Boggabri Coal Expansion Project

Ecological Assessment for Boggabri Coal Project Modification

Modification 5

30 October 2015

PARSONS BRINCKERHOFF

Document information
Client: Boggabri Coal Expansion Project Title: Ecological Assessment for Boggabri Coal Project Modification Subtitle: Modification 5 Document No: 2119017A-ENV-REP-001 RevC Date: 30 October 2015

Rev	Date	Details
A	22/06/2015	Draft
B	29/06/2015	Amended with client comments
C	06/08/2015	Amended with client comments
D	30/10/2015	FINAL

Author, Reviewer and Approver details			
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Glossary

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: ▪ genetic diversity — the variety of genes (or units of heredity) in any population ▪ species diversity — the variety of species ▪ ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. 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 Conservation 2004). 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.
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 (Ensbey & Johnson 2009). 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 2013).
Introduced	Not native to the area: not indigenous (Ensbey & Johnson 2009). 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 Conservation 2004). 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 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	10 km within the vicinity of the modification study area boundary.
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.
MIA	Mine Infrastructure Area
modification study area	Proposed modifications that will occur outside the Project Boundary which have not been assessed under Project Approval (09_0182). These modifications will require the removal of native understorey vegetation and/or ground disturbance
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).
Project Boundary	Project Boundary describes the area approved under Project Approval 09_0182.
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 Threatened 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 (Office of Environment and Heritage 2012a).
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.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, endangered or critically endangered (collectively referred to as threatened) under the 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 characterised by high seed production and the ability to colonise disturbed ground quickly (Ensbey & Johnson 2009). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

1. Introduction

Boggabri Coal Operations Pty Limited (BCOPL) is majority owned (80%) by Idemitsu Australia Resources Pty Limited (Idemitsu), a subsidiary of Japanese company Idemitsu Kosan Pty Ltd which operate the Boggabri Coal Mine. The Boggabri Coal Mine (BCM) is located 15 kilometres (km) north-east of the township of Boggabri in the north-west Region of NSW Following the grant of PA 09_0182 (the Project Approval), Boggabri Coal has conducted detailed design studies for the infrastructure required to facilitate the Boggabri Coal Project (the Project). These studies have identified the need for amendments to the conceptual Project layout for which the Project approval was originally granted, including installation and operation of groundwater bores and associated infrastructure (the proposed modification).

Parsons Brinckerhoff Australia Pty Ltd (Parsons Brinckerhoff) was 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).

This report provides an ecological assessment of the proposed modification. This report outlines field survey methods, the existing environment of the modification study area, potential impacts on threatened biodiversity associated with the proposed modification.

The proposed modification will involve the construction and operation of production bores and associated infrastructure on the Heathcliffe, Cooboobindi, Roma, Belleview and Victoria Park properties including 11kV power lines, above and below ground pipelines and access tracks.

The proposed modification occurs within agricultural tenures, the Namoi Biodiversity Offset Area and within the mine infrastructure area (MIA). Within the Namoi Biodiversity Offset Area the proposed modification largely occurs in areas mapped for habitat restoration, but also includes areas of corridor enhancement and habitat management (refer to Figure 1.1).

This report examines flora and fauna assemblages as well as habitats within the modification study area and identifies impacts to the ecological aspects including species, populations and communities within the Project modification. 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).

Providing background to this EA is a number of related ecological studies which were undertaken for the Boggabri Coal Project and are listed in Section 2.3. 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.

1.1 Legislative context

This report supports an EA for the modification, which 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:

- *Environmental Planning & Assessment Act 1979* (EP&A Act)
- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

- *Threatened Species Conservation Act 1995* (TSC Act)
- *Native Vegetation Act 2003* (NV 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 either in this assessment or in the EA.

1.2 Biodiversity offsets

A Biodiversity Offsets Strategy (BOS) was prepared for the continuation of Boggabri Coal Mine (2010b). 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 2008a) 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 are within the identified biodiversity offsets in the Boggabri Coal Mine BOS (2010b). The modification will result in new impacts outside the current project boundary (refer to Figure 1.1). These are associated with the construction and operation of production bores and associated infrastructure on the Heathcliffe, Cooboobindi, Roma, Belleview and Victoria Park properties) not subject to assessment under the existing PA 09_0182. These new impacts will require additional offsets and are discussed in detail in Section 7. These purposed Project Boundary modifications require revisions to the Biodiversity Offset Strategy approved under Project Approval 09_0182.

While Boggabri Coal is committed to providing offsets for the impacts of the modification in accordance with the approved BOS, the recent NSW Biodiversity Offsets Policy for Major Projects (Offset Policy 2014) has been considered and is discussed in Section 7.

1.3 Proposed modification

The proposed modification will involve an extension of the Project Boundary for the construction and operation of permanent production bores and associated infrastructure (i.e. access tracks, 11kV power lines and above and below ground water pipelines).

The production bores will supply water resources to meet Boggabri Coal Mine's water demands. The locations of the proposed production bores are illustrated in Figure 1.2. The installation of the proposed bores will involve the following activities:

- **Establishment of access tracks —** generally located in existing farm access tracks, in some locations some grading or stabilisation works may be required to ensure the tracks are suitable for use by construction equipment and ongoing maintenance.
- **Establishment of bore compounds —** involves installation of temporary fencing, erosion and sediment controls and equipment storage areas.
- **Drilling of bores —** at each nominated bore site, a temporary test production bore and monitoring piezometer has been installed with approval from NSW Department of Primary Industries, Office of

Water. This assessment is being undertaken to convert the existing bore into a permanent groundwater production bore and monitoring piezometer.

- **Installation of power lines —** overhead 11 kV power lines will be installed to each bore from existing power lines located throughout the modification study area. Overhead 11kV power lines will be constructed on wooded support poles along each transfer pipeline to power the production bores and transfer pumps. These power lines will connect to the closest existing 11 kV power lines. A small section of underground power line will be installed within the Roma property (refer Figure 1.2).
- **Installation of water pipelines —** above and below ground water pipelines will be installed between each bore and the proposed tank farm or the MIA. The above ground pipelines are polyvinyl (PVC) pipelines of 280 mm notional diameter and will be installed in the majority of the non-flood prone land between the groundwater bores and the existing water transfer pipeline running along the haul road.
- **Construction of the tank farm —** established at a site on the private haul road (refer to Figure 1.2) and this will consist of several above ground water storage tanks and a water transfer pump that will pump water collected from the production bores to the MIA.

1.4 Definitions used in this report

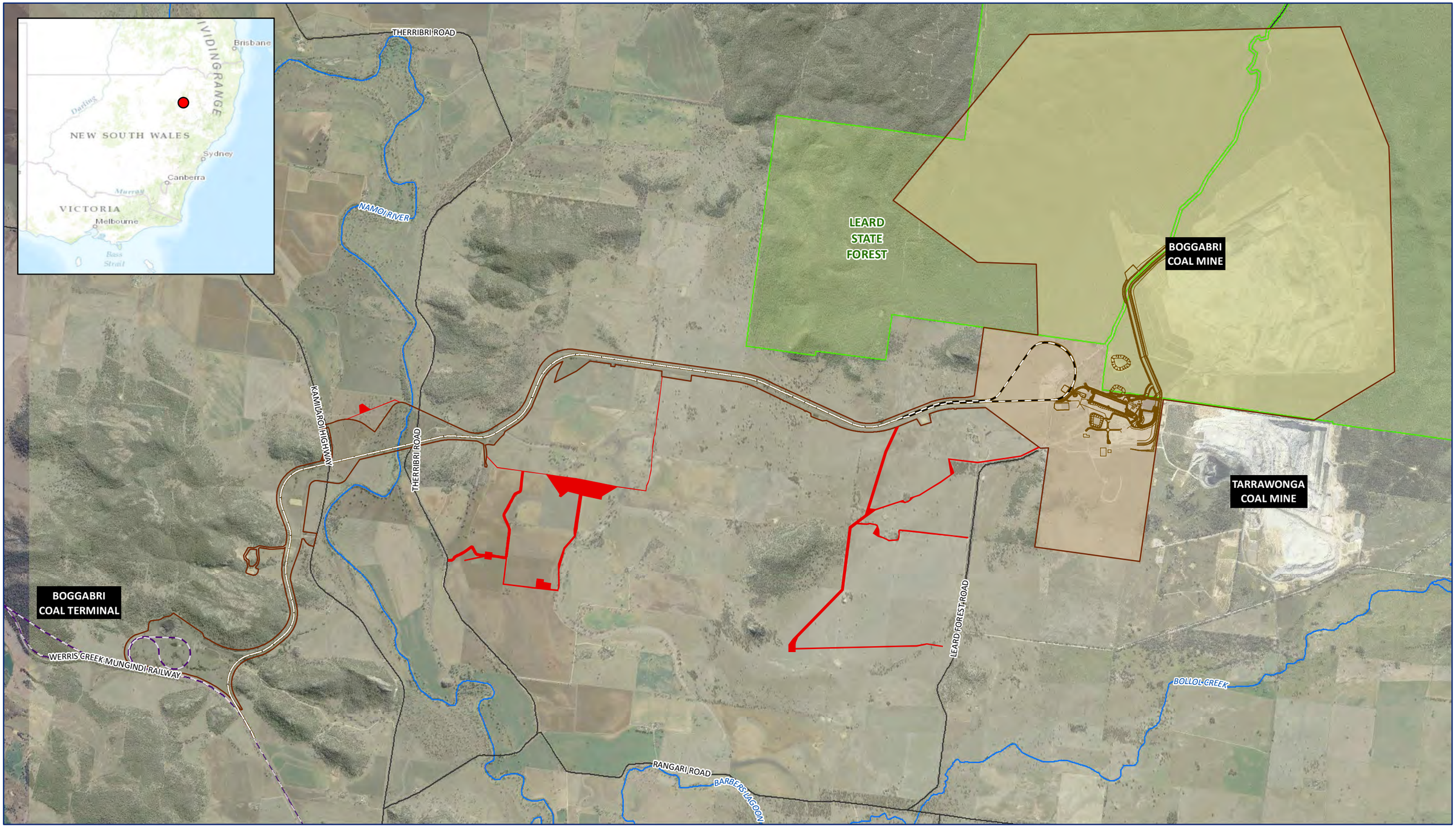
For the purpose of this report the following definitions apply:

- **Project Boundary** area approved under Project Approval (09_0182).
- **Modification study area** proposed modifications that will occur outside the Project Boundary which have not been assessed under Project Approval (09_0182). These modifications will require the removal of native understorey vegetation and/or ground disturbance.
- **Locality** 10 km within the vicinity of the modification study area boundary.
- **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).

Location information for the modification study area is outlined in Table 1.1.

