to a decrease in the size of a local population, but this decrease would not be significant nor lead to a long term decrease in the size of an important population.

Will the action reduce the area of occupancy of an important population?

The proposed Modification would reduce the area of occupancy for a local population of *Diuris tricolor*. However, this population is not considered to be important nor will the proposed Modification affect a large portion of the area of occupancy for this species.

Will the action fragment an existing important population into two or more populations?

The proposed Modification is not likely to fragment an existing important population into two or more populations.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat has been listed for the *Diuris tricolor* under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006)

The habitat that would be affected as a result of the proposed Modification does not represent habitat critical to the survival of *Diuris tricolor*.

Will the action disrupt the breeding cycle of an important population?

If present, the population of *Diuris tricolor* within the boundaries of the proposed Modification would not be considered an important population. Nevertheless, the fertilisation and dispersal mechanisms are unlikely to be affected by the proposed Modification therefore the breeding cycle is unlikely to be disrupted.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposed Modification will reduce the availability of habitat by 14.0 ha. Removal of habitat to this extent is not considered likely to cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat?

Appropriate weed management actions would mean it would be unlikely that a significant invasive species would be introduced by the proposed Modification.

Will the action introduce disease that may cause the species to decline?

No, there are no known diseases associated with *Diuris tricolor*.

Will the action interfere substantially with the recovery of the species?

As the vegetation within the proposed Modification is not important potential habitat, removal of this area is unlikely to substantially interfere with the recovery of the species.

Conclusion

The potential population of *Diuris tricolor* within the boundaries of the proposed Modification is not considered an important population. Based on the above assessment, the reduction of potential *Diuris tricolor* habitat by 14.0 ha is unlikely to significantly impact upon the species.

4. *Tylophora linearis*

Status

Tylophora linearis is listed as Endangered under the *EPBC Act 1999* and Vulnerable under the *TSC Act 1995*.

Description

The species is an herbaceous climber in the Asclepiadaceae family. This species has cylindrical stems which have clear latex. The leaves are dark green in colour, linear in shape and grow to approximately 100 mm in length and 4 mm in width. Flowers are purplish internally with olive green petals, these flowers cluster in radiating groups of 3 to 8 (Office of Environment and Heritage 2013). Fruits form follicles 95-100 mm in length and 5 mm in width. This species flowers in Spring with flowers being recorded in early winter around May and as late as November. Fruiting occurs approximately two to three months later (Department of Environment Water Heritage and the Arts 2008b).

Distribution, habitat and ecology

Tylophora linearis populations occurs in ten known populations from Southern Queensland into Central NSW and as far south as Temora. This species is known to occur in several state forests including Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil , Hiawatha and Eura State Forests. This species has also been recorded in Coolbaggie Nature Reserve, Goobang National Park and Beni State Conservation Area. Old records for the species are as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs (Office of Environment and Heritage 2013).

This species has been recorded associated with dry scrub, open forest and woodlands. Most frequency recorded associated with over storey trees such as *Melaleuca uncinata, Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens*, *Callistris endlicheri, Callistris glaucophylla, Allocasuarina luemannii, Acacia hakeoides, Acacia lineata* and *Myoporum sp.* This species has been recorded in EPBC Act listed communities of Brigalow (*Acacia harpophylla* dominant and co-dominant) and White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (Department of Environment Water Heritage and the Arts 2008b). The population within the vicinity of the Modification Study Area at Piliga West State Forest occurred within woodland dominated by *Eucalyptus pilliganesis* and *Callitris glaucophylla* with an understorey of *Acacia hakeoides* (NSW Scientific Committee 2008).

Threats

The main identified threats include forestry activities, and fire. Track maintenance and inappropriate disturbance regimes and Invasion of habitat from introduced weeds such as Lantana (Lantana camara) have also been identified as a threat to *Tylophora linearis* (Department of Environment Water Heritage and the Arts 2008b).

Specific impacts

No *Tylophora linearis* individuals were recorded during surveys, however habitat for *Tylophora linearis* within the Modification Study Area was identified in the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

A total of 14.0 ha of potential habitat will be removed as a result of the proposed Modification.

4.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The lifecycle of *Tylophora linearis* within the Modification Study Area is unlikely to be affected by the proposed Modification. While the pollination mechanisms of *Tylophora linearis* have not been identified, like other species of the *Tylophora* genus, it is likely to be insect pollinated. The woodland and grassland communities within the Modification provide habitat for the pollinators of *Tylophora linearis.* The species has plumed seeds which are dispersed by wind (Benson & McDougall 1993). The proposed Modification is unlikely to affect wind conditions in the area, and removal of 14.0 ha of potential habitat for *Tylophora linearis* is unlikely to have a significant impact upon the lifecycle processes.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed Modification will remove 14.0 ha of potential habitat. This is in addition to the vegetation being removed by the BCEP. As a large area of potential habitat

remains in the locality, this is not considered a significant proportion of the habitat available within the region.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Connectivity within a plant population relates to the ability of individuals to disperse and cross pollinate. As previously mentioned the proposed Modification is unlikely to affect the mechanisms by which this species cross-pollinates or disperses.

The removal of 14.0 ha of potential habitat is unlikely to further fragment the population significantly.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Due to the small size and relatively degraded nature of the habitat to be removed, it is not considered to be important to the long-term survival to either of the species in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species. The habitat within the boundaries of the proposed Modification is not considered to be critical to the survival of this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for *Tylophora linearis*, However, 12 priority actions for the recovery of this species have been identified by Office of Environment and Heritage (Office of Environment and Heritage 2013). The proposed Modification will not interfere with any of the identified recovery actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification will directly involve one Key Threatening Process for this species: clearing of native vegetation. Invasion of habitat by exotic perennial grasses may also occur unless weed control measures are implemented during construction.

Conclusion

No *Tylophora linearis* were observed during site inspections, however 14.0 ha of potential habitat was identified in the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

The proposed Modification is unlikely to have an adverse effect on the lifecycle of a viable local population so that *Tylophora linearis* is placed at risk of extinction. The proposed Modification is unlikely to affect pollination or seed dispersal mechanisms, because the areas to be removed are largely on the edge of larger stands of bushland and as such the edge effect and barrier effects will not be significantly altered from current regimes. The importance of the habitat to be removed by the proposed Modification, in terms of the long-term survival of *Tylophora linearis* in the locality, is likely to be low. Consequently, a significant impact to *Tylophora linearis* is considered unlikely to occur as a result of the proposed Modification.

4.2 EPBC Act significance assessment

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following.

Will the action lead to a long-term decrease in the size of a population?

No *Tylophora linearis* were observed within subject site. Any potential populations is unlikely to decrease in size over the long-term as a result of the proposed Modification because of the minimal disturbance (14.0 ha) and the extent of similar or greater quality habitat in the surrounding landscape.

Will the action reduce the area of occupancy the species?

Approximately 14.0 ha of potential habitat for *Tylophora linearis* would be affected by the proposed Modification. As the vegetation to be cleared is relatively small in terms of the extent of similar or greater quality habitat available in the surrounding landscape, the proposed Modification will not significantly reduce the area of occupancy for the species.

Will the action fragment an existing population into two or more populations?

No *Tylophora linearis* population or individuals were identified within the Modification Study Area. Further, the proposed Modification would not fragment an existing population into two or more populations. Existing potential habitat is fragmented as a consequence of existing land use practices, therefore the proposed Modification is not expected to increase fragmentation or isolation.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat has been listed for the species under the EPBC Act. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

The potential habitat affected as a result of the proposed Modification is unlikely to be important for the long-term survival of *Tylophora linearis*, important for genetic diversity, or important for re-introductions as this patch of habitat is small and generally low condition.

Will the action disrupt the breeding cycle of a population?

Pollination vectors are unknown for this species, but other species of *Tylophora* are known to be pollinated by insects (Benson & McDougall 1993). *Tylophora linearis* produces plumed seeds and most likely relies on wind for seed dispersal. As these processes is unlikely to be significantly affected by the proposed Modification it is conceded that the breeding cycle for *Tylophora linearis* population are unlikely to be significantly affected.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposed Modification will impact 14.0 ha of habitat for *Tylophora linearis* via the direct removal of suitable habitat. However, this does not constitute a significant proportion of the habitat available within the region, and as such is unlikely to result in a decline in the species.

Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The area of potential habitat which surrounds the proposed Modification is already disturbed from past land use practices and exotic species invasion; weeds occur commonly throughout all vegetative communities in the Modification Study Area. The proposed Modification is unlikely to significantly increase the spread of existing invasive species or contribute to the introduction of new species that are harmful to *Tylophora linearis.* If appropriate weed control management plans are implemented, impacts to potential habitat or any populations that are potentially present can be minimised.

Will the action introduce disease that may cause the species to decline?

There are no diseases known to affect this species and the proposed Modification is unlikely to introduce plant pathogens to the area.

Will the action interfere with the recovery of the species?

A recovery plan has not been prepared for the species, however, recovery actions have been identified by Office of Environment and Heritage (2013). The proposed Modification will not interfere significantly with any of the identified recovery actions.

Conclusion

The proposed Modification will require the removal of 14.0 ha of potential habitat identified in the following vegetation communities present within the Modification Study Area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

Based on the relatively small area of habitat, this species is unlikely to be significantly affected by the proposed Modification. Overall, the potential impact from the proposed Modification on the species is not considered significant.

5. Threat-listed woodland birds

Threatened woodland birds have been assessed together as they generally share similar habitat requirements, threats that affect their recovery and potential impacts. Woodland species of bird considered in this significance assessment include:

- Brown Treecreeper (*Climacteris picumnus victoriae*).
- Hooded Robin (*Melanodryas cucullata cucullate*).
- Black-chinned Honeyeater (*Melithreptus gularis gularis*).
- Painted Honeyeater (*Grantiella picta*).
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*).
- Speckled Warbler (*Pyrrholaemus sagittatus*).
- Diamond Firetail (*Stagonopleura guttata*).
- Varied Sittella (*Daphoenositta chrysoptera*).

Status

All eight species are part of a group of woodland birds considered to be declining within Australia (Reid 1999; Trail & Duncan 2000) and all are listed as Vulnerable under the TSC Act.

Threats

Threats that affect these species include clearing of woodland resulting in loss and fragmentation of habitat; Modification and destruction of ground habitat through heavy grazing and compaction by stock; removal of litter and fallen timber; introduction of exotic pasture grasses; and frequent fire (Department of Environment and Conservation 2006c; Reid 1999; Trail & Duncan 2000).

Specific impacts

No threat-listed woodland birds were observed during the site inspections; however 14.0 ha of potential habitat will be removed as a result of the Modification. This is made up of all the Woodland habitats in the Modification Study Area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

Brown Treecreeper (eastern subspecies) – *Climacteris picumnus victoriae*

Brown Treecreepers occur in eucalypt woodland and adjoining vegetation. Sometimes this species is recorded in semi-cleared pasture; in grasslands scattered with trees in cleared paddocks outside woodlands or in shelterbelts fringing cleared lands (Higgins & Peter 2002). It is sedentary and nests in tree hollows (Garnett & Crowley 2000) breeding in pairs or communally in small groups within territories ranging in size up to 11 ha. The nest is a collection of grasses, feathers and other soft material, placed in a suitable tree hollow or similar site (Higgins *et al.* 2001). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Pizzey & Knight 2007).

Hooded Robin - south-eastern form *(Melanodryas cucullata cucullate)*

Hooded Robins occur in lightly wooded country, usually open eucalypt woodland, mallee and acacia shrublands. Movements are not well known, however, they are thought to be resident or sedentary, but may undertake some local movements (Department of Environment and Conservation 2006c), possibly in response to drought and food availability (Pizzey & Knight 1997). Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than one to five metres above the ground (Higgins & Peter 2002).

Black-chinned Honeyeater - eastern subspecies *(Melithreptus gularis gularis)*

This species occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. It also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees (Department of Environment and Conservation 2006c). It is a gregarious species usually seen in pairs and small groups of up to 12 birds (Higgins & Davies 1996). Feeding territories are large, making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least five ha. Nectar is taken from flowers, and honeydew is gleaned from foliage (Higgins & Davies 1996).

Painted Honeyeater *(Grantiella picta)*

Painted Honeyeaters occur in dry forests and woodlands. The primary food is mistletoes in the genus Amyema, although they will take some nectar and insects (Department of Environment and Conservation 2006c). The breeding distribution is dictated by the presence of mistletoes, which are largely restricted to older trees. The species is less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).

Grey-crowned Babbler *(Pomatostomus temporalis temporalis)*

The Grey-crowned Babbler is found mainly in rural districts where it predominantly lives in roadsides and private land (Schulz 1991). Suitable habitats are usually abundant with leaf litter and debris; often dominated by eucalypts including box and ironbark species, partly-cleared woodland, acacia shrubland and adjoining farmland (Higgins 1999). Grey-crowned Babblers is unlikely to occur in regrowth forest, large patches of forest or woodland and forest with dense understorey or grassland with few trees (Schulz 1991).