Table 1.1 Modification study area location information

Location information	Modification study area
Bioregion	Brigalow Belt South, Namoi sub-region (Thackway & 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



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- Existing mine infrastructure
- Existing/operational rail
- Proposed rail
- Road
- River/creek
- MOD 5 study area
- Boggabri Project Approval Area
- Boggabri Coal Mine
- State Forest
- Leard State Conservation Area

0 0.5 1 1.5 km

Figure 1.1
Project location

MAP A

MAP B

MAP C

HEATHCLIFFE (HC01)

NAMOI RIVER

DAISYMEDE (DM1)

BELLEVIEW 1 (BCBF8)

BELLEVIEW 2 (BCBF10)

COOBOOBINDI

ROMA

THERRIBRI ROAD

LEARD FOREST ROAD

GOONBRI ROAD

VICTORIA PARK (VP02)

0 0.25 0.5 0.75 km

Groundwater bores
Tank farm
Proposed Power line
Proposed pipeline
Access road
Road
Drainage
Rail line
MOD 5 study area
Boggabri Project Approval Area
Flood prone land

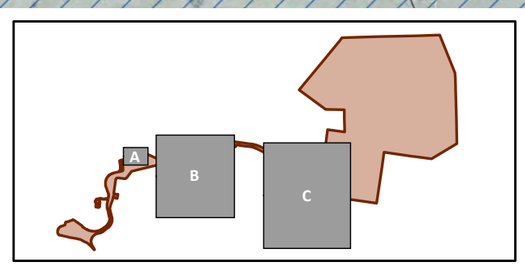

Figure 1.2
Modification study area and impacts

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1.5 Study aims

The overall objective of this study was to assess the impacts on the biodiversity values of the proposed modification within 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 of threatened species, populations and communities (biodiversity) listed under the FM Act, TSC Act and EPBC Act within the modification study area.
- undertake significance assessments for threatened biodiversity that occur or have potential habitat within the modification study area.
- propose mitigation measures to minimise impacts on the ecological values associated with the construction and operation phases of the modification.

2. Methodology

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 mine and surrounding area, and a review of previous studies (refer to Section 2.3).

2.1 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2015). 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 Parsons Brinckerhoff vegetation mapping of the study area (2010a) adapted from the broad scale vegetation mapping of the Vegetation of the Namoi Catchment Management Authority (Eco Logical Australia 2008) and the threatened ecological community names where applicable. Flora species that are not native are marked with an asterisk.

Names of vertebrates used in this document follow the Australian Faunal Directory (Department of the Environment 2015) and as used in the Bionet Atlas of NSW Wildlife (Office of Environment and Heritage 2015). 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.

2.2 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2.1.

Table 2.1 Contributors and their roles

Name	Qualification	Role
Tanya Bangel	BEnvSc (Hons)	Ecologist – botanical and fauna surveys, report preparation
Debbie Landenberger	BSc (Hons)	Technical review
Alex Cockerill	BSc (Hons)	Project manager, technical input and review
Rob Suansri	BSc, BEco	Geospatial consultant

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.

2.3 Desktop assessment

The aim of the desktop background research was to identify threatened flora and fauna species, populations and ecological communities; Commonwealth listed Migratory species or critical habitat recorded previously or predicted to occur in the vicinity of the modification study area.

This allowed the known habitat characteristics to be compared with those of the modification study area to determine the likelihood of occurrence of each species or population. These results informed the identification of appropriate field survey effort to focus on the groups most likely to be present.

The desktop assessment included a review of:

- research papers, books and other published data
- aerial photographs and topography maps
- the '*A Vegetation Map for the Namoi Catchment Management Authority*' (Eco Logical Australia 2008)
- OEH Vegetation Types Database (Office of Environment and Heritage 2012b)
- database searches (refer to Table 2.2 and Appendices C and D)
- existing documentation for the continuation of Boggabri Coal Mine and the surrounding area including:
  - Due Diligence Assessment – Proposed Pipeline and Power Infrastructure Alignment (2014b)
  - Ecological Assessment for Boggabri Coal Project modification (2013)
  - Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (2010a).
  - Boggabri Coal – Biodiversity Management Plan (2012)
  - Preliminary vegetation mapping and survey report for Boggabri Coal lease (2009)
  - Flora and Fauna Summary of the Boggabri Coal Project (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)
  - Continuation of Boggabri Coal Mine – Biodiversity Offset Strategy (2010b)
  - Continuation of Boggabri Coal Mine – Worst Case Cumulative Impact Scenario for Biodiversity (2010c)
  - Continuation of Boggabri Coal Mine – Response to Submissions (2011b)
  - Continuation of Boggabri Coal Mine – Matters of National Environmental Significance (2011c)
  - Boggabri Coal Expansion Project: Ecological Assessment for Boggabri Coal Project modification - modification 4 (2014a).

Table 2.2 Database searches

Database	Date of search	Search area	Reference
Bionet Atlas of NSW Wildlife	17 June 2015	10 km locality search	Office of Environment and Heritage (2015)
PlantNet Database	17 June 2015	10 km locality search around Narrabri Shire Council	Royal Botanic Gardens (2015)
EPBC Protected Matters Search Tool	17 June 2015	10 km locality search	Department of Environment (2015)
NSW Fisheries Threatened and Protected Species – records viewer	17 June 2015	Namoi Catchment Management Authority	Department of Trade & Investment Regional Infrastructure & Services (2015)
Noxious Weeds Database	17 June 2015	Narrabri Shire Council	Department of Primary Industries (2015)

2.4 Field survey

The modification study area (refer Figure 1.1) was inspected during daylight hours by a suitably qualified ecologist on 10 June 2015, 28 January 2014, 18 March 2014, 13 October 2014 and 24, 25 and 26 November 2014. These surveys sought to assess the extent and condition of vegetation and fauna habitat contained within the modification study area, specifically threatened species, populations and ecological communities, and assess the impacts associated with the proposal in regards to the identified biodiversity.

2.4.1 Flora surveys

2.4.1.1 Species of plant and vegetation communities

A walk over inspection, conducted throughout the proposed modification study, identified area with floristic composition and structure, dominant species and vegetation communities. The floristic diversity, possible presence of threatened species and identity of vegetation communities was assessed using quadrat and random meander surveys.

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

- threatened ecological communities and flora listed under the EPBC Act, TSC Act or FM Act
- potential flora and fauna habitat related to flora values present on site
- significant habitat for threatened and migratory species or locally significant species.

The presence of threatened 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.

Targeted threatened flora searches for *Tylophora linearis* were undertaken in habitat within the proposed modification study area in accordance with the random meander technique (Cropper 1993). These surveys were undertaken within the May – November flowering period for this species.

Twelve (12) flora quadrats (20 X 20 m) were used within the modification study area (refer Figure 3.1) to identify the presence/absence of the native vegetation communities present. The flora quadrats were in accordance with the BioBanking Operation Manual (Office of Environment and Heritage 2014). Attributes recorded during the random meander transects included variation in species composition and vegetation structure, the presence or absence of threatened or noxious species of plant and boundaries between vegetation communities.

2.4.1.2 Vegetation condition

The condition of vegetation was assessed using parameters such as structural intactness, native species diversity, evidence of disturbance, weed invasion and plant health. Random meander surveys were the primary method of data collection for the vegetation community identification and condition assessment.

Three categories were used to describe the condition of vegetation communities:

- **Good:** vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact groundcover, shrub and canopy layers.
- **Moderate:** vegetation generally still retains its structural integrity, but has been disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants.
- **Poor:** vegetation that has lost most of its species and is significantly modified structurally. Often such areas have a discontinuous canopy of the original tree cover, with very few shrubs. Exotic species, such as introduced pasture grasses or weeds, replace much of the indigenous ground cover. Environmental weeds are often co dominant with the original indigenous species.

2.4.2 Fauna surveys

Fauna survey was conducted via opportunistic surveys, hollow tree survey and habitat assessment. Each of the survey techniques is described in further detail in the following sections.

2.4.3 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 1998). All inspected ground shelter was returned to its original position.

2.4.3.1 Hollow-bearing tree survey

Hollow-bearing trees were recorded on a hand held GPS whereby the number of tree hollows was based on visual inspection.

2.4.3.2 Fauna habitat assessment

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species identified to occur within the locality from the literature and database review) occurring within the modification study area. Fauna habitat characteristics assessed included:

- Structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources.
- Presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles.
- Presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians.
- Presence of waterways (ephemeral or permanent) and water bodies.

A general fauna habitat features traverse was undertaken throughout the modification study area during the survey covering all major native vegetation occurrences. During the traverse, opportunistic recordings of species were made through incidental sightings, aural recognition of calls and observing indirect evidence of species presence (such as scats, feathers, hair, tracks, diggings and burrows).

2.4.3.3 Fauna habitat condition

The following criteria were used to evaluate the condition of 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 or greatly reduced (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 clearing in the past.

2.5 Likelihood of occurrence assessment

The likelihood of threatened and migratory species and threatened populations occurring within the modification study area were assessed against the criteria outlined in Table 2.3.

Species subject to likelihood of occurrence assessments were those identified during the desk-top and field based investigations and/or the professional opinion of contributors to this assessment.

Table 2.3 Likelihood of occurrence assessment

Likelihood-of-occurrence	Criteria
Low	▪ have not been recorded previously in the modification study area and surrounds which are beyond the current known geographic range ▪ are dependent on specific habitat types or resources that are not present in the modification study area ▪ are considered extinct in the locality
Moderate	▪ have been recorded previously in the modification study area and surrounds infrequently (i.e. vagrant individuals) ▪ 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 utilise resources within the modification study area opportunistically during variable seasons or migration

Likelihood-of-occurrence	Criteria
High	■ have been previously recorded in the modification study area ■ are dependent on 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 modification study area or surrounds during regular seasonal movements or migration
Recorded	■ recorded in the modification study area during current field study

2.6 Significance assessments

Significance assessments were carried out for threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) or *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) that were known or predicted to occur in the proposal locality (within a 10 km radius from the modification study area), with a moderate to high likelihood of occurring within the modification study area, based on suitable habitat and were likely to be impacted by the construction.

For species or communities listed under the TSC Act, significance assessments were completed by addressing the factors of Part 5A of the *Threatened species assessment guidelines The assessment of significance* (Department of Environment and Climate Change 2007) (refer to Section 8 and Appendix E) . For species or communities listed under the FM Act, significance assessments were completed by addressing the factors outlined in *Threatened species assessment guidelines, The assessment of significance* (NSW Department of Primary Industries 2008). For species or communities listed under the EPBC Act, significance assessments were completed in accordance with the *Significant Impact Guidelines 1.1 Matters of National Environmental Significance (Department of Environment 2013)*.

2.7 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 on data acquired for the site and the environmental field surveys. Therefore, conclusions are indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species. Also, that site conditions, including the presence of threatened species, can change with time.

Where surveys were conducted outside the optimal time for detecting a particular species, or field surveys were of limited scope, a precautionary approach was taken and we assumed the species was present if suitable habitat was observed.