An understorey of young trees and shrubs, in the 10 to 25 cm diameter at breast height range, is used for nest sites and shelter, and a relatively sparse ground layer with more litter and less ground cover is preferred by the species (Adam & Robinson 1996). Within that broad habitat category, they prefer sites with large trees, a scattered understorey of small trees or shrubs and a sparse ground layer of litter and short grass (Davidson & Robinson 1992). At the local scale, the species is common in edge habitats where there is access to both tree-cover and open ground. Historically this edge habitat would be found near larger trees in mature woodland habitat, but is now largely restricted to roadside vegetation and the edges of remnant patches (Robinson *et al.* 2001). The Grey-crowned Babbler is a prolific nest builder, building nests throughout the year for both breeding and roosting (Counsilman 1979), and defend a territory of approximately 10 ha, however territories up to 50 ha have been recorded.

Speckled Warbler *(Pyrrholaemus sagittatus)*

Speckled Warblers prefers eucalypt dominated vegetation that has a grassy understorey, often on rocky ridges or in gullies (NSW Scientific Committee 2001). The bird is a sedentary species that breeds in pairs and trios, and feeds on seeds and insects on the ground and in understorey vegetation and builds domed nests on the ground in grass tussocks, dense leaf litter and fallen branches (Reid 1999). Speckled Warblers occur at low densities (0.19-0.54 per ha) and have relatively large home ranges of 6-12 ha for pairs or trios of birds (Higgins & Peter 2002).

Diamond Firetail *(Stagonopleura guttata)*

Diamond Firetails are found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. They occur also in open forest, mallee, native grasslands, and in secondary grasslands derived from other communities (Trail & Duncan 2000). They feed exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). They are usually encountered in flocks of between five and 40 birds, with groups separating into small colonies to breed, between August and January (Department of Environment and Conservation 2006c). Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. The species appears to be sedentary, although some populations move locally (Higgins & Peter 2002).

Varied Sittella *(Daphoenositta chrysoptera)*

The Varied Sittella is sedentary and inhabits most of mainland Australia, with a nearly continuous distribution in NSW from the coast to the far west (Higgins & Peter 2002). It inhabits open eucalypt forests and woodlands (particularly rough-barked species), mallee, inland acacia woodland and coastal tea-tree scrubs (Pizzey & Knight 2007).

Varied Sittella are highly social, with groups foraging together, whereby they fly into the heads of trees and generally make their way down limbs and the trunk of the tree. They feed on arthropods, which are gleaned from dead branches, small branches in the canopy and crevices from rough or decorticating bark (NSW Scientific Committee 2009c). This species typically breeds in groups of five to seven individuals during spring and summer, with nests well camouflaged and situated in a fork, high in the living tree canopy. The same fork or tree is often used in successive years. During winter this species forms larger companies.

The threats that affect Varied Sittella include the continued decline in habitat cover and quality (Watson *et al.* 2005). Furthermore, cleared agricultural landscapes potentially act as a barrier to movement and dispersal due the sedentary nature of this species. Thus, survival and population viability is considered sensitive to processes such as reduction in patch size and isolation and simplification of habitat including the removal of canopy cover, logs, fallen branches and litter. Therefore, three Key Threatening Processes listed under the TSC Act affect this species; clearing of native vegetation, loss of hollow-bearing trees and the removal of dead wood and dead trees.

5.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No threatened woodland species of bird were recorded during recent field surveys. Previous field studies associated with Boggabri Coal have recorded all of these species in the locality. It is therefore assumed that approximately 14.0 ha of potential habitat would be affected by the proposed Modification. This habitat provides potential foraging, roosting and breeding resources for the species. This area is a small portion of the available habitats in the area.

Any species located in the proposed Modification Study Area would be considered a small patch of a larger meta-population therefore it is unlikely that the local population would be placed at risk of extinction by the proposed Modification.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

It is estimated that approximately 14.0 ha of potential threat-listed woodland bird habitat would be affected by the proposed Modification. However, this habitat is not considered to be core and similar habitat of equal or greater quality exists in the adjacent landscapes.

Specific habitat features likely to be affected include down timber (used for foraging) and mature trees with mistletoe that is used by Painted Honeyeater which is a specialist forager.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Available threat-listed woodland bird habitat in the locality is considered to be already fragmented, with the exception of Leard State Forest which occurs as a continuous patch of woodland vegetation. It is unlikely that the proposed Modification would contribute significantly to the fragmented state of woodland bird habitat however it would add incrementally to the impacts associated with the BCEP Project.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Due to the small size of the sites, any species within the Modification is as are considered a small proportion of a larger meta-population and are therefore not considered to be important to the long-term survival of the assessed species in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the *Threatened Species Conservation Act 1995*, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species. Habitat occurring adjacent to the Modification Study Area in the remaining Leard State Forest, is considered to represent 'core habitat', particularly for sedentary species including Brown Treecreeper, Hooded Robin, Grey-crowned Babbler, Speckled Warbler, Diamond Firetail and Varied Sittella.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery or threat abatement plans have been prepared for the threat-listed woodland bird species being assessed. The Office of Environment and Heritage has identified a number of priority actions for the recovery of each of these species, except the Varied Sittella. The proposed Modification will not interfere significantly with any of these priority actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to threat-listed woodland bird species, the proposed Modification contributes to one key threatening process – clearing of native vegetation. As the proposed Modification will only make a minor contribution to this threatening process it is considered unlikely to significantly affect species.

Conclusion

No threat-listed woodland bird species were located during field survey during May 2013. In previous studies conducted for Boggabri Coal eight threated woodland species were recorded in the locality, including Brown Treecreeper, Hooded Robin, Black-chinned Honeyeater, Grey-crowned Babbler, Speckled Warbler, Diamond Firetail and Varied Sittella.

It is estimated that 14.0 ha of potential habitat would be affected by the proposed Modification. This is made up of the following vegetation communities within the Modification Study Area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

Similar habitats of equal or greater quality will remain within and surrounding the boundaries of the proposed Modification. Populations, if present, are considered to be small patches of a larger metapopulation. The proposed Modification is unlikely to increase fragmentation. Based on the above assessment, woodland birds are unlikely to be significantly impacted by the proposed Modification, however the impacts add incrementally to those associated with the BCEP Project.

6. Spotted Harrier (*Circus assimilis*)

Status

The Spotted Harrier is listed as a Vulnerable species under the TSC Act.

Distribution, habitat and ecology

The Spotted Harrier is widespread throughout most of the Australian mainland. Individuals disperse widely, with this species being nomadic and irruptive in response to local conditions (food abundance). The Spotted Harrier occupies grassy open woodland, inland riparian woodland and grasslands, but is most commonly associated with native grassland and agricultural environments (NSW Scientific Committee – preliminary determination). This species builds a stick nest in open or remnant woodland and generally breeds from August to December or February to April (Pizzey & Knight 2007). The diet of the Spotted Harrier generally consists of terrestrial mammals (rodents), birds (quail) and reptiles (NSW Scientific Committee 2009b).

Threats

The main threat that affects this species is the clearing and degradation of foraging and breeding habitat, particularly where it affects prey densities. Other threats include the possibility of secondary poisoning from rodenticides and pindone used to control rabbits (NSW Scientific Committee 2009b).

Specific impacts

This species was recorded in agricultural land associated with BCEP during field studies and is frequently observed within and around the Modification Study Area. The proposed Modification would remove 47.6 ha of potential habitat for this species, including all the vegetation communities present in the Modification Study Area.

6.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Spotted Harrier was recorded in agricultural land associated with BCEP during field studies in 2010.

47.6 ha of potential foraging habitat would be affected by the proposed Modification, adding to the 365.4 ha area being affected by BCEP. This area is considered to be potential foraging habitat.

This species is more commonly associated with native grasslands and agricultural landscapes, where they hunt low over the ground searching for prey. While the proposed Modification would affect 47.6 ha of potential foraging habitat, similar habitat would remain in the area. This area is considered known foraging habitat due to sightings during previous field surveys.

While the proposed Modification would remove foraging and potential nesting habitat, it is not likely that the lifecycle of this species would be affected. Potential nesting and foraging habitats would remain in the locality post-development. The mobility of the species would not restrict breeding mechanisms and allow dispersal to similar, higher quality habitat in the locality.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

47.6 ha of known foraging habitat (grassland and agricultural crops, similar to where this species was recorded during previous studies) would be affected by the proposed Modification. This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. Similar habitats would remain in the locality post-development.

The associated BCEP could potentially create new habitat for this species at the completion of mining activities when the subject site (particularly the open cut pit) is likely to be rehabilitated.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Spotted Harrier is widespread throughout most of the Australian mainland, except in densely forest or wooded habitats of the coast. While this species is widespread, individuals are sparsely distributed, with this species being nomadic and irruptive in response to local conditions. The ability for the Spotted Harrier to access adjacent habitat would remain. As such, it is unlikely that the proposed Modification will fragment or isolate the Spotted Harrier habitat to individuals or a local population's detriment. However, it would reduce the overall extent of known habitat to a small degree and further exacerbate key threatening processes for these species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. Extensive areas of similar habitats would remain in the locality post-development.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species due to its listing as a Vulnerable species.

The areas proposed for the works are not considered to be critical to the survival of this species due to their small size.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for the Spotted Harrier. No recovery actions have been identified by the Office of Environment and Heritage.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification would involve a small amount of clearing of native vegetation, which is a known threatening process for this species. Whilst extensive areas of similar habitats would remain in the locality post-development, the proposed Modification would contribute to the threatening process.

Conclusion

This species was not observed during field survey for the proposed Modification, however, the Spotted Harrier was recorded foraging over grassland and agricultural crops during surveys for the BCEP Project and is frequently observed within the grasslands within and directly adjoining the Modification Study Area. 47.6 ha of potential foraging habitat would be affected by the proposed Modification. The area affected is not considered to represent core habitat for this species.

As this species is likely to exist in similar agricultural environments and remnant vegetation in the locality, it is not likely that this species would be significantly affected by the proposed Modification.

7. Little Lorikeet (*Glossopsitta pusilla*)

Status

The Little Lorikeet is listed as a Vulnerable species under the TSC Act 1995.

Distribution and habitat

The Little Lorikeet inhabits forests and woodlands, with most associations occurring in dry, open eucalypt forest and woodlands (Office of Environment and Heritage 2011b).

Threats

Key threats to this species include:

- Extensive clearing of woodlands for agriculture. Small scale clearing, such as during road works and fence construction, continues to destroy habitat and it will be decades before revegetated areas supply adequate forage sites.
- The loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species that need large hollows with small entrances to avoid predation. Felling of hollow trees for firewood collection or other human demands increases this competition.
- Competition with the introduced Honeybee for both nectar and hollows exacerbates these resource limitations.

Specific impacts

No little lorikeet specimens were recorded during field surveys in May 2013. The species is considered to have a moderate likelihood of occurring in the areas of the proposed Modification. The proposed Modification will remove 14 ha of potential habitat for this species including all the Box Gum woodlands and woodland containing White Box or Poplar Box. Vegetation communities within the Modification Study area which are considered potential habitat for this species are;

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

No little lorikeet was located during surveys, however habitat for little lorikeet was identified within the woodlands within the Modification Study Area.

A total of 14 ha of potential habitat will be removed as a result of the proposed Modification.

7.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Little Lorikeet is dependent on flowering resources across a wide range of habitats (woodlands and forests).

Breeding and nesting occurs from May – September close to feed areas and typically in riparian areas (OEH 2012).

As the impact area is 14 ha it is unlikely that the lifecycle of this opportunistic species would be significantly affected, particularly considering that approximately 6,750 ha remnant vegetation (Leard State Forest) would remain in the areas adjacent to the proposed Modification.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

It is estimated that 14 ha of potential foraging habitat for the assessed species will be affected by the proposed Modification, which will increase the total area impacted upon by the BCEP. Given the mobility of this species, it is not considered to be significant in terms of the available (potential) habitat in the wider locality.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

As the Little Lorikeet is dependent on flowering resources across a wide range of already fragmented habitat, it is unlikely that the removal of 14 ha of native vegetation will significantly affect these species. The likelihood of isolation is also low due to their mobility.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. Similar habitats would remain in the locality post-development.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land crucial to the survival of particular threatened species, population or ecological community. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species.

Due its high mobility, the Little Lorikeet is capable of accessing off-site habitat resources. Therefore the habitat that is present is not considered to be critical to the survival of the species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

There are no recovery threat abatement plans or priority actions prepared for the Little Lorikeet.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Little Lorikeet, the proposed Modification contributes to one key threatening process – clearing of native vegetation. As the proposed Modification will only make a minor contribution to this threatening process it is considered unlikely to significantly affect species.

Conclusion

Within the survey area potential foraging resources were located in the following vegetation communities within the Modification Study Area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

14 ha of potential habitat for the little lorikeet would be affected by the proposed Modification, which will increase the total area, impacted upon by BCEP (365.4 Ha). However, given the species high mobility and ability to access adjacent remnant woodland in the locality and region, it is not likely that this species would be significantly affected by the proposed Modification. Although it would further exacerbate key threatening processes that affect this species.

8. Swift Parrot *(Lathamus discolour)*

Status

The Swift Parrot is listed as Endangered under the TSC Act 1995 and the EPBC Act 1999.

Distribution and habitat

Breeding occurs in Tasmania, migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW.

In mainland Australia the species is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering *Acacia pycnantha,* is indicated. Sites used vary from year to year (Garnett & Crowley 2000),(Swift Parrot Recovery Team 2001).

Threats

Key threats to this species include:

- On the mainland the main threat is loss of habitat through clearing for agriculture, and urban and industrial development.
- Collisions with wire netting fences, windows and cars, during the breeding season and winter migration (especially where such obstacles are in close proximity to suitable habitat).

Specific impacts

No Swift Parrot specimens were recorded during field surveys in May 2013. The species is considered to have a moderate likelihood of occurring in the areas of the proposed Modification. The proposed Modification will remove 14 ha of potential woodland habitat for this species including the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

8.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Swift Parrot is an opportunistic blossom nomad dependent on flowering resources across a wide range of habitats (woodlands and forests). The removal of 14 ha of habitat containing suitable foraging trees for these species is highly unlikely to disrupt their lifecycle. Approximately 6,750 ha remnant vegetation (Leard State Forest) would remain adjacent to the proposed Modification.

Breeding events for the Swift Parrot occur during summer in Tasmania so no critical breeding habitat will be affected by the proposed Modification. It is therefore considered that the proposed Modification is not likely to affect the lifecycle of this species.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

It is assumed that approximately 14 ha of potential foraging habitat for the assessed species will be affected by the proposed Modification, which will increase the total area impacted upon by the BCEP. Given the mobility of this species, it is not considered to be significant in terms of the available (potential) habitat in the wider locality.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

As the Swift Parrot is dependent on flowering resources across a wide range of already fragmented habitat, it is unlikely that the removal of 14 ha of native vegetation will significantly affect these species. The likelihood of isolation is also low due to their mobility.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. Similar habitats would remain in the locality post-development.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, population or ecological community. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species.

As previously mentioned, due its high mobility, these species are capable of accessing off site habitat resources. Moreover, Swift Parrots breed in spring/ summer in Tasmania and as such, no breeding habitat would be affected by the proposed Modification. It is therefore considered that the proposed Modification will not have an adverse effect on critical habitat.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

There is neither a recovery nor threat abatement plan for the Swift Parrot. The Office of Environment and Heritage has however identified 14 priority actions owing to the small extent of potential habitat to be removed (14 ha), the proposed Modification is not considered inconsistent with any identified priority action statements or recovery measures.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Swift Parrot the proposed Modification contributes to one key threatening process – clearing of native vegetation. As the proposed Modification will only make a minor contribution to this threatening process it is considered unlikely to significantly affect this species.

Conclusion

Potential foraging resources were located in the Modification Study Area within the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine grassy woodland.

It is estimated that 14 ha of potential winter foraging habitat for the Swift Parrot would be affected by the proposed Modification, which will increase the total area, impacted upon by BCEP. However, given the species high mobility and ability to access adjacent remnant habitat in the locality and region, it is not likely that this species would be significantly affected by the proposed Modification. However, it would further exacerbate key threatening processes that affect this species.

8.2 EPBC Act significance assessment

The Swift Parrot is listed as Endangered under the EPBC Act.

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following.

Lead to a long-term decrease in the size of a population

Potential foraging habitat for this species exists in the Modification Study Area, however the extent proposed to be removed represents a very small proportion of available habitat in the locality. As Swift Parrots breed in Tasmania and given the high mobility of this species, no breeding resources would be affected by the proposed Modification. Therefore, it is considered unlikely that the proposed Modification would lead to a long-term decrease in this species.

Reduce the area of occupancy of the species

The proposed Modification will remove 14 ha of foraging habitat for this species. This area is relatively small in terms of the extent of similar or greater quality habitat available in the Modification Study Area and surrounding landscape.

Fragment an existing population into two or more populations

Owing to the mobility of this species, the proposed Modification is unlikely to fragment any populations potentially present.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for this species. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment Water Heritage and the Arts 2009).

The proposed Modification would remove 14 ha of suitable winter foraging habitat. As this species is highly mobile, it is likely that the abundance of higher quality foraging resources in the locality would be used by locally occurring Swift Parrots. As such the habitat within the Modification Study Area is not considered to be critical to the survival of the species.

Disrupt the breeding cycle of a population

Swift Parrots breed in Tasmania during spring and summer, migrating to south-eastern Australia during autumn and winter (Department of Environment and Conservation 2006c). While Swift Parrots are dependent on flowering resources across a wide range of habitats (woodlands and forests) within their NSW wintering grounds, the removal of 14 ha of suitable habitat is not likely to disrupt their migratory patterns. As such, the proposed Modification is not likely to affect their breeding cycle.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed Modification will remove 14 ha of potential foraging habitat for this species. This area of potential habitat is relatively small in terms of the extent of similar or greater quality habitat within the surrounding landscape. As such, it is unlikely that the proposed Modification would cause the Swift Parrot to decline.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Swift Parrot would become further established as a result of the proposed Modification.

Introduce disease that may cause the species to decline, or

It is not likely that disease would be increased by the proposed Modification.

Interfere with the recovery of the species.

The *Action Plan for Australian Birds* (Garnett & Crowley 2000) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Specific objectives of the Swift Parrot Recovery Plan (Swift Parrot Recovery Team 2001) include:

- identify priority habitats and sites across the range of the Swift Parrot
- implement management strategies to protect and improve priority habitats and sites resulting in a sustained improvement in carrying capacity
- reduce the incidence of collisions with man-made structures
- determine population trends within the breeding range
- quantify improvements in carrying capacity by monitoring changes in extent and quality of habitat
- increase public awareness about the recovery program and to involve the community in the recovery.

Owing to the small extent of potential habitat to be removed and its location outside of listed priority habitats, it is considered that the proposed Modification will not interfere substantially with the recovery of the Swift Parrot.

Conclusion

Potential habitat for the Swift Parrot was present within the Modification Study Area within the following vegetation communities:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

This species is considered to have a moderate-high likelihood of occurrence within the Modification Study Area. The proposed Modification would remove 14 ha of potential habitat for the Swift Parrot, which represents a small proportion of available habitat in the locality. Owing to the mobility of the species and small extent of potential habitat to be removed, the proposed Modification is unlikely to significantly impact upon this species or interfere with its recovery.

9. Regent Honeyeater (*Xanthomyza phrygia*)

Status

The Regent Honeyeater is listed as Endangered and Migratory under the *EPBC Act 1999* and Critically Endangered under the *TSC Act 1995*. Under the *Environment Protection and Biodiversity Conservation Act 1999* important habitat for migratory species includes areas where the species is declining. Given that this species is Endangered, it can be considered to be declining within the Modification Study Area and the wider locality. This species is therefore assessed using the threatened species criteria of the *Principal Significance Guidelines 1.1* (Department of the Environment and Heritage 2006).

Distribution, habitat and ecology

Regent Honeyeaters inhabit dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak (Department of Environment and Conservation 2006c). The woodlands they inhabit support a significantly high abundance and species richness of bird. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes (Higgins *et al.* 2001).

The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Nectar and fruit from the mistletoes *Amyema miquelii, A. pendula* and *A. cambagei* are also eaten during the breeding season (Oliver 2000). When nectar is scarce, lerp and honeydew comprise a large proportion of the diet. Insects make up about 15 % of the total diet and are important components of the diet of nestlings (Higgins *et al.* 2001). A shrubby understorey is an important source of insects and nesting material (Oliver *et al.* 1998).

Colour-banding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres (Higgins *et al.* 2001). However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on spatial and temporal flowering and other resource patterns. To successfully manage the recovery of this species a full understanding of the habitats used in the non-breeding season is critical (Department of Environment and Conservation 2006c).

There are three known key breeding areas, two of them in NSW — Capertee Valley and Bundarra-Barraba regions (Geering & French 1998). The species breeds from May to March, but with peak breeding activity from September to November (NSW Department of Environment and Climate Change 2009b) in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River She-oak. Regent Honeyeaters usually nest in horizontal branches or forks in tall, mature eucalypts and She-oaks (Oliver 2000). An open cup-shaped nest is constructed of bark, grass, twigs and wool (Oliver *et al.* 1998).

Threats

Threats to this species include:

- Historical loss, fragmentation and degradation of habitat from clearing for agricultural and residential development, particularly fertile Yellow Box-White Box-Blakely's Red Gum woodlands.
- Continuing loss of key habitat tree species and remnant woodlands from strategic agricultural developments, timber gathering and residential developments.
- Suppression of natural regeneration of over storey tree species and shrub species from overgrazing. Riparian gallery forests have been particularly affected by overgrazing.
- Inappropriate forestry management practices that remove large, mature resource-abundant trees. Firewood harvesting in Box-Ironbark woodlands can also remove important habitat components.
- Competition from larger aggressive honeyeaters, particularly Noisy Miners, Noisy Friarbirds and Red Wattlebirds.
- Egg and nest predation by native birds (Department of Environment and Conservation 2006c).

Specific impacts

This species was not recorded during surveys for the BCEP project or the proposed Modification, however habitat exists within the Box Gum habitats of the Modification Study Area, including:

- Poplar Box Woodland.
- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

Approximately 14.0 ha of potential habitat will be removed as a result of the Modification, and this is in addition to the habitat already removed for the BCEP project.

The significance impact assessment conducted for the BCEP found that the impacts upon the Regent Honeyeater as a result of the Continuation of Boggabri Coal Mine Project would be significant. These findings are likely to hold for the Modification Boundary.

9.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

It is assumed that 14.0 ha of potential habitat for this species, including foraging, roosting and nesting resources would be affected by the proposed. Modification Study Areas are situated approximately 50 km to the south-west of one of only two main breeding locations in NSW, being the Bundarra-Barraba area. While this species has not been recorded in the BCEP project area, the presence of large tracts of suitable habitat coupled with records of this species occurring west to the Pilliga Nature Reserve (NSW Department of Environment and Climate Change 2009b), indicate that the Modification Study Area might be utilised at least on a transient basis. While this species may exhibit some fidelity to nesting areas, pairs have also been recorded breeding up to 75 km from sites used in the previous breeding season (Oliver 1998) (Oliver 2000) (Geering & French 1998) (Oliver *et al.* 1998). However, any identified population of Regent Honeyeater in the area would not be restricted to habitat within the subject site, due to the species' large home range, similar foraging and nesting habitat can be accessed in the local area. Although the proposed Modification may temporarily affect the dynamics of any potential local population, it is not likely to affect the lifecycle of this species, but would exacerbate key threatening processes that currently undermine this species recovery.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iv) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

v) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

vi) the extent to which habitat is likely to be removed or modified as a result of the action proposed

14.0 ha of habitat is likely to be removed or modified as a result of the proposed Modification. This is in addition to the incremental loss of habitat for the BCEP project.

vii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The habitat within the project area is already largely fragmented. Removal of 14.0 ha of potential habitat for the species would not affect habitat connectivity to a level that would impact upon the conservation of the species, especially considering the high mobility of the species.

viii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Whilst the proposed Modification will result in a small incremental loss in habitat it is unlikely to significantly affect the long term survival of the Regent Honeyeater.

This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential breeding and foraging opportunities. Similar habitats would remain in the locality post-development.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the *TSC Act 1995*, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The *Action Plan for Australian Birds* (Garnett & Crowley 2000) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Specific objectives of the Regent Honeyeater recovery plan (Menkhorst *et al.* 1999) include:

- Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range, by active participation in land-use planning processes and by active vegetation rehabilitation at strategic sites.
- Monitor trends in the Regent Honeyeater population size and dispersion across its range to allow assessment of the efficacy of management actions
- Facilitate research on strategic questions that will enhance the capacity to achieve the long-term objectives. In particular, determine the whereabouts of Regent Honeyeaters during the non-breeding season and during breeding season absences from known sites. Identify important sites and habitat requirements at these times.
- Maintain and increase community awareness, understanding and involvement in the recovery effort
- Maintain the captive population of Regent Honeyeaters at a size that will provide adequate stock to: provide insurance against the demise of the wild population; continuously improve captive-breeding and husbandry techniques; provide adequate stock for trials of release strategies; and maintain 90 % of the wild heterozygosity in the captive population.

The impact assessment conducted for the Boggabri EA concluded that based on the potential ecological impacts of the BCEP Project, it would likely interfere with the recovery of the Regent Honeyeater by removing large tracts of potential habitat, which occurs in proximity to one of only two main breeding areas in NSW. The additional clearing for the proposed Modification is considered unlikely to alter these findings.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Regent Honeyeater the proposed Modification contributes to one key threatening process – loss of foraging habitat (mature key nectar tree species & mistletoe). As the proposed works will only make a minor contribution to this threatening process it is considered unlikely to significantly affect species.