3. Landscape context

3.1.1 Bioregion

The modification study area is located in the Brigalow Belt South bioregion. The region forms the southern extremity of the Brigalow Belt, however is not dominated by Brigalow (*Acacia harpophylla*). The signature trees occurring 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.

3.1.2 Brigalow and Nandewar Western Regional assessment

The modification is located within an area previously assessed at a broad scale under the Brigalow and Nandewar Western Regional Assessments (WRA). The Boggabri Coal Project is largely restricted to Leard State Forest, which was not identified for conservation in the WRA regional assessments.

3.2 Vegetation communities

The field survey and desktop assessment identified that the vegetation within the modification study area was comprised of five (5) native vegetation communities previously described by (2009), the distribution of which is related to geological, topographical, and geomorphological characteristics and previous land use (refer to Table 3.1 and Figure 3.1). In addition, one (1) non-native vegetation community was recorded. The vegetation communities identified in the modification study area are listed in Table 3.1.

Detailed summaries of these communities including structure and dominant species recorded and vegetation habitat assessments are provided below. Copies of the field data sheets for the 12 BioBanking quadrats and transects are provided in Appendix F.

Table 3.1 Identified vegetation communities

Existing vegetation mapping community equivalent (Parsons Brinckerhoff 2009)	Field Verified Vegetation community (Office of Environment and Heritage 2012b)[5]	Local broad-scale mapping (Eco Logical Australia 2008)	Threatened ecological community	OEH Vegetation class (Gibbons *et al.* 2008)	OEH Vegetation formation class (Gibbons *et al.* 2008)
Weeping Myall Woodland[1]	NA219: Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (PCT27)	RVC75: Weeping Myall open woodland, Darling Riverine Plains, Brigalow Belt South and Nandewar	E	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
Pilliga Box – Poplar Box – White Cypress Pine grassy woodland	NA179: Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (PCT88)	RVC32: Pilliga Box – Poplar Box – White Cypress Pine/grass woodland on sandy loams, Darling Riverine Plains and Brigalow Belt South	-	Dry Sclerophyll Forests (Shrub/grass subformation)	Pilliga Outwash Dry Sclerophyll Forests

Existing vegetation mapping community equivalent (Parsons Brinckerhoff 2009)	Field Verified Vegetation community (Office of Environment and Heritage 2012b)[5]	Local broad-scale mapping (Eco Logical Australia 2008)	Threatened ecological community	OEH Vegetation class (Gibbons *et al.* 2008)	OEH Vegetation formation class (Gibbons *et al.* 2008)
River Red Gum riparian woodlands and forests & derived native grasslands[2]	NA336: River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion (PCT438)	RVC73: River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar.	E	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
Derived Native Grasslands[3]	NA179: Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams mainly of the temperate (hot summer) climate zone (PCT88)	RVC32: Pilliga Box – Poplar Box – White Cypress Pine/grass woodland on sandy loams, Darling Riverine Plains and Brigalow Belt South	-	Dry Sclerophyll Forests (Shrub/grass subformation)	Pilliga Outwash Dry Sclerophyll Forests
Plains Grassland[4]	NA181: Plains Grass - Bluegrass grassland of the Nandewar and Brigalow Belt South Bioregions (PCT27)	RVC26: Dry grasslands of alluvial plains, Darling Riverine Plains and Brigalow Belt South		Western slopes grassland	Grasslands
Exotic grassland with scattered trees	-	-	-	-	-

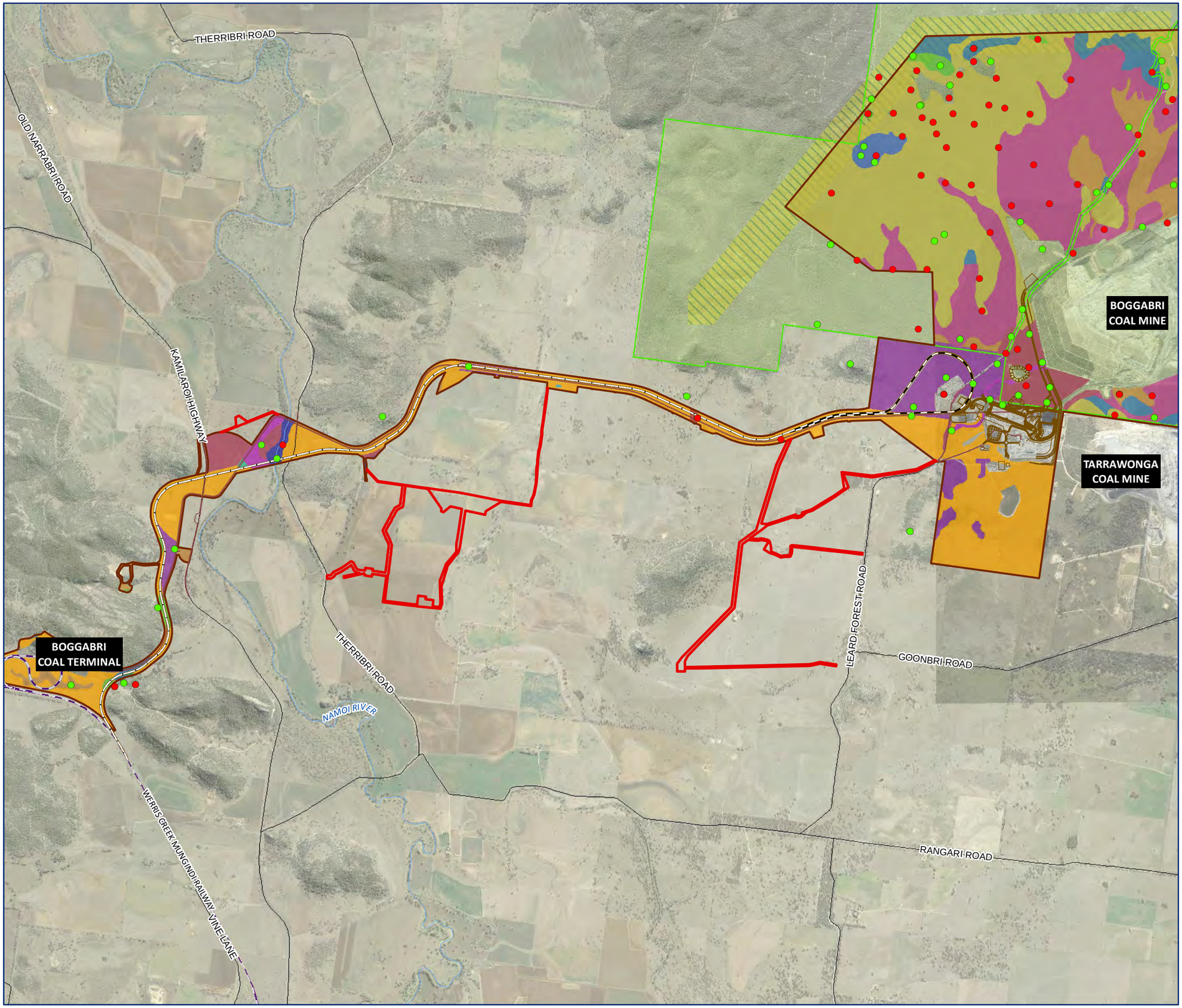
(1) E = Endangered ecological community, Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions (TSC Act)
E = Endangered Ecological Community Weeping Myall Woodland (EPBC Act).

(2) E = Endangered under the Fisheries Management Act 1994, Natural Drainage System of the Lowland Catchment of the Darling River.

(3) This community generally occurred as native grassland with scattered trees.

(4) This community does not meet criteria for Native Vegetation on Cracking Clay Soils of the Liverpool Plains (TSC Act) or Critically Endangered ecological community, Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (EPBC Act).

(5) NA refers to Biometric Type for the Namoi CMA, and PCT refers to Plant Community Types as set out by OEH.



Flora Survey Quadrats (Jan 2009)
Flora Survey Quadrats (April 2009)
Mine infrastructure
Road
Existing/operational rail
Proposed rail
MOD 5 study area
Boggabri Project Approval Area
Biodiversity offset corridor
Leard State Forest
Leard State Conservation Area
Blue-leaved Ironbark heathy woodland
Derived native grassland
Exotic grassland
Farm dams
Narrow-leaved Ironbark - Brown Bloodwood - White Cypress Pine shrubby open forest
Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland
Plains Grassland
River Red Gum riparian woodlands and forests
Silver-leaved Ironbark heathy woodland
Weeping Myall grassy open woodland
White Box - Blakelys Red Gum - Melaleuca riparian forest
White Box - Narrow-leaved Ironbark - White Cypress Pine grassy open forest
White Box - Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
White Pine - Narrow-leaved Ironbark Shrub - Grass Open Forest (SW)
Yellow Box - Blakelys Red Gum grassy woodland

0 0.5 1 1.5 km

Figure 2.1
Flora values within the project boundary

3.2.1 Weeping Myall Woodland

Weeping Myall Woodland is a native low open woodland vegetation community that reaches approximately 10 m in height. This community was recorded as isolated two patches of remnant vegetation which has been subjected to heavy disturbance as a result of agricultural activities and road infrastructure. This vegetation community was recorded immediately adjacent Therribri Road (refer to Figure 3.1).

The disturbance of much of this community has resulted in the ground layers containing both native and exotic grasses and forbs. The community does however contain a native canopy cover characteristic of the Weeping Myall Woodland (Table 3.2) which is listed as an Endangered Ecological Community under both the TSC Act and EPBC Act.

Table 3.2 Vegetation Characteristics of Weeping Myall Woodland

Weeping Myall Woodland			
Description			
Conservation significance	**High**. This community is representative of the Endangered Weeping Myall Woodlands listed under both the TSC Act and EPBC Act. Refer to Section 4.1 for further detailed assessment.		
Condition	**Moderate.** This community is subject to high disturbance from previous and current land use including agricultural activities, neighbouring road infrastructure, vegetation clearing, edge effects and weed invasion. This community contains a canopy of remnant mature and juvenile *Acacia pendula.* The ground layer was generally dominated by native groundcover species and some exotic species including numerous perennial grasses and herbs.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	4-8	0-40	*Acacia pendula.*
Shrub layer	0.4-2	0-10	Juvenile *Acacia pendula* and in some areas (predominantly on the periphery of the community) *Sclerolaena muricata* and *Lycium ferocissimum*.*
Ground cover	0.1-1.6	40-90	*Austrostipa verticillata, Austrostipa aristiglumis, Enteropogon articularis, Sporobolus creber, Vittadinia sulcata, Euchiton sphaericus, Chloris truncata, Rytidosperma bipartitum, Dichanthium sericeum,* and exotic pasture grasses and herbaceous weeds including *Sida rhombifolia**, *Hypochaeris radicata*, Cirsium vulgare*, Brassica sp.*, Echium plantagineum*, Avena fatua*, Plantago lanceolata** and *Bidens pilosa**.