Conclusion

Approximately 14.0 ha of potential habitat will be removed by the proposed Modification. This is made up of the following vegetation communities present within the Modification Study Area:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

It is unlikely that removal of this small amount of woodland would have a significant impact upon the species; however it contributes to the e removal of potential habitat for the BCEP project.

9.2 EPBC Act significance assessment

Will the action lead to a long-term decrease in the size of a population of a species?

The subject site boundary is situated approximately 50 km to the south-west of one of only two main breeding locations in NSW, being the Bundarra-Barraba area. The presence of large tracts of suitable habitat coupled with records of this species occurring west to the Pilliga Nature Reserve (NSW Department of Environment and Climate Change 2009b), indicate that the subject site might be utilised on a transient basis. However, any identified population of Regent Honeyeater in the area would not be restricted to habitat within the subject site, due to the species' large home range, similar foraging and nesting habitat can be accessed in the locality. Therefore, the proposed Modification is not likely to result in a decline of the local population.

Will the action reduce the area of occupancy of the species?

The subject site is situated approximately 50 km to the south-west of one of only two main breeding locations in NSW, being the Bundarra-Barraba area (NSW Department of Environment and Climate Change 2009b). Furthermore, this species is known to disperse widely (Higgins *et al.* 2001), and with records occurring west to the Pilliga Nature Reserve (NSW Department of Environment and Climate Change 2009b), it is considered that this species might utilise habitat resources within the proposed Modification on at least a transient basis. Although the species is highly mobile, which is likely to be in response to spatial flowering and resources (Higgins *et al.* 2001), the removal of 14.0 ha of potential habitat in addition to the removal of potential habitat for the BCEP project would reduce the

area of occupancy for the Regent Honeyeater. Furthermore, the proposed Modification would add incrementally to and exacerbate threatening processes that affect this species.

Will the action fragment an existing population into two or more populations?

Regent Honeyeaters are highly mobile and have a large foraging range that enables them to access similar habitat resources in the locality. Therefore, it is not likely that the proposed Modification would isolate habitat or fragment an existing population into two or more populations.

Will the action adversely affect habitat critical to the survival of a species?

The Regent Honeyeater is known to breed in two main areas in NSW, being the Bundarra-Barraba area and Capertee Valley. Regent Honeyeater's typically occur in associations that support species which produce copious amounts of nectar, including *Eucalyptus albens*. They are also associated with woodland that support *E. blakelyi*, *E. crebra* and sometimes native *Callitris* (pine) woodlands mixed with eucalypts (NSW Department of Environment and Climate Change 2009b). The Modificationsupports *Eucalyptus albens* and *E. crebra*, and thus, with the Modificationoccurring in proximity to a known breeding area, it potentially provides important breeding resources for this species. However, as this species would not be restricted to habitat within the subject site, this area may not be considered critical to the survival of this species.

Will the action disrupt the breeding cycle of a population?

The proposed Modification would affect 14.0 ha of potential habitat for this species, including foraging and nesting resources. Furthermore, the subject site occurs approximately 50 km from one of two main locations where this species is concentrated, being the Bundarra-Barraba area (NSW Department of Environment and Climate Change 2009b), While this species may exhibit some fidelity to nesting areas, pairs have also been recorded breeding up to 75 km from sites used in the previous breeding (Oliver 1998) (Oliver 2000) (Geering & French 1998) (Oliver *et al.* 1998). Therefore, while this species may utilise habitat resources in the Modification on at least a transient basis, the removal of 14.0 ha of potential habitat is not likely to disrupt the breeding cycle of a potential population of Regent Honeyeater. It will however add incrementally to the processes threatening this species.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The subject site occurs approximately 50 km to the south-west of one, of only two main locations where this species is concentrated in NSW, being the Bundarra-Barraba area (NSW Department of Environment and Climate Change 2009b). The removal of 14.0 ha of vegetation would not significantly modify, destroy, remove and decrease the availability of habitat for Regent Honeyeater, although it adds to the incremental loss of habitat for the BCEP project.

Will the action result in invasive species that are harmful to an endangered species becoming established in the endangered species´ habitat?

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Regent Honeyeater would become further established as a result of the Project.

Will the action introduce disease that may cause the species to decline?

No. It is not likely that disease would be increased by the action.

Will the action interfere with the recovery of the species?

The *Action Plan for Australian Birds* (Garnett & Crowley 2000) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Specific objectives of the Regent Honeyeater recovery plan (Menkhorst *et al.* 1999) include:

- Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range, by active participation in land-use planning processes and by active vegetation rehabilitation at strategic sites.
- Monitor trends in the Regent Honeyeater population size and dispersion across its range to allow assessment of the efficacy of management actions
- Facilitate research on strategic questions that will enhance the capacity to achieve the long-term objectives. In particular, determine the whereabouts of Regent Honeyeaters during the non-breeding season and during breeding season absences from known sites. Identify important sites and habitat requirements at these times.
- Maintain and increase community awareness, understanding and involvement in the recovery effort
- Maintain the captive population of Regent Honeyeaters at a size that will provide adequate stock to: provide insurance against the demise of the wild population; continuously improve captive-breeding and husbandry techniques; provide adequate stock for trials of release strategies; and maintain 90 % of the wild heterozygosity in the captive population.

It is not likely that the Project will significantly interfere with the recovery of the species.

Conclusion

Populations of Regent Honeyeaters in the locality are considered important, particularly those using the area for breeding resources. It is considered unlikely that the proposed Modification would significantly affect the species. However, the proposed Modification would add incrementally to the processes threatening this species, through the removal of 14.0 ha of potential habitat, including:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

10. Superb Parrot (*Polytelis swainsonii*)

Status

The Superb Parrot is listed as Vulnerable under both the *Environment Protection and Biodiversity Conservation Act 1999* and *Threatened Species Conservation Act 1999.*

Distribution, habitat and ecology

Superb Parrots inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. On the South-west Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (Higgins 1999). This species nests in small colonies, often with more than one nest in a single tree, and breed between September and January (Department of Environment and Conservation 2006c). Part of the population of this species undertakes regular seasonal movements from the south-west slopes region to the eucalypt–pine woodlands of central-north and central-west NSW, with the range extending north to around Narrabri and Wee Waa (Department of Environment Water Heritage & Arts 2009)

Superb Parrots may forage up to 10 km from nesting sites, primarily in grassy box woodland. They feed in trees and understorey shrubs and on the ground; their diet consists mainly of grass seeds and herbaceous plants. The parrots also eat fruits, berries, nectar, buds, flowers, insects and grain (Higgins 1999)

Threats

Threats to this species include:

- poor regeneration of nesting trees and food resources
- removal of hollow-bearing trees
- clearing of woodland remnants
- feeding on grain spills and subsequently being struck by vehicles
- loss of hollows to feral bees and native and exotic hollow-nesting birds
- illegal trapping which can also result in the destruction of hollows (Department of Environment and Conservation 2006c).

Specific impacts

This species was not recorded during surveys for the BCEP project or the proposed Modification; however habitat exists within the Box Gum Woodlands of the Modification Study Area, including the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box – White Cypress Pine shrubby open.

Approximately 14.0 ha of potential habitat will be removed as a result of the Modification.

10.1 Significance assessment – Environment Protection and Biodiversity Conservation Act 1999

The Superb Parrot is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*. The following assessment has been undertaken following the *Principal Significant Impact Guidelines 1.1* (Department of the Environment and Heritage 2006). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

A population of Superb Parrot in the Project Boundary, if present, is not considered to be important, as no breeding habitat would be affected by the Project, and this species northern limit extends to Narrabri and Wee Waa, which occur north/ north-west of the Project.

Will the action lead to a long-term decrease in the size of an important population of a species?

If present, the population of Superb Parrots would not be an important population. Approximately 14.0 ha of potential foraging habitat for this species would be affected by the Modification. This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young Department of Environment Water Heritage & Arts 2009). Therefore, no breeding habitat would be affected by the Project.

Any identified population of Superb Parrot in the area would not be restricted to habitat within the Project Boundary, as similar foraging habitat could be accessed in the locality. Furthermore, the northern limit for this species extends north of the Project Boundary, approximately around Narrabri and Wee Waa. Although the Project may temporarily affect the dynamics of any local population, it is not likely to result in a decline of the local population.

Will the action reduce the area of occupancy of an important population of the species?

If present, the population of Superb Parrots would not be an important population. Vegetation occurring within the Project Boundary could potentially be used by individuals of those populations of this species that migrate north during winter. This species range extends north to around Wee Waa and Narrabri, from a line joining Coonabarabran and Narrabri, and extending as far west as Quambone, with occasional records further west Department of Environment Water Heritage & Arts 2009). Although Leard State Forest essentially occurs outside the normal range of where this species migrates; the removal of approximately 1,384 ha of potential foraging habitat might reduce the area of occupancy of this species. However, given that this species was not recorded in the Project Boundary, that the northern range of this species effectively occurs (approximately) 50 km to the north-east of the Project Boundary, and the fact that any local population of Superb Parrot would not be restricted to habitat resources in the Project Boundary; it is considered that the Project would not reduce the area of occupancy of an important population of this species.

Will the action fragment an existing important population into two or more populations?

If present, the population of Superb Parrots would not be an important population. Superb Parrots are highly mobile and have a large foraging range that would allow them to use similar habitat resources in the locality. Therefore, it is not likely that the Project would isolate habitat or fragment an existing population into two or more populations.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat is listed for this species under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006a).

The Project would remove approximately 1,384 ha of potential foraging habitat for this species. However, with only part of the population of Superb Parrot regularly undertaking seasonal movements, with a northern limit extending to Narrabri and Wee Waa, this would not meet the above criteria. Furthermore, no breeding habitat would be affected by the Project. Therefore, habitat in the Project Boundary is not considered critical to the survival of the species.

Will the action disrupt the breeding cycle of an important population?

If present, the population of Superb Parrots would not be an important population. This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young (Department of Environment Water Heritage & Arts 2009). At least part of the population of the Superb Parrot undertakes regular seasonal movements, vacating breeding areas at the conclusion of the breeding season and heading north to the eucalypt-pine woodlands of central-west NSW (Department of Environment Water Heritage & Arts 2009). While this species is dependent on flowering resources across a wide range of habitats (woodlands and forests) in its wintering grounds in NSW, the removal of 14.0 ha of potential habitat is not likely to disrupt their migratory pattern, which generally occurs 50 km to the west of the Modification Study Area. As such, the Modification is not likely to affect their breeding cycle.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 14.0 ha of potential foraging resources for Superb Parrot would be affected by the Modification. This species can forage over long distances, and would be able to access off site resources. Furthermore, the extent of this species range (for individuals undertaking regular seasonal movements north) extends north to Narrabri and Wee Waa and extends as far west as Quambone and no breeding habitat would be affected by the Modification. Therefore, it is not likely that the Modification would further isolate or decrease the availability of this habitat so that the species declines.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat?

It is not likely that invasive species (such as introduced predators) that are harmful to the Superb Parrot would become further established as a result of the Modification.

Will the action introduce disease that may cause the species to decline?

No. It is not likely that disease would be increased by the Project.

Will the action interfere with the recovery of the species?

A draft national recovery plan is currently being prepared for the Superb Parrot. The *Action Plan for Australian Birds* (Garnett & Crowley 2000) addresses the need for further ecological research on the species and the conservation and protection of foraging and breeding habitat and identification of specific breeding requirements. Based on the potential ecological impacts of the Project on the species, as discussed above, it is not likely that the Project would interfere with the recovery of this species.

Conclusion

The population of Superb Parrot potentially occurring in the Modification Study Area is not considered an important population. Based on the above assessment, the Superb Parrot is not likely to be significantly affected by the Modification and the removal of 14.0 ha of potential habitat.

10.2 Significance assessment – Environmental Planning and Assessment Act 1979

How is the Project likely to affect the lifecycle of a threatened species and/or population?

This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young (Department of Environment and Conservation 2006b). At least part of the population of the Superb Parrot undertakes regular seasonal movements, vacating breeding areas at the conclusion of the breeding season and heading north to the eucalypt-pine woodlands of central-west NSW (Department of Environment and Conservation 2006b) (Department of Environment Water Heritage & Arts 2009). While this species is dependent on flowering resources across a wide range of habitats (woodlands and forests) in its wintering grounds in NSW, the removal of 14.0 ha of potential habitat is not likely to disrupt their migratory

pattern, which generally occurs 50 km to the west of the Project. As such, the Project is not likely to affect this species lifecycle.

How is the Project likely to affect the habitat of a threatened species, population or ecological community?

Approximately 14.0 ha of potential foraging habitat for this species would be affected by the Modification. This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young (Department of Environment and Conservation 2006b). Therefore, no breeding habitat would be affected by the Project.

Vegetation occurring within The Modification Study Area could potentially be used by individuals of those populations of this species that migrate to the north of their range during winter. This species range extends north to around Wee Waa and Narrabri, from a line joining Coonabarabran and Narrabri, and extending as far west as Quambone, with occasional records further (Department of Environment Water Heritage & Arts 2009) (Department of Environment and Conservation 2006b). Although Leard State Forest essentially occurs outside the normal range of where this species migrates; the removal of approximately 14.0 ha of potential foraging habitat might reduce the area of occupancy of this species. However, given that this species was not recorded in the Modification Study Area or the BCEP Project Boundary, that the northern range of this species effectively occurs (approximately) 50 km to the north-east of Leard State Forest, and the fact that any local population of Superb Parrot would not be restricted to habitat resources in the Modification Study Area; it is considered that the Modification would not reduce the area of habitat for this species.

Does the Project affect any threatened species or populations that are at the limit of its known distribution?

The Superb Parrot is found throughout all regions of eastern inland NSW. Breeding sites are known to occur in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round, and also in an area bounded by Molong, Yass and Young. (Department of Environment and Conservation 2006b). At least part of the population of the Superb Parrot undertakes regular seasonal movements, vacating breeding areas at the conclusion of the breeding season and heading north to the eucalypt-pine woodlands of central-west NSW during winter (Webster 1988). The north of this species' range (for that part of the population which migrates annually) extends to around Wee Waa and Narrabri from a line joining Coonabarabran and Narrabri, and extends as far west as Quambone, with occasional records further west (Department of Environment and Conservation 2006b). Although the Modification Study Area essentially occurs outside the normal range of where this species migrates; any identified species potentially occurring within the Modification Study Area could be considered as occurring at the north-eastern limit of its distribution. However, with such a far ranging distributional limit in the northern wintering grounds, this species would not be at the distributional limit of its known distribution.

How is the Project likely to affect current disturbance regimes?

The Modification Study Area currently exhibits disturbance regimes associated with agriculture, grazing and mining. These disturbances include vegetation clearing and habitat removal, artificial noise/light regimes and some weed invasion.

The Modification would increase the clearing of native vegetation, which is a known disturbance for this species. The Modification would also increase edge effects and would essentially introduce edge effects into new areas, however the areas impacted are already suffer edge effects and weed invasion.

How is the Project likely to affect habitat connectivity?

Habitat connectivity would be unlikely to be affected by the Modification due to the small area to be impacted (14.0 ha) and the high mobility of this species.

How is the Project likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the *Threatened Species Conservation Act 1995*, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared due to this species listing as a Vulnerable species. However, potential habitat occurring in the Modification Study Area is not considered critical to the survival of this species.

Conclusion

Although the Superb Parrot was not recorded in the Modification Study Area, or the BCEP Project Boundary, within the Modification Study Area there is potential foraging resources for that part of the population that migrates north at the conclusion of the breeding season (winter). While the Modification would affect 14.0 ha and this would add to the remnant woodland, being removed as part of the BCEP Project, it is considered that the Modification would not reduce the area of occupancy of this species as the general area that this species occupies during migration, essentially occurs (approximately) 50 km to the west of Leard State Forest. While vagrant records of this species may occur within the vicinity of the Modification Study Area, it is not likely that this species would be significantly affected by the Modification.

11. Turquoise Parrot (*Neophema pulchella*)

Status

The Turquoise Parrot is listed as Vulnerable under Schedule 2 of the *TSC Act*.

Distribution and habitat

Turquoise Parrots occur in the foothills of the Great Dividing Range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey, often in the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland (Department of Environment and Conservation 2006c). They nest in tree hollows, stumps or even fence posts, from August to December, laying four or five eggs on a nest of decayed wood dust. This species is usually seen in pairs or small, possibly family, groups and has also been reported in flocks of up to 30 individuals (Higgins 1999). The parrots spend most of the day on the ground and feed on seeds of both native and introduced grass and herb species. They forage quietly and may be quite tolerant of disturbance (Garnett & Crowley 2000).

Threats

This species is predominately threatened by degradation or loss of habitat, particularly the loss of hollow bearing trees (OEH 2012).

Specific impacts

This species was recorded during recent field surveys for the BCEP Project, in Grassy Woodlands on fertile soils, however was not recorded during survey for the proposed Modification. Within the Modification Study Area, potential habitat exists within the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- White Box White Cypress Pine grassy woodland.

Approximately 14.0 ha of potential habitat would be removed as a result of the Modification.

11.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Habitat likely to be affected by the proposed Modification provides foraging, roosting and breeding resources. It is unlikely that removal of 14.0 ha of potential habitat, representing only a small fraction of available habitat, would have a significant impact upon the lifecycle of the species in the locality, however it adds to the cumulative loss of 336.3 ha for the BCEP project.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

ix) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

x) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

xi) the extent to which habitat is likely to be removed or modified as a result of the action proposed

Turquoise Parrot is commonly associated with disturbed areas and often favours the ecotone of forest edges and pasture or other grasslands (NSW Department of Environment and Climate Change 2009c). As this species is highly mobile, remnant habitat occurring outside the boundaries of the proposed Modification is likely to support local populations. It is unlikely that removal of 14.0 ha of potential habitat would have a significant impact upon the species, however it adds to the cumulative loss of 336.3 ha for the BCEP project.

xii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The habitat within the project area is already fragmented. Removal of a total 14.0 ha of potential habitat across the Modification sites would not affect habitat connectivity to a level that would impact upon the conservation of the species.

xiii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Whilst the proposed Modification will result in a small incremental loss in habitat it is unlikely to significantly affect the long term survival of the Turquoise Parrot.

This area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. Similar habitats would remain in the locality post-development.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species due to its listing as a Vulnerable species. However despite not being on the register habitat within the proposed Modification is not considered to be critical.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

There is neither a recovery nor threat abatement plan for the Turquoise Parrot. The Office of Environment and Heritage has however identified 10 priority actions. Owing to the small extent of potential habitat to be removed, the proposed Modification is not considered inconsistent with any identified priority action statements or recovery measures.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Turquoise Parrot the proposed Modification contribute to one key threatening process – clearing of native vegetation. As the proposed works will only make a minor contribution to this threatening process it is considered unlikely to significantly affect species.

Conclusion

14.0 ha of potential habitat will be removed by the proposed Modification. This is made up of the following vegetation communities identified in the Modification Study Area:

- Derived native grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Yellow Box – Blakely's Red Gum grassy woodland.
- White Box Grassy Woodland.
- White Box White Cypress Pine grassy woodland.
- Poplar Box Woodland.

It is unlikely that removal of 14.0 ha of grassy woodland would have a significant impact upon the species; however it contributes to the cumulative removal of 336.3 ha of known habitat for the BCEP project.

12. Little Eagle *(Hieraaetus morphnoides)*

Status

The Little Eagle is listed as a Vulnerable species under the TSC Act.

Distribution, habitat and ecology

The Little Eagle is distributed throughout most of the Australian mainland, except in the most densely forested parts of the Great Dividing Range escarpment (NSW Scientific Committee 2009a), with adults being sedentary (to partly migratory in autumn-winter) and young being dispersive (Pizzey & Knight 2007). The Little Eagle occupies plains, foothills, open eucalypt forest and woodland or open woodland, while acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993). This species builds a large stick nest in tall living trees within remnant patches of vegetation and generally breeds from July to October (Pizzey & Knight 2007). The diet of the Little Eagle generally consists of terrestrial mammals, birds and reptiles (NSW Scientific Committee 2009a).

Threats

Over 50 % of forest and woodlands in NSW have been cleared (Lunney 2004), thus, the main threat that affects this species is the further clearing and degradation of foraging and breeding habitat (NSW Scientific Committee 2009a). On the NSW tablelands and western slopes, important habitat is 53 – 84 % cleared and moderately to highly stressed (NSW Scientific Committee 2009a). Loss of breeding sites may bring this species into increasing interspecific competition with the larger and more dominant Wedge-tailed Eagle.

Specific impacts

This species has been recorded during field studies for BCEP, soaring over the Modification Study Area and adjoining landscapes. As all the vegetation communities are considered potential habitat for the Little Eagle, The proposed Modification would require clearing of 47.6 ha of potential breeding and foraging habitat for this species.

12.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

In addition to the 1,817.1 ha of habitat removed already for the BCEP, 47.6ha of known and potential foraging and breeding habitat for Little Eagle would be affected by the proposed Project Boundary Modification.

The proposed Modification would affect tall living trees, which is a requirement for this species to build a nest – reducing potential breeding habitat. However, similar habitats will remain in the area. As it is a marginal disturbance, and considering the mobility of this species and the large home ranges occupied, it is considered unlikely that the proposed Modification would adversely affect the lifecycle of the species. However, it would add incrementally to the loss of foraging and breeding habitat.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

47.6 ha of potential habitat would be removed representing a small reduction in habitat for the Little Eagle.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Remnant forest and woodland vegetation on private land adjacent to wooded areas along roads, tracks, creeks and paddock boundaries is essential to maintain connectivity across the landscape, to facilitate dispersal and to maintain foraging and breeding resources (NSW National Parks and Wildlife Service 2003). An area of 47.6 ha comprising nesting and foraging habitat, would be affected by the proposed Project Boundary Modification, thereby reducing the overall extent of known and potential habitat. Connectivity would not be affected any more than currently occurs in the locality.

Due to the large home range and mobility of this species, the ability to access adjacent habitat occurring outside the Modification Study Area would remain. Therefore, it is unlikely that individuals or a local population of this species would become fragmented or isolated from other areas of habitat. However, it would reduce the overall extent of known habitat and further exacerbate key threatening processes for this species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Due to the small size of habitat to be disturbed (47.6 ha) and considering the remaining habitat within the locality (8,134 ha in Leard State Forest) this area is not considered to represent core habitat for this species, although it is recognised that it provides nesting and foraging opportunities.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species due to its listing as a Vulnerable species. Regardless, the small area of habitat affected by the proposed Modification is not considered critical to the survival of this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for the Little Eagle. There have also been no recovery actions identified by the Office of Environment and Heritage.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification would involve a small amount of clearing of native vegetation, which is a known disturbance for this species.

Conclusion

It is estimated that approximately 1,817.1 ha of known foraging habitat and potential breeding habitat would be affected by the BCEP. The proposed Modification would contribute a further 47.6 ha. While this reduction would add incrementally to the loss of foraging and breeding habitat in the locality, it is not likely to significantly affect this species, as a large continuous patch of remnant woodland would remain within the locality of the proposed Modification.

13. Square-tailed Kite (*Lophoictinia isura*)

Status

The Square-tailed Kite (Debus *et al.* 1993)is listed as a Vulnerable species under the TSC Act (NSW National Parks and Wildlife Service 1999b).

Distribution, habitat and ecology

This raptor is endemic to Australia and is widespread throughout the mainland, although it is sparsely distributed (Marchant and Higgins 1993). The species is recorded along coastal and sub-coastal areas, from south-western to northern Australia, Queensland, NSW and Victoria. Scattered records throughout NSW indicate that the species is a regular resident along the major west-flowing river systems. This species is also migratory throughout its range and is a summer breeding migrant to south-eastern and south-western Australia. The Square-tailed Kite inhabits open forests, woodlands with particular preference for timbered watercourses. Within NSW, the species is often associated with ridge and gully forests containing *Eucalyptus longifolia* (Woollybutt), *E. maculata* (Spotted Gum) *E. elata* (River Peppermint) and *E. smithii* (Ironbark Peppermint), as well as forests containing Angophora and Callitris and Box-Ironbark woodland.

The Square-tailed Kite occupies large home ranges, in the order of 100 square kilometres, and is specialist hunter of passerines (particularly honeyeaters) and foliage insects, with most prey taken from the outer foliage of the tree canopy (NSW National Parks and Wildlife Service 1999b). Breeding occurs from July to February with an average clutch size of three eggs. Nest sites are generally located near watercourses in a fork or large horizontal branches of eucalypts or Angophora tree species.

Except when breeding, this species tends to be a solitary bird, usually seen hunting alone high in, or just above the tree canopy in coastal or sub-coastal rainforest, forest or woodland. Nests have been reported in *Eucalyptus* spp., *Angophora* spp. and native pine forests. Prey taken has included fledging birds, insects, rabbits and lizards.

Threats

Over 50 % of forest and woodlands in NSW have been cleared (Lunney 2004), thus, the main threat that affects this species is the further clearing and degradation of foraging and breeding habitat (NSW National Parks and Wildlife Service 1999b).

Specific impacts

This species has been anecdotally recorded in Leard State Forest (David Robertson 2009). Habitat exists within the Box Gum habitats of the Modification Study Area, including:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

The proposed Modification would clear 14 ha of habitat for this species in addition to the habitat cleared for the BCEP project.

13.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Square-tailed Kite has been anecdotally recorded in Leard State Forest (David Robertson 2009). Approximately 14 ha of potential foraging and breeding habitat for Square-tailed Kite would be affected by the proposed Modification, in addition to areas cleared for BCEP.

Whilst the proposed Modification will reduce potential foraging and breeding opportunities for this species, remaining Leard State Forest would occur as a large continuous patch of remnant woodland adjacent. Therefore, it is likely to support nesting and foraging resources for this species. Moreover, given the mobility of this species and large home ranges occupied, this species would be able to access similar habitats in the locality with ease.