Weeping Myall Woodland

3.2.2 Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland

Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland is a native open woodland vegetation community that was recorded as isolated patches of remnant trees within a heavily disturbed landscape as a result of agricultural activities. This community occurred as isolated patches of remnant vegetation near the Roma, Belleview and Victoria Park bore pipelines (refer to Figure 3.1 and Table 3.3). The pipeline will be installed above ground through these sections and therefore no ground penetration will be required.

The majority of this community was heavily disturbed by agriculture and as a result is dominated by a combination of both native and exotic grasses and forbs. The community does however contain a native canopy cover characteristic of the Pilliga Box – Poplar Box – White Cyprus Pine grassy woodland.

Table 3.3 Vegetation Characteristics of Pilliga Box – Poplar Box – White Cypress Pine Grassy Woodland

Pilliga Box – Poplar Box – White Cyprus Pine grassy Woodland			
Description			
Conservation significance	Not consistent with any endangered ecological communities.		
Condition	**Low - Moderate.** This community is subject to high disturbance from previous and current land use including agricultural activities, vegetation clearing, edge effects and weed invasion. This community contains a sparse canopy of remnant and occasional planted species such as *Eucalyptus pilligaensis* and *Eucalyptus populnea* subsp. *bimbil.* The ground layer was generally dominated by native and exotic groundcover species including numerous perennial grasses and herbs.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	6-14	0-30	*Eucalyptus pilligaensis* and *Eucalyptus populnea subsp. bimbil.*
Shrub layer	0.4-2	0-10	Occasional exotic shrub species such as *Sclerolaena birchii** and juvenile *Eucalyptus populnea* subsp. *bimbil**

Pilliga Box – Poplar Box – White Cyprus Pine grassy Woodland			
Ground cover	0.1-1.8	0-100	*Austrostipa bigeniculata, Austrostipa verticillata, Austrostipa aristiglumis, Chloris truncata, Panicum effusum, Rytidosperma bipartitum, Dichanthium sericeum,* and exotic pasture grasses and herbaceous weeds including *Sida rhombifolia**, *Hypochaeris radicata*, Cirsium vulgare*, Brassica sp.*, Echium plantagineum*, Avena fatua*, Plantago lanceolata*, Centaurea calcitrapa** and *Bidens pilosa**.

3.2.3 River Red Gum riparian woodlands and forests

This community was recorded within the study area as part of the Boggabri Coal Mine Biodiversity Offsets Audit (Niche Environment and Heritage 2015). This community occurred predominantly as derived native grassland in proximity to the Heathcliffe groundwater bore along the Namoi River and as two additional patches located near the Daisymede and Belleview groundwater bores. The community occurred predominantly as derived native grassland and a small area of remnant trees within floodplain depressions throughout the areas described above (refer to Figure 3.1). Agricultural activities such as grazing, cropping and vegetation clearance have heavily disturbed the community, which generally occurred adjacent to exotic grassland.

The majority of this community is dominated by a combination of native and exotic grasses and forb but retains a native canopy cover is some areas characteristic of the River Red Gum riparian woodlands and forest. This community occurred on the floodplains of the Namoi River and therefore is considered to be part of the endangered community listed under the FM Act of Natural Drainage System of the Lowland Catchment of the Darling River.

Table 3.4 Vegetation Characteristics of River Red Gum riparian woodland

River Red Gum riparian woodlands and forests			
Description			
Conservation significance	**High**. This community is representative of the endangered ecological community listed under the *Fisheries Management Act 1994*, Natural Drainage System of the Lowland Catchment of the Darling River.		
Condition	The community is subject to high disturbance from previous and current land use including agricultural activities, vegetation clearing, edge effects and weed invasion. **Low.** Derived native grassland characterised by groundcover species characteristic of this community. **Moderate.** Highly disturbed vegetation community with a sparse canopy of remnant *Eucalyptus camaldulensis* and the occasional *Eucalyptus melliodora*. The ground layer was dominated by exotic groundcover species as a result of pasture grassing including numerous perennial grasses and herbs such as *Vicia sativa* subsp. *nigra*, Hypochaeris radicata*, Cirsium vulgare*, Sonchus oleraceus* * and *Bidens pilosa**.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	4-22	0-25%	*Eucalyptus camaldulensis* and the occasional *Eucalyptus melliodora.*
Shrub layer	0.4-2	0-10	Occasional exotic shrub species such as *Sclerolaena birchii** and *Vachellia farnesiana**
Ground cover	0.1-1	50-90	*Hypochaeris radicata*, Cirsium vulgare*, Brassica spp.*, Silybum marianum*, Lolium perenne*, Echium plantagineum*, Avena fatua*, Trifolium arvensis*, Vulpia myuros*, Rumex crispus*, Anagallis arvensis*, Trifolium sativa*, Chloris gayana*, Plantago lanceolata*, Centaurea calcitrapa** and *Bidens pilosa**. The community also comprised the occasional native plant species such as *Austrostipa aristiglumis, Chloris truncate, Carex appressa* and *Cyperus spp.*

River Red Gum riparian woodlands and forests

Note: Photo of River Red Gum riparian woodlands and forests from within the Project Area Boundary

3.2.4 Derived native grassland

The derived native grassland is a highly modified native vegetation community that occurs immediately adjacent the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland. Specifically the community occurs in the southern sections of the modification study area and along the majority of the Haul Road (Sites 4-9). The community is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. Given the floristic composition and presence of regrowth Poplar Box – White Cypress Pine this community is likely to have comprised the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland prior to the clearing.

The majority of this community was dominated by a variety of exotic and cultivated native pasture grasses and exotic herbs. Most of the canopy and shrub layer within the community had been previously cleared and its condition class was considered to be poor. Isolated paddock trees of *Eucalyptus populnea subsp. bimbil* were scattered throughout this community.

Table 3.5 Vegetation Characteristics of Derived native grassland

Derived native grassland	
Description	
Conservation significance	Not consistent with any endangered ecological communities.
Condition	**Low to moderate.** Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion. This community generally did not contain a canopy or shrub layer aside from the occasional

Derived native grassland			
	planted or remnant plant species (*Eucalyptus populnea* subsp. *bimbil)*. The ground layer was dominated by native and exotic groundcover species including numerous perennial grasses (including crops) and herbs.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	4-18	0-30	Isolated paddock trees of *Eucalyptus populnea* subsp. *bimbil*
Shrub layer	0.4-1	0-20	Occasional *Sclerolaena birchii**
Ground cover	0.1-1.8	80-100	*Enchylaena tomentosa, Einadia nutans* subsp. *linifolia, Austrostipa scabra subsp. scabra, Austrostipa verticillata, Calotis cuneifolia, Vittadinia cervicularis var. cervicularis.*

3.2.5 Plains grassland

Plains grassland has been recorded within the modification study area as part of the Boggabri Coal Mine Biodiversity Offsets Audit (Niche Environment and Heritage 2015). Specifically the community occurred to the north-east of Belleview, and is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. Plains grassland usually occurs within the Namoi floodplain on black cracking fine textured clays soils which are Quaternary alluvial derived from Tertiary basalts.

The plains grassland within the study area occurs on Namoi River Meander Plains, which are composed of recent Quaternary alluvial deposits rather than from Tertiary Basalt geology (Duggin & Allison 1984). Therefore the Plains grassland is not consistent with the Native Vegetation on Cracking Clay Soil of the

Liverpool Plains listed as under the TSC Act and/or the EPBC Act. Further discussion on this is provided in Section 4.1.

This community contained a variety of exotic and cultivated native pasture grasses and exotic herbs. The majority of the groundcover, however, was dominated by native species and the occasional isolated paddock tree.

Table 3.6 Vegetation Characteristics of Plains Grassland

Plains grassland			
Description			
Conservation significance	**Moderate.** This community is not consistent with any threatened ecological communities (refer Section 4.1), however it does have habitat for threatened biodiversity.		
Condition	**Low to moderate.** Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	4-18	0-30	Occasional scattered tree of *Eucalyptus melliodora, Eucalyptus populnea subsp. Bimbil* and *Eucalyptus albens*
Shrub layer	0.4-2	0-5	Occasional *Vachellia farnesiana** and *Sclerolaena birchii**
Ground cover	0.1-1.8	80-100	*Austrostipa aristiglumis, Dichanthium sericeum subsp. sericeum, Panicum queenslandicum var. queenslandicum, Sclerolaena muricata, Austrodanthonia spp, Aristida leptopoda, Leiocarpa panaetioides, Vittadinia cuneata, Daucus glochidiatus* and *Carex inversa*

Exotic grassland with scattered trees

The exotic grassland with scattered trees is a highly disturbed vegetation community occurring throughout the majority of the proposed modification study area. The community is associated with areas impacted by a history of agricultural activities and no longer resembles any local native remnant vegetation communities (refer to Figure 3.1). The majority of this vegetation community was dominated by a variety of exotic and cultivated native pasture grasses and exotic herbs.

Table 3.7 Vegetation Characteristics of Exotic grassland with scattered trees

Exotic grassland with scattered trees			
Description			
Conservation significance	Not consistent with any native vegetation communities or endangered ecological communities.		
Condition	**Low.** Subject to high disturbance from previous and current land use including vegetation clearing, infrastructure, edge effects and weed invasion. This community generally did not contain a canopy or shrub layer aside from the occasional planted or remnant plant species such as *Eucalyptus pilligaensis* and *Eucalyptus populnea* subsp. *bimbil*. The ground layer was dominated by exotic groundcover species including numerous perennial grasses (including crops) and herbs.		
Strata	**Height range (m)**	**Foliage cover (%)**	**Dominant species**
Canopy	4-18	0-20	Occasional remnant *Eucalyptus populnea* and *Eucalyptus pilligaensis.*
Shrub layer	0.4-1	0-20	Occasional *Sclerolaena birchii**
Ground cover	0.1-1.2	0-100	*Dichanthium sericeum, Panicum spp., Hypochaeris radicata*, Datura ferox*, Xanthium occidentale*, Cirsium vulgare*, Brassica spp.*, Silybum marianum*, Lolium perenne*, Echium plantagineum*, Avena fatua*, Trifolium arvensis*, Vulpia myuros*, Rumex crispus*, Anagallis arvensis*, Trifolium sativa*, Chloris gayana*, Plantago lanceolata*, Centaurea calcitrapa*, Medicago polymorpha*, Triticum aestivum** and *Bidens pilosa**.

Exotic grassland with scattered trees

3.2.6 Species of plant

A total of 129 species of plant was recorded within the proposed modification study area (Appendix A). Of these species, 79 (61%) were native. The most diverse plant families were the Poaceae (grasses), Asteraceae and Fabaceae.

No threatened species were recorded within the modification study area during the field surveys.