While the loss of potential habitat would add incrementally to the loss of foraging and breeding habitat, it is not likely to substantially affect the lifecycle of this species in the locality.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The Square-tailed Kite is known to occupy territories up to 100 square kilometres in eucalypt forest, woodland, open woodland and riparian woodland (NSW National Parks and Wildlife Service 1999a); therefore, it is estimated that less than 14 ha of habitat will be affected by the proposed Modification.

Habitat to be removed provides potential breeding and foraging resources for this species. However, the remaining large continuous patch of remnant woodland in the locality (remaining Leard State Forest) is likely to provide greater nesting and foraging resources for this species.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Remnant forest and woodland vegetation is essential to maintain connectivity across the landscape, to facilitate dispersal and to maintain foraging and breeding resources (NSW National Parks and Wildlife Service 2003). Whilst small areas of remnant vegetation, comprising potential breeding and foraging habitat, would be affected by the proposed Modification, connectivity would not be impacted any more than currently occurs in the locality. Due to the large home range and mobility of this species, the ability to access adjacent habitat occurring outside the proposed Modification would remain. Therefore, it is unlikely that individuals or a local population of this species would become fragmented or isolated from other areas of habitat.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

In consideration of the potential habitat remaining in the locality, and the high mobility of the species, this area is not considered to represent core habitat for this species, although it is recognised that it may provide potential nesting and foraging opportunities. The small incremental loss in habitat it is unlikely to significantly affect the long term survival of the Square-tailed Kite.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species due to its listing as a Vulnerable species.

The habitat in the Modification Study Area is not considered critical.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for the Square-tailed Kite, however three priority actions have been identified by Office of Environment and Heritage. The Proposed Modification is unlikely to interfere with these actions, as no nest tree was identified.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification would involve a small amount of clearing of native vegetation, which is a key threatening process.

Conclusion

The Square-tailed Kite has been anecdotally recorded in Leard State Forest.

It is estimated that 14 ha of potential foraging and breeding habitat would be affected by the proposed Modification. While this reduction would add incrementally to the loss of foraging and breeding habitat in the locality, it is not likely to significantly affect this species, as a large, continuous patch of remnant woodland would surround the Modification Study Area, which is likely to provide foraging and nesting opportunities.

14. Barking Owl (Ninox connivens) and Masked Owl (*Tyto novaehollandiae*)

The Barking Owl and Masked Owl have been assessed together as they generally share similar habitat requirements; threats that affect their recovery; and potential impacts as result of the proposed Modification. Neither species were recorded during survey for the Modification within the Modification Study Area. All native communities are potential habitat for these species.

Barking Owl – *Ninox connivens*

The Barking Owl is listed as Vulnerable under Schedule 2 of the TSC Act. Barking Owls inhabit eucalypt woodland, open forest, swamp woodlands, and especially in inland areas, timber along watercourses (Pizzey & Knight 1997). Dense vegetation is used occasionally for roosting. During the day this species roosts along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts (Higgins 1999).

Barking Owls feed on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals, such as smaller gliders, possums, rodents and rabbits, becoming important during breeding. Estimates of Barking Owl home ranges indicated that territories range from 30 ha to 200 ha and hunt 5 km from roosts (Higgins 1999). However, surveys in the Pilliga forests of western NSW (Kavanagh, R. P. 2009) found that Barking Owl home ranges averaged approximately 2,000 ha. Regurgitated pellets also showed that prey items consisted of mostly birds, insects and some mammals.

Eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*) and Blakely's Red Gum (*Eucalyptus blakelyi*). Nest-hollow entrances are 2 m to 35 m above the ground with a diameter of 20 cm to 46 cm and depth of 20 cm to 300 cm. Breeding occurs during late winter and early spring (NSW National Parks and Wildlife Service 2003).

Cluster analysis of records from NSW Wildlife Atlas within 300 km diameter around the Pilliga forests (Soderquist 2009) identified seven Barking Owl populations in the region of north-west NSW. The Pilliga population spreads to the Warrumbungle ranges and to the lower slopes of Mount Kaputar. While this population is an extensive one, no obvious lines of connectivity to other populations in the region were evident. Moreover, the gaps between these populations are generally wide expanses of mostly cleared habitat and without knowledge of juvenile dispersal ability, connectivity across the landscape cannot accurately be determined (Soderquist 2009).

Masked Owl – *Tyto novaehollandiae*

The Masked Owl is listed as Vulnerable under Schedule 2 of the *TSC Act 1995*. Masked Owls are distributed mainly throughout NSW from the coast where it is most abundant to the western plains (NSW Scientific Committee 2004), where they inhabit a diverse range of wooded habitats including eucalypt forests, woodlands and almost treeless inland plains. Optimal habitat includes an open understorey and a mosaic of sparse and dense ground cover. Large hollows in live or occasionally dead eucalypts are used for roosting (Department of Environment and Conservation 2006a) but are also known to roost and nest in dense foliage in gullies and caves (Garnett & Crowley 2000).

Masked Owls typically prey on terrestrial mammals including rodents and marsupials but would also take other species opportunistically. Territories range 400 ha to 1000 ha and forages by hunting from perches at ecotones within forests and at forest edges (Kavanagh, R. P. a. M. M. 1996).

Eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*) and Blakely's Red Gum (*Eucalyptus blakelyi*). Nest-hollow entrances are at least three metres above the ground with a diameter greater than 40 cm and depth greater than 100 cm. Breeding mostly occurs during autumn and winter (NSW National Parks and Wildlife Service 2003).

Specific Impacts

The proposed Modification would remove 14 ha of potential habitat, in the form of the Woodlands within the Modification Study Area, including:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

Habitat likely to be affected provides foraging, roosting and breeding resources for these species.

14.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The habitat to be removed provides feeding resources for Barking Owls and Masked Owls in the form of birds, insects and some terrestrial mammals. Roosting resources in the Modification Study Area include dense clumps of canopy leaves in large Eucalypts for the Barking Owl and large hollows in Eucalypts for the Masked Owl. Breeding resources for both species include hollows of large, old White Box (*Eucalyptus albens).*

It is unlikely that the removal of 14 ha for the proposed Modification would significantly impact upon the lifecycle of the species. However, it contributes to the loss of 365.4 ha of known habitat for the BCEP project.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iv) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

v) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

vi) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The proposed Modification would remove 14 ha of potential habitat in total. It is unlikely this would significantly impact upon the species. However, it contributes to the loss of 365.4 ha of known habitat for the BCEP project.

vii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Much of the habitat within the Modification Study Area and locality is already fragmented. Removal of 14 ha of potential habitat for the species would not increase habitat fragmentation to a level that would impact upon the conservation of the species. Moreover, these species have large home ranges (up to 1000 ha for the Masked Owl and 2000 ha for the Barking Owl).

viii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

This area is not considered important for the long term survival of the species, as additional breeding and foraging habitat will remain in the locality, and 14 ha of habitat to be removed only represents a small fraction of the species range.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species. However, the potential habitat to be cleared is not considered to be critical to the survival of these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for either of the Owls.

A number of priority actions have been identified by the Office of Environment and Heritage; 17 for the Barking Owl and 24 for the Masked Owl. Owing to the small extent of habitat to be affected, the proposed Modification is not considered inconsistent with any identified priority action statements or recovery measures.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed Modification would involve a small amount of clearing of native vegetation including the removal of hollow bearing trees, which are key threatening process that threaten these species.

Conclusion

Approximately 14 ha of potential habitat will be removed for the proposed Modification. It is unlikely that removal of this small amount of woodland would have a significant impact upon these species; however it contributes to the cumulative removal of 365.4 ha of known habitat for the BCEP project.

15. Hollow dependant microchiropteran bats

Threatened hollow-dependent species of microchiropteran bat have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the proposed Project Boundary Modification. Hollow-dependent microchiropteran bats considered for this impact assessment are:

- Greater Long-eared Bat – south eastern form (*Nyctophilus timoriensis*).
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).

Greater Long-eared Bat – south-eastern form

The Greater Long-eared Bat is listed as Vulnerable under the *TSC Act 1995* and the *EPBC Act 1999*.

Greater Long-eared Bats inhabit a variety of vegetation types, including mallee and box eucalypt dominated communities, but they are distinctly more common in box/ironbark/cypress-pine vegetation, which occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. They roost in tree hollows, crevices and under loose bark. It is a slow flying, agile bat using the understorey to hunt non-flying prey — especially caterpillars and beetles — and will even hunt on the ground. Mating takes place in autumn, with one or two young born in late spring to early summer (Churchill 2008).

Although no individuals were recorded during current surveys, this species has previously been recorded in Leard State Forest (Pennay 2001), and suitable habitat exists within the Modification Study Area.

Eastern False Pipistrelle

The Eastern False Pipistrelle is listed as Vulnerable under the *TSC Act 1995*.

This species is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania (Department of Environment and Climate Change 2005; NSW Department of Environment and Climate Change 2009a). Its distribution extends over the Great Dividing Range, with a preference for wet altitude forests. This species is thought to hunt beetles and moths above, or just below the canopy. The Eastern False Pipistrelle roosts in tree hollows, although it can sometimes be found in caves (Jenolan area) and buildings (Churchill 1998). This species hibernates during winter, with females pregnant in late spring-early summer (NSW Department of Environment and Climate Change 2009a).

This species was recorded via Anabat during field surveys for the BCEP in 2010.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat is listed as Vulnerable under the *TSC Act 1995.*This species has been frequently observed in the Box Gum woodlands within Leard State Forest. This species is wide ranging and found across northern and eastern Australia, encompassing the majority of NSW. Although, only scattered records exist across the New England Tablelands and north-west slopes (NSW Department of Environment and Climate Change 2009d). This species occurs in eucalypt forest where it flies high above the canopy, feeding on insects. In mallee or open country it feeds closer to the ground. Generally a

solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows and is thought to be a migratory species to southern Australia during late summer and autumn (Churchill 1998). Little is known about this species' life cycle. Breeding has been recorded from December to late March in this species (NSW Department of Environment and Climate Change 2009d).

This species was recorded via Anabat during field surveys for the BCEP – more detail in the Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010).

Threats (combined for all species)

- Loss or Modification of habitat (including feeding habitat) near roosting and maternity sites.
- Clearing and isolation of dry eucalypt forest and woodland, particularly about cliffs and other areas containing suitable roosting and maternity sites, mainly as a result of agricultural and residential development.
- Predation by cats.
- Application of pesticides in or adjacent to foraging areas may reduce the availability of invertebrates, or result in the accumulation of toxic residues in individuals' fat stores.
- Damage to roosting and maternity sites from mining operations.
- There is a strong likelihood that unrecorded populations could be unintentionally affected by land management actions.

15.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Field surveys identified that the Modification Study Area contains hollow-bearing trees. During previous studies conducted for the BCEP two Threatened hollow-dependent species of microchiropteran bat, Eastern False Pipistrelle and Yellow-bellied Sheathtail Bat, were recorded via Anabat. Greater Long-eared Bat has previously been recorded in the area by NSW National Parks and Wildlife Service (Pennay 2001).

The proposed Modification will require the removal of up to six hollow bearing trees and 14.0 ha of native vegetation, all of which is considered potential roosting and foraging habitat. Although hollow bearing trees will be removed as a result of the proposed Modification, a number of hollow bearing trees will remain in the locality and as such the proposed Modification is unlikely to have a significant adverse effect on the lifecycle of this species as it is relatively small areas of potential breeding, foraging and commuting habitat being impacted.

Furthermore, as outlined in the Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010) a large continuous patch of remnant woodland, with a similar or greater density of hollow-bearing trees, would remain in the area surrounding the Modification Study Area providing important habitat resources for foraging, roosting and breeding.

The cumulative effect of the proposed Modification and the BCEP may affect the local population. However the Modification alone is not considered likely to have a significant impact on these species.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

14.0 ha of native vegetation representing suitable foraging habitat for this species is likely to be affected by the proposed Modification. This is a relatively small area of potential breeding, foraging and commuting habitat being impacted. However it contributes to the cumulative removal of 336.3 ha for the BCEP project.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

The proposed Modification is unlikely to represent significant habitat isolation and/or fragmentation given the small incremental increase of disturbance of potential habitat (14.0 ha) and the mobility of the species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposed Modification would affect 14.0 ha of moderate to good value habitat that provides foraging, roosting and breeding resources. Increasing the total area affected by the BCEP and associated works.

The area of habitat proposed to be removed for the BCEP alone was considered to be of importance to the long-term survival of Hollow Dependant Microchiropteran Bats in the locality. The further disturbance caused by the proposed Modification would further reduce the area of occupancy for these species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. Under the *TSC Act 1995*, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species due to their Vulnerable species listing. The habitat which would be affected by the proposed Modification is not considered critical to the survival of the species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery or threat abatement plans have been prepared for any of the hollow dependant Microchiropteran bats. The Office of Environment and Heritage has however identified measures that need to be implemented to recover these species.

The proposed development is not likely to significantly adversely affect any of these recovery actions with the possible except of vegetation removal around possible marginal (non-breeding) roost sites (i.e. small fissures in trees). This impact is unlikely to significantly affect the recovery of any local population of the species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The action proposed constitutes the following key threatening processes, as listed under the *TSC Act 1995*:

- clearing of native vegetation
- loss of hollow-bearing trees.

Considering the cumulative impact the BCEP and proposed Modification, these key threatening processes could negatively impact the Hollow Dependant Microchiropteran Bats. However, the proposed Modification would only affect a marginal area of suitable habitat in relation to the availability to these habitats in the broader locality.

Threat abatement plans have not been prepared for these processes.

Implementation of mitigation measures are recommended, such as the installation of nest boxes to compensate for the loss of the hollow-bearing trees.

Conclusion

Field surveys identified many hollow bearing trees within the Modification Study Area, particular in the Kamilaroi Access Site. During previous studies, conducted for the Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010), two threatened hollow-dependent species of microchiropteran bat, Eastern False Pipistrelle and Yellow-bellied Sheathtail Bat, were recorded via Anabat. Greater Long-eared Bat has previously been recorded in the area by NSW National Parks and Wildlife Service (Pennay 2001).

In addition to the habitat being affected by the BCEP, 14.0 ha of moderate to good habitat would be removed. Therefore, it is considered that the proposed Modification would reduce the area of occupancy and add incrementally to processes that threaten these species.

15.2 EPBC Act significance assessment

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following.

Will the action lead to a long-term decrease in the size of an important population of a species?

The Proposed Modification would remove 14.0 ha of habitat for this species, including potential roosting and foraging resources. However, this species is highly mobile (known to forage more than three kilometres from roost sites) (Churchill 1998), and similar foraging and roosting resources would remain in the locality.

Will the action reduce the area of occupancy of an important population of the species?

A local population of Greater Long-eared Bat would not be restricted to habitat resources in the Modification Study Area. A relatively small patch (14.0 ha) of potential foraging and roosting habitat for this species would be affected by the proposed Modification and similar habitat resources will remain in the surrounding landscape (Leard State Forest). Thus, the proposed Modification is not considered likely to reduce the area of occupancy of an important population of Greater Long-eared Bat.

Will the action fragment an existing important population into two or more populations?

Habitat connectivity would be unlikely to be significantly affected by the proposed Modification. Given the mobility of the Greater Long-eared Bat and the similar habitats in the locality it is unlikely that the proposed Modification would isolate the habitat fragment an existing population into two or more populations.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat is listed for this species under the *EPBC Act 1999*.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006a).

The proposed Modification would remove approximately 14.0 ha of potential foraging and breeding habitat for this species. However, this species high mobility would allow it to access and occupy foraging and roosting/breeding resources outside the Modification Study Area. Furthermore a large stand of continuous remnant woodland would remain around the area. Therefore, habitat within the subject site is not considered critical to the survival of the species.

Will the action disrupt the breeding cycle of an important population?

Any potential population of this species occurring within the Modification Study Area is not considered an important population. While the proposed Modification might disrupt the dynamics of a potential population, similar breeding resources would remain in the large stand of continuous remnant woodland in the locality.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposed Modification would decrease the availability of suitable habitat by 14.0 ha. However, important habitat resources such as tree hollows have similar densities inside and outside the Modification Study Area (Parsons Brinkerhoff 2010). Furthermore, the proposed Modification is not likely to increase the degree of fragmentation or isolation of this species. Thus, it is considered unlikely that the decrease in available habitat would cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat?

It is not likely that invasive species (such as introduced predators) that are harmful to the Greater Long-eared Bat would become further established as a result of the proposed Modification.

Will the action introduce disease that may cause the species to decline?

No. There are no known diseases that are likely to increase in the area as a result of the proposed Modification.

Will the action interfere with the recovery of the species?

The *Action Plan for Australian Bats* (Duncan *et al.* 1999) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific roosting requirements.

Based on the potential ecological impacts of the proposed Modification on the Greater Long-eared Bat, as discussed above, it is not likely that the activities would interfere with the recovery of this species.

Conclusion

Populations of Greater Long-eared Bat potentially occurring in the Modification Study Area are not considered to be critical to the survival of the species. Based on the above assessment, this species is not likely to be significantly affected by the 14 ha of potential habitat to be removed for the proposed Modification.

16. Squirrel Glider *(Petaurus norfolcensis)*

Status

The Squirrel Glider is listed as Vulnerable under *TSC Act 1995*.

Distribution, habitat and ecology

Squirrel Gliders inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. Suitable vegetation communities include at least one species of plant that flowers heavily in winter and one or more of the smooth-barked eucalypts (Department of Environment and Conservation 2005)

Tree hollows greater than five centimetres diameter, in both living and dead trees as well as hollow stumps, are used as den sites for refuge and nesting (Gibbons & Lindenmayer 2000). Studies in Queensland showed that Squirrel Gliders used ironbark eucalypts and stags more than the hollows of smooth barked eucalypts and non-eucalypt tree species (Rowston 1998).

Squirrel Gliders use tree hollows for diurnal shelter either alone or in family groups of up to six individuals and offspring that occupy the same hollow simultaneously. The size and composition of groups of gliders occupying a particular hollow varies from day to day because gliders regularly swap den trees (van der Ree 2002). The nests are bowl-shaped and lined with leaves within tree hollows (Triggs 1996).

Squirrel Gliders are nocturnal and display seasonal trends in feeding behaviour that are in accordance with phenological patterns consists of trees and shrubs (Goldingay & Sharpe 1998). Their diet includes acacia gum, eucalypt sap, nectar, honeydew and manna, lichens with invertebrates and pollen providing protein (NSW National Parks and Wildlife Service 1999b).

Squirrel Gliders are agile climbers and can glide for more than 50 metres in one movement. Nightly movements are estimated at between 300 metres and 500 metres. Home-ranges have been estimated as between 0.65 hectares and 8.55 hectares and movements tend to be greater for males than females. The home-range of a family group is likely to vary according to habitat quality and availability of resources, with more productive forests attributed to smaller home ranges (Quin 1995).

Specific impacts

This species was not recorded during field surveys in January 2013 however, this species is considered with a moderate or higher likelihood to utilise the Woodland habitats within the Modification Study Area, due to the presence of numerous habitat trees which provide suitable tree hollows and foraging resources. A total of 14 ha of potential habitat will be removed as a result of the Modification. This is made up of all the Woodland habitats in the Modification Study Area, including:

- Poplar Box Woodland.
- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

- White Box – White Cypress Pine shrubby open.

The removal of 14 ha of potential habitat including up to six hollow bearing trees will reduce the potential habitat and roosting opportunities for this species within the locality. However, a large tract of continuous bushland will remain in addition to many hollow bearing trees adjacent to the Modification sites.

16.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Boggabri Coal currently operates on the southern edge of Leard State Forest, which occurs as a >8,000 hectare remnant stand of vegetation, surround by an agricultural landscape between the Nandewar Range to the east, and the Pilliga Scrub to the west.

The proposed Modification will impact up on 14 ha of potential foraging and breeding resources.

If present within the Modification Study Area, this species is likely to persist in similar habitats outside the Modification Study Area. This species regularly swap den sites, occupy territories between 0.65 hectares and 8.55 hectares, and have nightly movements ranging from 300 metres to 500 metres.

It is considered unlikely that the species lifecycle will be affected by the proposed Modification itself; however, cumulative pressures from the BCEP within the Leard State forest area have been classified as a significant impact upon the lifecycle of the Squirrel Glider. The proposed Modification will add incrementally to the impact.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

14 ha of potential foraging and breeding habitat for this species would be affected by the proposed Modification. While this species was not recorded in the Modification Study Area during field surveys in January 2013, potential habitat resources have been identified in the area.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Remnant forest and woodland vegetation on private land adjacent to wooded areas along roads, tracks, creeks and paddock boundaries is essential to maintain connectivity across the landscape, to facilitate dispersal and to maintain foraging and breeding resources (NSW National Parks and Wildlife Service 2003).

Whilst 14 ha of potential habitat would be affected by the proposed Modification, thereby reducing the overall extent of potential habitat, connectivity would not be significantly impacted any more than currently occurs in the locality

Due to the relatively large home range and mobility of this species, this potential loss of habitat is unlikely to result in isolation of habitat any more than currently occur within the locality. The ability to access adjacent habitat, occurring in the surrounding landscape, outside the Modification Study Area will remain. Therefore, it is unlikely that any local population of Squirrel Glider would become fragmented or isolated from other areas of habitat any more than currently occurs within the Modification Study Area. However, the proposed Modification would reduce the overall extent of potential habitat and further exacerbate key threatening processes affecting this species.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The importance of habitat to be removed by the proposed Modification, in terms of the long-term survival of the Squirrel Glider, is not considered to be high. It will reduce the over-all occupancy area for the species and potentially affect a minor amount of important foraging and breeding resources including up to six hollow bearing trees.

Whilst the Modification alone is not considered a significant impact to the species, the cumulative impacts of the BCEP are considered to be important to the long-term survival of the Squirrel Glider in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The Department of Environment, Climate Change and Water maintains a register of critical habitat. Land within the Modification Study Area is not listed or considered as critical habitat.

Habitat being removed for the associated BCEP is considered to be ‘core habitat’’ for this species, as Leard State Forest effectively occurs as an island of remnant vegetation surrounded by a cleared landscape.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Neither a recovery nor threat abatement plan has been prepared for this species. The Office of Environment Heritage has identified 9 priority actions for this species. The proposed Modification does not interfere with any of these actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Squirrel Glider, the proposed Modification contributes to one key threatening process - clearing of native vegetation. As the proposed works will only make a minor contribution to this threatening process it is considered unlikely to significantly affect species.

Conclusion

No squirrel gliders were identified during diurnal surveys conducted in the Modification Study Area in 2013. However potential habitat resources were identified in the form of hollow bearing trees and foraging trees with in the vegetation communities within the Modification Study Area, including:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

It is assumed that 14 ha of potential habitat for the Squirrel Glider would be affected by the proposed Modification, which will increase the total area, impacted upon by BCEP and associated works. Given the species high mobility and ability to access adjacent remnant woodland in the locality and region, it is not likely that this species would be significantly affected by the proposed Modification itself – but it is considered to be affected by the cumulative impact of the proposed Modification and the BCEP.

17. Koala (*Phascolarctos cinereus*)

Status

The Koala is listed as Vulnerable under the *TSC Act 1995* and Vulnerable for the combined populations of Queensland, New South Wales and the Australian Capital Territory under the *EPBC Act 1999*.

Description

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kilograms and adult females weigh 5 to 8 kilograms (NSW National Parks and Wildlife Service 2002a).

Distribution, habitat and ecology

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of New South Wales, but now occurs in sparse and possibly disjunct populations (NSW National Parks and Wildlife Service 2003a).

Koalas are found in areas where there are suitable feed trees, ranging from open eucalypt woodlands to dense forests. Like other folivores, this species tends to be associated with forests growing on high-nutrient soils along river flats and drainage lines, most of which have been cleared for farmland (NSW National Parks and Wildlife Service 1999b). The suitability of forest and woodland communities as habitat for Koalas is influenced by the size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches. Koalas feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (Moore and Foley 2000).

Koalas are generally inactive for most of the day, feeding and moving mostly at night. They spend most of their time in trees, but will descend and traverse open ground to move between trees. They are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size (Lunney et al. 2000).

Females reach sexual maturity at approximately two years and can produce one offspring each year, generally in summer (Ellis et al. 2000). Following birth, the young lives in the pouch for 6 months and on leaving the pouch it remains dependent on its mother, riding on her back. Dispersal distances of young generally range from 1 11 kilometres, although movements in excess of 50 kilometres have been recorded (NSW National Parks and Wildlife Service 2003a).

In coastal northern New South Wales, populations have been estimated to range from one animal every 45 hectares to one every 4.5 hectares (average one every 20-25 hectares) (Melzer *et al.* 2000). Most young disperse at two to three years of age and females remain in their natal area. If no suitable habitat is found by young individuals then they become nomadic (Lunney *et al.* 2000).

Threats

Specific threats identified in the Koala Draft Recovery Plan (NSW National Parks and Wildlife Service 2003a) include:

- destruction of habitat by clearing for urban development, agriculture and mining, particularly on high nutrient content soils
- fragmentation of habitat by roads, urban development and agriculture, which creates barriers to movement, isolates individuals and populations, alters population dynamics and prevents gene flow and the ability to maintain recruitment levels
- mortality from attacks by dogs, road fatalities, fires, drought or other natural disasters, particularly in fragmented landscapes without suitable refuge areas
- degradation of habitat by fire, weed invasion, removal of important habitat trees and climate change
- in stressed populations, infection by Chlamydia, causing cystitis, kerato conjunctivitis, infertility and other symptoms.