Five (5) weed species (African Boxthorn, African Turnip Weed, Fireweed, Galvanised Burr and Prickly Pear) recorded within the modification study area are declared as noxious under the *Noxious Weeds Act 1993* for the Narrabri Shire Council weed control area (refer to Table 3.8)

These weeds are classified as Class 4 and Class 5 weeds under the *Noxious Weeds Act 1993* and must be managed in accordance with the control class measures specified as outlined under the Act. Fireweed and African Boxthorn are also listed as Weeds of National Significance and should be appropriately managed as it has high potential to invade and spread.

Table 3.8 Noxious weeds and weeds of national significance identified on the site

Scientific Name	Common Name	*Noxious Weeds Act 1993*[1]	Weed of National Significance
*Opuntia stricta**	Prickly Pear	4	-
*Senecio madagascariensis**	Fireweed	4	Yes
*Sclerolaena birchii**	Galvanised Burr	4	-
*Lycium ferocissimum**	African Boxthorn	4	Yes
*Sisymbrium thellungii**	African Turnip Weed	5	-

Note:

(1) Control Categories under the *Noxious Weeds Act 1993* for the Narrabri Shire Council: Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority, Class 5 The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with (Department of Trade and Investment Regional Infrastructure and Services 2014).

3.3 Fauna habitat

The quality of vertebrate fauna habitats is typically correlated with the patch size, configuration, structure, species composition and connectivity of the vegetation communities present at a given site and the presence of non-biological features such as rock outcrops and water bodies. Therefore, the fauna habitats present in the modification study area varied from low condition in highly modified areas (exotic grassland with scattered trees) and moderate condition in the highly disturbed open woodland.

The modification study area consisted of two (2) fauna habitat types outlined in Table 3.9.

Table 3.9 Fauna habitat with corresponding vegetation description

Fauna Habitat Description	Corresponding Vegetation community
Grassy Woodland on fertile soils	Weeping Myall Woodland Pilliga Box – Poplar Box – White Cypress Pine grassy Woodland River Red Gum riparian woodlands and forest (Moderate condition)
Grasslands	River Red Gum riparian woodlands and forest (Low condition) Derived Native Grassland Plains Grassland Exotic Grassland

3.3.1 Grasslands

This habitat type consisted of all exotic grassland with scattered trees, plains grassland and all derived native grassland vegetation communities recorded throughout the proposed modification study area.

The grassland areas have been subject to heavy disturbance (vegetation clearing, edge effects and weed invasion) as a result of agricultural and mining activities. This habitat is almost entirely devoid of trees and shrubs, consisting primarily of exotic and native grasses and herbaceous weeds with the occasional tree. The grassland habitat generally lacked a range of habitat features, such as tree hollows, fallen timber, rock outcrops, diverse native groundcover or deep leaf litter providing limited foraging resources and refuge sites for native animals. As this habitat lacked structural complexity it provided limited habitat suitable only for transient ground dwelling native species or highly mobile disturbance tolerant species (such as birds and bats) and is unlikely to be used on a permanent basis by most threatened fauna. This habitat does provide

foraging for a number of threatened birds of prey including the Little Eagle, Black Falcon, Square-tailed Kite and Spotted Harrier.

3.3.1.1 Grassy woodland on fertile soils

This habitat type included the Pilliga Box – Poplar Box – White Cypress Pine grassy woodland, River Red Gum riparian woodlands and forests and Weeping Myall Woodland vegetation communities. This habitat type occurred as moderately disturbed isolated patches of native remnant vegetation scattered throughout the proposed modification study area.

This area contained an intact native canopy cover, generally lacked a native shrub layer with a combined native and exotic groundcover (often dominated by exotic pasture grasses and herbaceous weeds). This habitat contained numerous hollows suitable for bird species however lacked other general habitat features such as fallen timber, rock outcrops and leaf litter. This habitat does provide foraging and roosting habitat for a number of disturbance tolerant species of animal including threatened bat and bird species.

3.3.2 Species of animal

19 animal species recorded in the proposed modification study area (Appendix B), of which, 16 (84%) were native. Birds accounted for 17 species (89%) while reptiles accounted for two (2) (11%) species.

No threatened animal species were recorded during the opportunistic fauna survey. Most of the species recorded are associated commonly with disturbed environments within a modified landscape.

4. Biodiversity of conservation concern

4.1 Endangered ecological communities

Results of the desktop assessment indicated that 12 threatened ecological communities listed under the TSC Act, FM Act, EPBC Act (Table 4.1) have potential to occur within the modification study area.

Two threatened ecological communities were recorded within the modification study area:

- Weeping Myall Woodland listed as endangered under both the EPBC Act and TSC Act
- River Red Gum riparian woodlands and forests listed as endangered under the FM Act.

None of the remaining communities identified within the modification study area correspond with any of the threatened ecological communities predicted to occur within the modification study area.

Table 4.1 Threatened ecological communities with potential to occur within the proposed modification study area

Ecological community name TSC Act (EPBC Act)	Conservational status			Recorded within the proposed modification study area
	TSC Act[1]	EPBC Act[2]	FM Act[3]	
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 proposed modification study area.
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 Grassland of South-eastern Australia)	E	E	-	No. Not identified within the proposed modification study area.
Native Vegetation on cracking Clay Soils of the Liverpool Plains (Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland)	E	CE	-	No. The Plains Grassland identified with the modification study area did not meet the criteria for this community.
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands		CE	-	No. Not identified within the proposed modification study area.
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion **(Weeping Myall Woodlands)[4]**	**E**	**E**	**-**	**Yes. Recorded within the modification study area along Therribri Road to the west of the study area.**

Ecological community name TSC Act (EPBC Act)	Conservational status			Recorded within the proposed modification study area
	TSC Act[1]	EPBC Act[2]	FM Act[3]	
White Box Yellow Box Blakely's Red Gum Woodland (White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland)	E	CE	-	No. Not identified within the proposed modification study area.
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 proposed modification study area.
Brigalow within the Brigalow Belt South, Nadewar and Darling Riverine Plains Bioregions (Brigalow (*Acacia harpophylla* dominant and co-dominant)	E	E	-	No. Not identified within the proposed modification study area.
Carabeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions	E	-	-	No. Not identified within the proposed modification study area.
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 proposed modification study area.
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 of South-eastern Australia)	E	E	-	No. Not identified within the proposed modification study area.
Cadellia pentastylis (Ooline) community in the Nandewar and Brigalow Belt South Bioregions	E	-	-	No. Not identified within the proposed modification study area.
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River	**-**	**-**	**E**	**Yes. Recorded within the modification study area by (Niche Environment and Heritage 2015).**

Note:

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

(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act*1999, E= Endangered, CE = Critically Endangered

(3) FM Act – *Fisheries Management Act 1994,* E = Endangered

(4) Community is characteristic and meets the condition criteria of both the EPBC Act and TSC Act listed community.

4.1.1 Commonwealth listed ecological communities

4.1.1.1 Weeping Myall Woodland

Weeping Myall Woodlands is listed as an Endangered Ecological Community under the EPBC Act. This community occurs as a low open to sparse woodland to a height of 10 m with a canopy dominated by *Acacia pendula* (Weeping Myall).

To be considered part of the EPBC Act listed ecological community remnant areas must meet the NSW Scientific committee's criteria. A comparison of the EPBC Act ecological community's condition criteria against the remnant vegetation recorded on site provided below Table 4.2.

Table 4.2 Condition criteria for meeting EPBC Act listed Weeping Myall Woodlands

	Condition criteria	Weeping Myall Woodland within the modification study area
1	Tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees.	Yes. The Weeping Myall Woodland contained a canopy cover dominated by Weeping Myall.
2	Overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha	Yes. The Weeping Myall Woodland contained a tree canopy cover with over 5% mature and semi-mature Weeping Myall trees.
3	Area is at least 0.5 ha in size.	Yes. The patch of Weeping Myall Woodland is greater than 0.5 ha in size.
4	The patch has either: ■ more than two layers of regeneration of Weeping Myall present; or ■ tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 m tall and of the vegetative cover present, 50% is comprised of native species.	■ Yes. The Weeping Myall Woodland contained two layers of regeneration of Weeping Myall present and the canopy is greater than 4 m high and contains greater than 50% native species.
END	**Does the patch meet final determination of the listed community (Department of Environment Water Heritage and the Arts 2008)?**	**Yes. The patch meets all condition criteria for the federal listing of Weeping Myall Woodland.**

4.1.1.2 Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland

Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland are listed as a critically endangered ecological community under the EPBC Act.

The process for identifying the presence of Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Qld community needs to consider the diagnostic features outlined in the Threatened Species Scientific Committee listing advice (Department of Environment Water Heritage and Arts 2008). The process for identifying the presence of Natural grasslands on basalt and fine-textured alluvial soils of northern New South Wales and southern Queensland is outlined in Table 4.3.

The Plains Grassland vegetation community identified in the recent Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) is not considered to be consistent with the final determination listing under the EPBC Act as the community did not meet the diagnostic characteristics outlined in Table 4.3.

Table 4.3 Summary table of EPBC diagnostic characteristics of Natural grasslands on basalt and fine-textured alluvial soils of northern NSW and southern Queensland

EPBC diagnostic characteristics	General comment for the modification study area
Distribution mainly in the Darling Downs of southern Queensland and the Liverpool Plains and Moree Plains of northern NSW. Occurrence is mainly associated with fine textured, often cracking clay soils derived from either basalt or alluvium.	Although the modification study area does occur within the Liverpool Plains catchment in the Brigalow Belt South Bioregion it is not associated with black cracking fine textured clays soils derived from alluvium and basalt. Soil mapping of the area identifies the soil type as Namoi River Meander Plains which is composed of recently deposited Quaternary alluvial soil which has not been derived from Tertiary Basalt.(Duggin & Allison 1984). In additional mapping of the EPBC-listed "Natural Grasslands on the basalt and fine textured alluvial plains of northern New South Wales and southern Queensland" in the Namoi Catchment (Eco Logical Australia 2010) has not identified the community as being present within the modification study area.
Occurrence on landforms that are typically flat to very low slopes (less than 5%/1 degree).	The area of Plains Grassland vegetation is located on a very flat landform with <5% slope.
Tree canopy usually absent to sparse, comprising less than 10% Projective crown cover.	Tree canopy cover is estimated at <5% Projective crown cover. Therefore identified as grassland.
The ground layer is typically dominated by perennial native grasses and contains 3 or more of the indicator native species listed below. ▪ *Aristida leptopoda* ▪ *Astrebla elymoides* ▪ *Astrebla lappacea* ▪ *Austrodanthonia bipartita* ▪ *Austrostipa aristiglumis* ▪ *Bothriochloa biloba* ▪ *Bothriochloa erianthoides* ▪ *Dichanthium sericeum* ▪ *Digitaria divaricatissima* ▪ *Elymus plurinervis* ▪ *Eriochloa crebra* ▪ *Eulalia aurea* ▪ *Panicum decompositum* ▪ *Panicum queenslandicum* ▪ *Thellungia advena* ▪ *Themeda avenacea* ▪ *Themeda triandra (synonym. T. australis)* *Walwhalleya proluta*	It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity is dominated by the perennial native grasses outlined in the determination.
Does the patch meet the criteria for the classification of the vegetation as the listed community?	**No**

4.1.2 State listed ecological communities (TSC Act, FM Act)

4.1.2.1 Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion is listed as an Endangered Ecological Community under the TSC Act.