Specific impacts

One Koala was recorded during the nocturnal spotlight field surveys for BCEP in 2010, in the area immediately adjoining the Modification Study Area. Potential habitat for Koalas exists in all the Box Gum woodland and the Poplar woodland within the Modification Study Area, including:

- White Box White Cypress Pine grassy woodland.
- Poplar Box Woodland.

In total, 14.0 ha of potential habitat would be removed as a result of the proposed Modification.

17.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No Koalas were observed during field surveys for the Modification, however habitat for this species was identified within the Modification Study Area. The low numbers of Koala recorded during field surveys for the BCEP in 2010 and lack of breeding females suggests that the areas proposed for the activities would not be considered core Koala habitat. The proposed Modification would remove a small area of 14.0 ha of habitat for the Koala. Koala habitat will be retained in adjacent areas, continuing to provide Koalas with sufficient foraging and breeding resources.

As such, it is unlikely that the removal of marginal foraging habitat would disrupt the local population of Koala and place it risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Two populations of Koala are currently listed as Endangered under Part 2 of Schedule 1 of the TSC Act (Hawks Nest and Tea Gardens area population and the Pittwater Local Government Area population). The Modification Study Area is outside the occurrence of these populations.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

(iii) the extent to which habitat is likely to be removed or modified as a result of the action proposed

The amount of marginal foraging habitat (which includes sparsely distributed feed trees) proposed for removal is considered to be relatively small. The habitat proposed for removal (approximately 14.0 ha) is insignificant in relation to the amount of undisturbed good quality habitat that will remain within the wider locality.

(iv) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

The home range of Koala varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size (Lunney *et al.* 2000). The feed trees proposed for removal occur in the isolated patches of Poplar Box Grassy Woodland located throughout the survey site and all the White box woodlands. Koala habitat will remain in the locality and the nature of clearing will not fragment habitat significantly.

(v) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The survey area provides a relatively small amount of suitable foraging habitat for Koalas. Foraging opportunities occurring in the Modification Study Area (i.e. *Eucalyptus populnea* and *E. albens* trees), will be retained within the wider locality. The proposed Modification would not impact habitat considered critical to the long-term survival of populations in the locality and is unlikely to further create a barrier to movement for the species.

The quality and importance of habitat proposed for removal is not considered to be significant for the local Koala population.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The NSW Minister for the Environment maintains a register of critical habitat. No critical habitat has been listed for this species to date. The land within the Modification Study Area is highly fragmented with weed incursions and contains only a moderate diversity of native understory species. This land does not contain significant foraging habitat for Koala. As such this area is unlikely to be critical to the survival of the species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has been prepared for the Koala (Department of Environment and Climate Change 2008) and aims to:

- reverse the decline of the Koala in NSW
- ensure adequate protection, management and restoration of Koala habitat
- maintain healthy and breeding populations of Koalas are present throughout their current range (NSW National Parks and Wildlife Service 2003a).

Specific objectives of the plan are to:

- conserve Koalas in their existing habitat
- rehabilitate and restore Koala habitat and populations
- develop a better understanding of the conservation biology of Koalas
- ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale
- manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care
- manage over-browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat.

Although the proposed Modification would include removal of a small area of fragmented habitat (14.0 ha) this is unlikely to affect the conservation of Koalas within the Modification Study Area or interfere with any of the other objectives of the draft recovery plan.

The proposed Modification would not interfere with the objectives or recovery actions proposed in the plan.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes are listed in Schedule 3 of the *TSC Act 1995*. The Koala is subject to a number of key threatening processes as well as other threats (Table 16.1).

The Proposed Modification would include clearing of native vegetation which is listed as a Key Threatening Process under the *TSC Act 1995*. However, the native vegetation to be affected is minimal and would include only a few individual *Eucalyptus populnea* a preferred feed tree, in several isolated patches Poplar Box Grassy Woodland. The proposed Modification would be unlikely to result in the increase in any other recognised threat for this species.

Table 16.1 Recognised threats for Koalas

Threat to species	Key Threatening Process	Threat likely to increase as a result of the Proposed Modification
Clearing of Native Vegetation	Yes	Yes
Predation by European Red Fox	Yes	No
Fragmentation of habitat through clearing for agriculture and development in coastal areas	No	No
Mortality from attacks by dogs, road fatalities, fires, drought or other natural disasters, particularly in fragmented landscapes without suitable refuge areas	No	No
Increase in weed invasion	Invasion by vines and scramblers is listed Invasion by *Lantana camara* has a preliminary listing	No
Stressed populations, infection by Chlamydia, causing cystitis, keratoconjunctivitis, infertility and other symptoms	No	No
Ecological consequences of high frequency fires	Yes	No
Degradation of habitat and removal of important habitat trees	No	No. Only a few young feed trees on the edge of a clearing would be removed.
Human caused climate change	Yes	No

Conclusion

No Koalas were recorded during field surveys for the proposed Modification however habitat in the form of feed trees (*E. poplar and E. albens*) were identified therein. One Koala was recorded during field surveys for the associated BCEP in 2010.

The proposed Modification requires the removal of 14.0 ha of woodland containing feed trees likely to be utilised by Koalas. Vegetation to be removed is not considered to be of great significance to the species, due to the abundance of retained habitat of similar or higher quality elsewhere in the wider locality. Therefore, it is considered unlikely that the proposed works will have a significant adverse effect on the species.

18. Pale-headed Snake (*Hoplocephalus bitorquatus*)

Status

The Pale-headed Snake is listed as Vulnerable under the TSC Act.

Description

The Pale-Headed Snake is a medium-sized largely tree-dwelling snake to 90 cm long. It is a uniform light brown or grey above with a white or cream band on the nape, bordered by a narrow blackish bar which may be solid, or broken in the middle. The top of the head is grey, and may have a series of black spots, which are most prominent along the edge of the white nape. The lips may have black vertical bars. The belly is creamy grey sometimes with darker flecks (Office of Environment and Heritage 2011b).

Distribution/habitat

It has a patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah. The species is found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. It favours streamside areas, particularly in drier habitats. It is known to shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees (Office of Environment and Heritage 2011b).

Ecology

This snake eats a variety of vertebrates, particularly tree-dwelling species, including frogs, geckos, skinks and bats. Examination of museum specimens revealed that frogs were the most common prey item (77 per cent of 26 prey items). Pale-headed Snakes hunt out in the open at night: however during the day they may remain active within their shelter and ambush other creatures also taking refuge.

Mating behavior has been observed mostly in captive individuals. Behaviour interpreted as courtship took place in both spring (October) and autumn (April), and actual mating in spring (September), summer (February) and autumn (March, May). In the wild, females with very large follicles have been found in mid-spring (October) and gravid females have been found in early summer (January). The species is live-bearing, and give birth to between 2 and 11 young measuring around 26-27 cm long.

Threats

Threats to the Pale-headed Snake include:

- clearing and fragmentation of habitat
- forestry practices which result in loss of old or dead trees
- too frequent burning for fuel reduction or grazing management which destroys old and dead trees and removes understorey vegetation
- illegal collection of snakes from the wild (Office of Environment and Heritage 2011a).

Recovery actions

A recovery plan has not been prepared for this species. However, the Office of Environment and Heritage has identified the following recovery measures:

- manage fire to protect old and dead trees and maintain understorey vegetation
- retain hollow-bearing trees as well as large, mature trees
- manage grazing to maintain understorey vegetation
- retain and protect stands of native vegetation, especially those with old and dead trees and along creek lines
- establish and protect forested wildlife corridors
- keep only captive-bred snakes in captivity and seek a reptile-keeper's licence from the DEC (Office of Environment and Heritage 2011b).

Specific impacts

No Pale-headed Snakes were recorded within the Modification Study Area. Potential habitat for the Pale-headed Snake exists in the riparian and woodland habitats within the Modification Study Area. These habitats include the following:

- White Box Grassy Woodland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

In total, 14 ha of potential habitat would be removed as a result of the proposed Modification,

18.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

This species requires large hollow bearing trees to complete vital aspects of its lifecycle such as reproduction. Six hollow bearing trees will be removed by the proposal, which may represent marginal potential sheltering and breeding habitat for the Pale-Headed Snake. Given that these trees are located in small areas of native vegetation isolated by grazed paddocks, and elevated from riparian foraging habitat, they are less likely to be utilised by the species than those located in larger areas of habitat in the locality or trees located near streams.

Although he cumulative effect of the proposed Modification and the BCEP may affect the local population, given the relatively small amount of potential habitat to be removed, it is unlikely that local populations of this species would be placed at a greater risk of extinction by the modification alone.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

It is estimated that approximately 14 ha of suitable habitat would be affected by the proposal, including six hollow-bearing trees.

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Approximately 14 ha of potential habitat is likely to be cleared in the study area, and whilst potential habitat would be affected by the proposed Modification, thereby reducing the overall extent of potential habitat, connectivity would not be significantly impacted any more than currently occurs in the locality.

It is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing within the study area.

iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal will result in the removal of approximately 14 ha of potential habitat for the Pale-Headed Snake which includes six hollow bearing trees. Little increase in fragmentation is expected from the proposed modification in light of the fragmented landscape surrounding the study area. Some small increase to isolation of habitat patches will occur. However, no impacts to dispersal are predicted for this species.

The importance of the habitat to be removed by the proposal in terms of the long-term survival of the Pale-Headed Snake in the locality is likely to be low. The habitat on site is considered to be moderately suitable when compared to the habitat present in the broader locality. The area of potential habitat to be removed is unlikely to be of critical importance to the long-term survival of the Pale-Headed Snake as it is small in relation to the extent of available habitat that occurs in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been listed for the Pale-headed Snake to date. It is estimated that approximately 14 ha of suitable habitat would be affected by the proposed Modification: Suitable habitat occurring in the Modification is not considered critical to the survival of these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

There is no recovery plan for the Pale-headed Snake as produced under the TSC Act. The Office of Environment and Heritage has identified recovery measures of which two will be interfered with by the Project:

- retain hollow-bearing trees as well as large, mature trees
- retain and protect stands of native vegetation, especially those with old and dead trees and along creek lines (Office of Environment and Heritage 2011b).

Owing to the small area of potential habitat for the Pale-Headed Snake to be removed and the extent of similar or greater quality habitat within the surrounding landscape, the proposed Modification is unlikely to interfere substantially with the recovery of the species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The action proposed constitutes the following key threatening processes, as listed under the *TSC Act 1995*:

- clearing of native vegetation
- loss of hollow-bearing trees.

Considering the cumulative impact the BCEP and proposed Modification, these key threatening processes could negatively impact the Pale-headed Snake. However, the proposed Modification would only affect a small area of suitable habitat in relation to the availability to these habitats in the broader locality.

Threat abatement plans have not been prepared for these processes.

Implementation of mitigation measures are recommended, such as the installation of nest boxes to compensate for the loss of the hollow-bearing trees.

Conclusion

Taking into consideration the significant impact criteria outlined above, and based on the fact that the potential habitat that would be affected (14 ha) is only likely to make up a small proportion of the habitat in the locality, the proposed Modification is unlikely to result in a significant impact to the Pale-Headed Snake.

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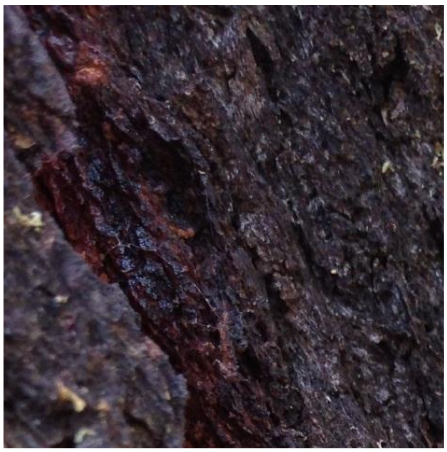

Appendix F

Limitations

Appendix F - Limitations

Reliance on externally supplied data

In preparing this study, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations. Except as otherwise stated in the study, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this study (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

Study for client use

This environmental impact study has been prepared for the exclusive use of the client and no other party. Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with in this study, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in this study (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in this study). Other parties should not rely upon the study or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

Field survey limitations

No sampling technique can totally eliminate the possibility that a species is present on a site. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present on site during surveys. The conclusions in this report are based upon data acquired for the site and the environmental field surveys and are, therefore, merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species. It should be recognised that site conditions, including the presence of threat-listed species, can change with time.

During the fieldwork undertaken for this study overnight temperatures were moderate, and this may have limited the activity (and therefore detectability) of some species of frogs, reptiles, and small mammals. However, if suitable habitat was observed, a precautionary approach was taken and it was assumed that the species was present (refer section 2.6 for likelihood of occurrence assessment).

Other limitations

To the best of Parsons Brinckerhoff's knowledge, the Project presented and the facts and matters described in this study reasonably represent the client's intentions at the time of preparation of the study. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may have resulted in a variation of the Project and of its possible environmental impact.

Parsons Brinckerhoff will not be liable to update or revise the environmental impact study to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the environmental impact study.