The final determination for this community under the TSC Act is broad however the Weeping Myall Woodland recorded within the modification study area is characteristic with the determination as it:

- Occurs as a low sparse woodland with a canopy dominated by *Acacia pendula* to 10 m in height
- Occurs within the Narrabri LGA and
- Contains characteristic species assemblage such as *Acacia pendula, Austrostipa aristiglumis, Boehavia dominii, Dichanthium sericeum, Sclerolaena muricata* and *Chloris truncata.*

Therefore the Weeping Myall Woodland recorded within the modification study area is characteristic of the Endangered Ecological Community.

4.1.2.2 Native Vegetation on cracking Clay Soils of the Liverpool Plains

Native Vegetation on Cracking Clay Soils of the Liverpool Plains is listed as an Endangered Ecological Community under the TSC Act.

The final determination for this community under the TSC Act encompasses four main features defining whether a patch is consistent with the community determination:

- Whether the site occurs on cracking clay soils (referred to as Black Soils) of the Liverpool Plains Catchment.
- Whether the floristic structure is that of grassland (can have sparse occurrences of trees and shrubs).
- Whether the community is generally dominated by one or more of the grasses including *Austrostipa aristiglumis, Dichanthium sericeum* or *Panicum queenslandicum*.
- Whether any of the listed characteristic species occur (including as part of the seedbank in the soil).

The process for identifying the presence of the Natural vegetation on Cracking Clay Soils of the Liverpool Plains community needs to consider the diagnostic features outlined in the Final Determination of this community and is summarised in Table 4.4

The Plains Grassland vegetation community identified in the recent Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) is not considered to be consistent with the final determination listing under the EPBC Act as the community did not meet the diagnostic characteristics outlined in Table 4.4.

Table 4.4 Summary table of TSC Act condition criteria for determination of native vegetation on cracking clay soils of the Liverpool Plains

TSC diagnostic characteristics	General comment for the modification study area
Distribution mainly occurs on cracking clay soils (vertosols – including soils referred to as Black Earth) and is within the Liverpool Plains Catchment. The Mooki River, Coxs Creek and their tributaries drain this catchment into the Namoi River. This catchment occurs in the Brigalow Belt south and Nandewar Bioregions.	Although the modification study area does occur within the Liverpool Plains catchment in the Brigalow Belt South Bioregion it is notassociated with black cracking fine textured clays soils derived from alluvium and basalt. Soil mapping of the area identifies the soil type as Namoi River Meander Plains which is composed of recently deposited Quaternary alluvial soil which has not been derived from Tertiary Basalt.(Duggin & Allison 1984). In additional mapping of the EPBC-listed "Natural Grasslands on the basalt and fine textured alluvial plains of northern New South Wales and southern Queensland" in the Namoi Catchment (Eco Logical Australia 2010) has not identified the community as being present within the modification study area.
Floristic structure that of grassland, only sparse occurrences of trees or shrubs.	The area of Plains Grassland vegetation is located on a very flat landform with <5% slope.
Tree canopy usually absent to sparse, comprising less than 10% Projective crown cover.	Tree canopy cover is estimated at <5% Projective crown cover. Therefore identified as grassland.
The ground layer is typically dominated by one or more of the perennial native grasses *Austrostipa aristiglumis, Panicum queenslandicum* or *Dichanthium sericeum.*	It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity is dominated by the perennial native grasses outlined in the determination.
Whether any of the listed characteristic species occur (including as part of the seedbank in the soil).	It is assumed based on the Boggabri Coal Mine – Biodiversity Offsets Audit (Niche Environment and Heritage 2015) that the floristic diversity and therefore the soil seed bank would contain the listed characteristic species outlined in the determination.
Does patch meet the criteria for classification of the vegetation as the listed community?	**No**

4.1.2.3 Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River

Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River is listed as endangered under the FM Act.

The final determination for this community lists the following features defining this community:

- The Darling River endangered ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within the State of New South Wales, and including Menindee Lakes and the Barwon River. This area includes:
- The main channels and tributaries of the lower Darling and Barwon-Darling Rivers from Mungindi (28º59'S; 149º30'E) on the Queensland border to the convergence with the Murray River at Wentworth (34º07'S; 141º55'E), and including the Menindee Lakes.
- The arid-zone intermittent rivers including the Warrego (29o00'S; 145o42'E), Culgoa (29º00'S; 147º22'E) and Narran Rivers (29º00'S; 148º05'E) and their tributaries south of the Queensland border.
- The border rivers including the MacIntyre River below Graman Weir (29º25'S; 150º58.8'E), Severn River downstream of Pindari Dam (29º23'S; 151º14'E) and the Dumaresq River below the junction with the Mole River (28º59.7'S; 151º31'E).

- The north-western slope rivers including the following: the Gwydir River from Copeton Dam (29°55'S; 150°55'E) downstream; the Namoi River from the junction of the Manilla River at Manilla (including Mehi River channel west of Moree) (30°46'S; 150°44'E) downstream; the Manilla River from Split Rock Dam (30°35'S; 150°42'E) downstream; the Peel River from Chaffey Dam (31°31'S; 151°08'E) downstream; the Macquarie River from Burrendong Dam (32°40'S; 149°10'E) downstream; the Cudgegong River from Windamere Dam (32°44'S; 149°46'E) downstream; the Castlereagh River from below Binnaway (31°30'S; 149°20'E) downstream; and the Bogan River from below Peak Hill (32°50'S; 148°00'E) downstream.

As the proposed modification study area occurs on the floodplains of the Namoi River and the community of River Red Gum Woodlands and Forests is riparian vegetation along this river, it is consistent with this EEC.

4.2 Endangered populations

Results of the desktop assessment indicated that three endangered populations listed under the EPBC Act and FM Act have been previously recorded, or have the potential to occur within the locality (10 km buffer) of the proposal. None of these endangered populations are considered likely to occur within the proposed modification study area. These included:

- *Tandanus tandanus* – Eel tailed catfish in the Murray/Darling Basin - This species was not recorded within the modification study area, no suitable habitat was recorded during the recent field survey and the modification study area is not within the Murray/Darling Basin, therefore it is considered unlikely that the species or population would occur within the modification study area.
- Australian brush-turkey population, Nandewar and Brigalow Belt South bioregions – This species was **not** recorded within the modification study area and no suitable habitat was recorded during the recent field survey, therefore it is considered unlikely that the species or population would occur within the modification study area.
- White-fronted Chat population in the Sydney Metropolitan Catchment Management Area – This species was **not** recorded within the modification study area, no suitable habitat was recorded during the recent field survey and the modification study area is not within the Sydney Metropolitan Bioregion, therefore it is considered unlikely that the species or population would occur within the modification study area.

4.3 Threatened plants

Results of the desktop assessment indicated that 21 species of plant listed under the TSC Act and/or EPBC Act have been previously recorded, or could potentially occur within the locality (10 km buffer) of the proposed modification study area. Of these 21 species, the modification study area contained potential habitat for four (4) threatened flora species (refer to Table 4.5). No threatened plant species were recorded within the modification study area during current surveys.

Table 4.5 Threatened species of plant

Species name	Common name	TSC Act[1]	EPBC Act[2]	Recorded?
Digitaria porrecta	Finger Panic Grass	E	-	**No**
Diuris tricolor	Pine Donkey Orchid	V	-	**No**
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	A leek orchid	-	CE	**No**
Tylophora linearis	-	V	E	**No**

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

(2) EPBC Act – *Environment Protection and Biodiversity Conservation Act*1999, E= Endangered, CE = Critically Endangered

Diuris tricolor is a cryptic orchid and field surveys were undertaken outside the flowering period (spring) of this species. Therefore a significance assessment was undertaken for this species in Appendix E as a precautionary measure due to the presence of potential habitat within the proposed modification study area.

The remaining 16 threatened flora species known or predicted to occur are considered to have a low likelihood of occurrence based on the availability of habitat in the modification study area (i.e. cleared land and remnant vegetation with a shrub and ground layer completely dominated by exotic species). Full details of the species requirements and reasons for not further considering impacts of the proposal for these threatened plants are provided in Appendix C.

4.4 Threatened fauna

Results of the desktop assessment indicated that 71 fauna species listed under the TSC Act, EPBC Act and/or FM Act have been previously recorded, or could potentially occur within the locality (10 km buffer) of the proposed modification study area. Of these 71 species, the modification study area contained potential habitat for 28 threatened fauna species (refer to Table 4.6).

One threatened bird species (Grey-crowned Babbler) was identified immediately adjacent to the modification study area during the field survey (refer Figure 4.1). The species was recorded within White Box – White Cypress Pine grassy woodland adjacent the site however may use the modification study area as foraging habitat.

The remaining 43 threatened fauna species known or predicted to occur are considered to have low likelihood of occurrence based on the availability of habitat within the modification study area. Full details of the species requirements and reasons for not further considering impacts of the proposed modification for these threatened fauna species are provided in Appendix D.

Table 4.6 Threatened 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	–
Falco subniger	Black Flacon	V	–
Lophoictinia isura	Square-tailed Kite	V	–
Hollow dependent microchiropteran bats			
Nyctophilus corbeni	Greater Long-eared Bat – south eastern form	V	V
Chalinolobus dwyeri	Large-eared Pied-bat	V	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	–
Chalinolobus picatus	Little Pied Bat	V	–
Vespadelus troughtoni	Eastern Cave Bat	V	–

Woodland birds			
Climacteris picumnus	Brown Treecreeper	V	–
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

4.5 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 desktop assessment, 13 Migratory species have been recorded or have the potential to occur in the Proposal locality. No Migratory species were recorded during field surveys. However, potential habitat was observed for the Eastern Great Egret, Cattle Egret, Regent Honeyeater 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 *Matters of National Environmental Significance, Significant Impact Guidelines 1.1 EPBC Act* (Department of Environment 2013) 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 unlikely that the proposed activity would significantly affect Migratory species and this group is not considered further.

4.6 State environmental planning policy 44 – Koala habitat protection

The proposed 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 proposed modification study area contained three koala feed trees, as listed under Schedule 2 of SEPP 44 (NSW Government 2000) and the Western Slopes and Plains Koala Management Area 6 (Department of Environment and Climate Change 2008b). The suite of koala feed trees available is the most important factor influencing koala habitat and occurrence (NSW National Parks and Wildlife Service 2002). 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 2002). Secondary or supplementary feed trees are species that provide a seasonal or supplementary dietary resource (NSW National Parks and Wildlife Service 2002).

One primary feed tree *Eucalyptus camaldulensis* and two secondary feed trees, *Eucalyptus populnea* subsp. *bimbil* and the occasional *E. albens*, were recorded therein (Table 4.7) The koala feed trees occurred as scattered trees throughout the proposed modification study area in the Pilliga Box – Poplar Box White Cypress Pine grassy open forest, River Red Gum riparian woodland and forests as well as occasional isolated trees in the exotic grasslands.

Impacts of the proposed modification on koala have also been assessed under the TSC Act and EPBC Act threatened species significance assessment, refer to Section 5.10. The significance assessment determined that the proposed modification would not significantly impact on the koala (refer Table 8.1).

Table 4.7 Koala feed tree species recorded in the proposed 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 camaldulensis	Yes. River Red Gum riparian woodlands and forests	Yes	Yes	Yes (P)
Eucalyptus populnea subsp. *bimbil*	Yes. Occurred in Pilliga Box – Poplar Box – White Cyprus Pine grassy Woodland as well as scattered in exotic grassland.	Yes	Yes	Yes (S)
Eucalyptus albens	Yes. As occasional isolated tree within exotic grassland community or adjacent study area.	No	Yes	Yes (S)

(1) Vegetation type based on surveys in the proposed 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). P – Primary, S – Secondary food tree species

Areas of habitat within the proposed modification study area are 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).

Furthermore, the habitat within the proposed modification study area represents remnant trees within an otherwise largely cleared landscape. This habitat is potentially a corridor allowing koalas to move throughout the landscape.

4.7 Commonwealth Koala habitat assessment

Database searches conducted for the proposal (refer to Section 2.4) did not locate any records of koala for the study area and koalas were not recorded during the ecological surveys. The most recent koala record within 3 km to the south of the proposed modification was within riparian vegetation along the Namoi River in 2014 (Office of Environment and Heritage 2015). The Department of Environment koala habitat assessment tool (Department of Environment 2014) was used to determine the quality of koala habitat in the proposal area and if it contained habitat critical to the survival of the koala (refer Figure 4.1).

Attribute	Score	Inland	Coastal
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	Has forest or woodland with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	Has forest or woodland with only 1 species of known koala food tree present.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above.	None of the above.
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

Figure 4.1 Koala habitat assessment tool

A score of 4 out of 10 was determined for the koala habitat in the study area based on the koala habitat assessment tool (refer Figure 4.1 and Table 4.8). Impact areas that score four or less using the habitat assessment tool for the koala do not contain habitat critical to the survival of the koala. Based on this value, the study area does not contain habitat critical to the survival of the koala.

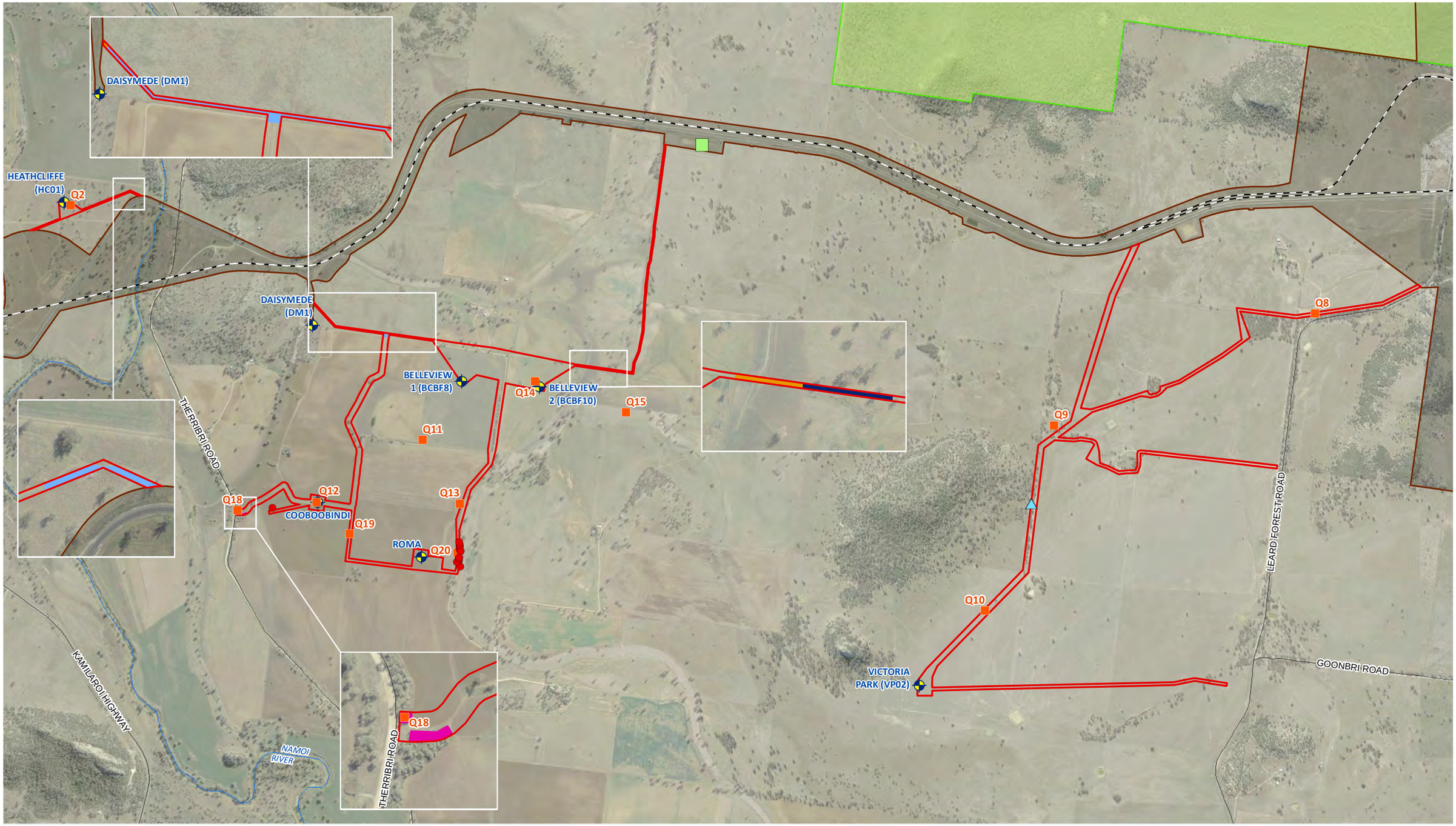
Table 4.8 Completed Koala habitat assessment tool for the study area

Attribute	Score	Habitat Appraisal	
Koala Occurrence	2	Desktop	■ Database searches conducted for the proposal did locate two recent records (within 5 years) of koala within 5 km of the study area (Office of Environment and Heritage 2015).
		On-site	■ No koalas or traces of koalas were recorded during the ecological surveys
Vegetation structure and composition	2	Desktop	■ LGA vegetation mapping and database searches indicate that numerous Koala feed trees are present and likely to be present in the study area.
		On-site	■ Habitat ground-truthing was carried out during field surveys identified three feed tree species listed under SEPP 44 Schedule 2 and the National Koala Recovery Plan: *Eucalyptus camaldulensis, Eucalyptus populnea subsp. bimbil* and *Eucalyptus pilligaensis* .
Habitat connectivity	0	■ The habitat that will be impacted by the proposal is located within a highly fragmented landscape which has been heavily disturbed by agriculture and vegetation clearing within the broader locality. The vegetation on site exists predominantly as isolated trees within the highly fragmented landscape. ■ Large contiguous habitat is located north and north east of the modification study area.	
Key existing threats	0	Desktop	■ Desktop assessment did not show any koala road kill or koala death records within 2km or the study area.
		On-site	■ The status of dog populations and level of predation is not known within the study area. The study area exists as fragmented agricultural land and no traces of dogs were recorded during field surveys.
Recovery value	0	■ Due to the size and fragmented nature of the landscape, vegetation composition and level of threats present the habitat is considered unlikely to be an important for the recovery of the koala. ■ The larger habitat areas that currently occur to the north and north-east of the study area will remain and provide a corridor to remnant bushland. (Leard State Forest).	
Decision	4	Habitat not critical to the survival of the koala – assessment of significance not required.	

4.8 Critical habitat

Critical habitat is listed under both the TSC Act and 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 community.

No listed critical habitat was found in the proposed modification. The area to be impacted by the proposed 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**.**



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- Hollow-bearing tree
- Quadrat
- Groundwater bores
- Tank farm
- Road
- Drainage
- Proposed rail
- MOD 5 study area
- Boggabri Project Approval Area
- Leard State Forest
- Natural grasslands on basalt and fine-textured alluvial plains on northern New South Wales and southern Queensland (TSC Act & EPBC Act)
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River (Low Condition) (FM Act)
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River (Moderate Condition) (FM Act)
- Weeping Myall Woodland (TSC Act & EPBC Act)
- Grey-crowned Babbler

0 0.25 0.5 0.75 km

Figure 4.2
Threatened biodiversity within the proposed Modification study area

5. Potential impacts

The potential impacts on biodiversity due to construction and operation of the proposed modification are summarised in Table 5.1 and described in detail below.

The potential impacts from the proposed modification are likely to be minor as a small area of disturbance for minor works are required and native understorey vegetation will be impacted upon by the proposed modification. Furthermore, the modification study area is composed of largely cleared agricultural lands with little native vegetation recorded.

Mitigation measures to ameliorate these impacts are discussed in Section 6 and assessments of significance for threatened biodiversity that occur or have potential habitat within the proposed modification study area (discussed in Sections 2.6, 4 and 8) are provided in Appendix E and summarised in Section 5.10.

Table 5.1 Potential impacts associated with the proposed modification

Potential impact	Potential phase of impact	
	Construction	Operation
Loss of vegetation	●	
Loss of vegetation within a secured offset area	●	
Direct loss of animals and plants	●	
Weed invasion and dispersal	●	●
Erosion and sedimentation	●	●

5.1 Loss of vegetation

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act.

The area of native vegetation to be impacted (18.8 ha) will not require removal of any trees and will be limited to ground and shrub layers disturbance. In addition to this the impacts associated with the above ground water pipeline (18.6 ha) does not require ground disturbance for installation, rather these impacts will be restricted to relatively minor disturbances to the understory vegetation associated with the placement of the pipeline on the ground.

The construction phase of the proposed modification will require impacts to 18.6 ha of native vegetation and of which approximately 1.4 ha of vegetation listed under the FM Act, TSC Act and EPBC Act as a threatened ecological community (refer to Table 5.2). Approximately 0.2 ha of these impacts will be ground disturbance due to the installation of the powerlines and below ground water pipeline. Approximately 18.6 ha will be limited to impacts associated with the above ground water pipeline.

An area of 8.6 ha of predominately disturbed and exotic vegetation will be impacted within the biodiversity offsets as described in the Boggabri Coal Mine Biodiversity Offsets Strategy. Measures to minimise impacts to threatened biodiversity affected by the loss of vegetation and associated habitat are described in Section 6.

Table 5.2 Potential loss of native vegetation within the modification study area

Vegetation community	TSC Act[1]	EPBC Act[2]	FM Act[3]	Total modification study area (ha)[4]		Area within offsets (ha)[7]	
				Ground Disturbance (ha)[5]	Above Ground Water pipeline (ha)[6]	Ground Disturbance (ha)[5]	Above Ground Water pipeline (ha)[6]
Exotic grassland with scattered trees	–	-	-	3.8	46.6	-	1.0
Derived native grassland[8]	-	-	-	-	11.2	-	2.9
Plains Grassland	-	-	-	-	0.1	-	0.1
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	-	-	0.2	5.9	-	3.4
Weeping Myall Woodland[9]	E	E	-	-	0.1	-	-
River Red Gum riparian woodlands and forests	-	-	E	-	1.3	-	1.3
Total clearing for modification				**4.0**	**65.2**	**-**	**8.6**
Total Native Vegetation clearing for modification				**0.2**	**18.6**	**-**	**7.7**
Total FM Act EEC clearing for modification				**-**	**1.3**	**-**	**1.3**
Total TSC Act EEC clearing for modification				**-**	**0.1**	**-**	**-**
Total EPBC Act EEC clearing for modification				**-**	**0.1**	**-**	**-**

(1) TSC Act, E = Endangered.
(2) EPBC Act, E = Endangered, CE = Critically Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Total modification study area (ha) = all sites assessed within this report that have not previously been assessed.
(5) Disturbance from underground pipeline and installation of power lines and associated infrastructure
(6) Area includes where the pipeline will be placed above ground and no ground disturbance will take place.
(7) For the purpose of this report, Area within offsets = Area (ha) within Namoi River Offsets associated with the proposed modification.
(8) This community generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.
(9) This community meets both the EPBC Act criteria and the TSC Act criteria for Weeping Myall Woodlands.

Vegetation clearing associated with the modification would be limited to the disturbance and clearing of groundcover vegetation only. Disturbance and clearing of hollow bearing trees and/or canopy is not required as part of the modification. The native groundcover vegetation to be disturbed and/or removed currently occurs within highly disturbed agricultural land surrounded by exotic vegetation.

The proposed modification will have a minimal impact on fauna habitats that will involve the disturbance and/or removal of groundcover vegetation only. The impact assessments confirm that the disturbance and/or removal of 18.6 ha of native understorey vegetation, which is predominantly comprised of derived native grassland, is unlikely to have a significant impact upon any threatened species, populations or communities.

5.2 Modification areas within offsets

The proposed modification impacts includes 7.7 ha of native understorey vegetation within previously identified offsets, as described in the Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy and as such these areas, will require an alternative replacement. The extent of the proposed adjustments to the offsets is presented in Table 5.3.

Table 5.3 Vegetation impacts within existing offsets

Vegetation community	TSC Act listing[1]	EPBC Act listing[2]	FM Act listing[3]	Area within offsets (ha)[4]
Exotic grassland with scattered trees	–	–	–	1.0
Plains Grassland	C	CE	-	0.1
Derived Native Grassland[5]	–	–	–	2.9
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	–	–	3.4
Weeping Myall Woodland[1,2]	E	E	–	–
River Red Gum riparian woodlands and forests[3]	–	–	E	1.3
Total area of modification within offsets				**8.7**
Total Native Vegetation within offsets				**7.7**
Total area of FM Act CEEC within modification offsets				**1.3**
Total area of TSC Act CEEC within modification offsets				**-**
Total area of EPBC Act CEEC within modification offsets				**-**

(1) TSC Act, E = Endangered.
(2) EPBC Act, E = Endangered, CE = Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Area within offsets = Total modification study area (ha) within Namoi River Offsets associated with the proposed modification.
(5) Represents Pilliga Box – Poplar box White Cypress Pine grassy open forest derived native grassland.

5.3 Direct loss of animals and plants

Fauna injury or death could occur, but is unlikely, as a result of the proposed modification. Specifically, the excavation and earthworks, during the construction phase of the modification, would involve ground disturbance and the removal of understorey vegetation.

While some mobile species, such as birds, have the potential to move away from the path of clearing, other species that are less mobile may have difficulty moving. Species of animal that may be affected by the removal of understorey vegetation include small terrestrial mammals, reptiles and frogs. Vehicle strike during construction, operation and maintenance works is considered unlikely to significantly increase as a result of the proposed modification.

5.4 Weed invasion and dispersal

The modification study area currently occurs within agricultural land which is already subjected to high levels of weed invasion. As weeds have already established within the proposed modification study area it is unlikely that the proposed modification will significantly increase the invasion of introduced weeds.

The invasion of exotic perennial grasses, such as *Chloris gayana*, Avena fatua*, Pennisetum clandestinum** and *Lolium perenne** which was recorded abundantly within the modification study area, is recognised as a Key Threatening Process under the TSC Act. The proposed modification has some potential to result in further spread of these species. The most likely causes of weed dispersal associated with the proposed modification would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. Dispersal of weeds during the operation phase would relate generally to maintenance activities.

Given the high level of weed invasion, and the presence of five noxious weeds, construction and to a lesser extent, operation phase, has the potential to spread weeds from the proposed modification study area to other sites. Therefore mitigation measures relating to weed control have been outlined in Section 6 of this report.

5.5 Erosion and sedimentation

Excavation and earthworks undertaken during the construction phase would expose soils with the potential to enter surrounding areas of vegetation. Erosion during the operation stage relates to maintenance activities and is likely to be minor. Section 6 of this report provides a number of mitigation measures, and if properly adhered to, the impacts associated with the proposed modification are not considered significant.

5.6 Key threatening processes

Key Threatening Processes (KTPs) are listed under Schedule 3 of the NSW TSC Act, FM Act, Commonwealth EPBC Act. A process is defined as a KTP 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 KTP 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 listed threatened species or community to become more endangered, or if it adversely affects two or more listed threatened species or ecological communities.

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

- TSC Act Key Threatening Processes:
  - clearing of native vegetation (refer Section 5.1)
  - invasion of native plant communities by exotic perennial grasses (refer to Section 5.4).
  - loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (refer to Section 5.4)
- EPBC Act Key Threatening Processes:
  - land clearance (refer to Section 5.1)
  - loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (refer to Section 5.4).

The proposed modification will result in the loss of native understorey vegetation (removal of any canopy vegetation or hollow bearing trees is not required) and thus contribute to one key threatening processes, clearing of native vegetation and land clearance. 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 6. The proposed modification is unlikely to significantly impact upon the degradation of native riparian vegetation as the vegetation to be removed is in low to moderate condition and does not require removal of any native trees in riparian environments.

6. Mitigation measures

This section identifies appropriate management and mitigation measures that build upon the strategies currently employed as part of the Boggabri Coal Biodiversity Management Plan. The relevant management and mitigation measures previously identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment 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.

6.1 Detailed mitigation measures

Detailed measures to mitigate ecological impacts that are adopted at the Boggabri Coal Mine are shown in Table 6.1. The mitigation measures are presented for both the construction and operational phases of the proposed modification.

Table 6.1 Detailed mitigation measures

Impact	Mitigation
Pre-construction	
Targeted *Tylophora linearis* surveys	▪ pre-clearing surveys to be undertaken along with other ecological pre-clearance surveys during the May – November flowering period for *Tylophora linearis* before any understorey vegetation clearing is to begin.
Construction	
Vegetation and habitat loss	▪ limit disturbance of understorey vegetation to the minimum necessary for each stage of the clearing ▪ restrict equipment and stockpiling of resources to designated areas in cleared land to minimise the overall impact of the construction ▪ progressively revegetate disturbed areas
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
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

Impact	Mitigation
Vehicle strike or direct mortality	■ Notify injured wildlife service if injured fauna is identified during construction.

7. Biodiversity offsets

7.1 Background

While the majority of impacts associated with the proposed modification can be mitigated, the loss of understorey native vegetation will be adequately ameliorated under the Biodiversity Offset Strategy. Impacts associated with the proposed modification, will be considered in the revision of the Biodiversity Offset Strategy.

Boggabri Coal is committed to providing offsets for the modification in accordance with the quantum (ratio) and principles of the existing BOS.

7.2 Changes to existing offset areas in BOS

The proposed modification includes areas within previously identified offsets, as described in the Continuation of Boggabri Coal Mine - Biodiversity Offset Strategy and are associated with the production of bores to accommodate water requirements for the Project. The extent of the modification's impact on the Namoi River Offset Area is presented in Table 7.1.

The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently excised for the proposed Project Boundary adjustments of the modification will be replaced by an alternative offset. The quantum of this transfer will comprise up to 7.7 ha of understorey native vegetation and threatened species habitat.

7.3 Proposed modification biodiversity offsets

The relatively minor changes to the Namoi River Offset Area resulting from this modification and associated refined vegetation mapping will be incorporated into the final amended BOS and BMP.

Boggabri Coal considers the relatively minor impacts described in the modification EA to be adequately offset by the substantial BOS approved as part of PA 09_0182. The minor modifications are considered part of the Boggabri Coal Project's detailed design and Project refinement and are to be expected for a Project of this scale and significance.

Boggabri Coal will provide an additional offset for the impacts of the modification. This offset will be consistent with the final ratio of 5.6:1 specified in the approved BOS, which has been developed in accordance with the *OEH Principles for Biodiversity Offsets* and consideration of the NSW Biodiversity Offsets Policy for Major Projects (2014).

A summary of the total offset requirements for the new impacts associated with the modification are provided below in Table 7.1.

Table 7.1 Offset requirements for impacts associated within the modification

Vegetation community	TSC Act listing[1]	EPBC Act listing[2]	FM Act [3]	Area not previously assessed (ha)[4]	Offsets requirement (ha)[5]
Derived native grassland[6]	-	-	-	11.2	62.7
Plains Grassland	E	CE	-	0.1	0.6
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	-	-	6.1	34.2
Weeping Myall Woodland	E	E	-	0.1	0.6
River Red Gum riparian woodlands and forests	-	-	E	1.3	7.3
Total Native Vegetation clearing for modification				**18.8**	**105.4**
Total FM Act EEC clearing for modification				**1.3**	**7.3**
Total TSC Act EEC clearing for modification				**0.1**	**0.6**
Total EPBC Act EEC clearing for modification				**0.1**	**0.6**

(1) TSC Act, E = Endangered.
(2) EPBC Act, CE = Critically Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Area not previously assessed (ha) = all sites for which new impacts to biodiversity has not yet been assessed within the existing EA (PA 09_0182) (impact assessments in Appendix E).
(5) For the purpose of this report, Offset requirements = Application of the final ratio of 5.6:1 specified in the approved BOS to all Area not previously assessed.
(6) The derived grassland generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.

The proposed additional offset for the modification impacts will therefore incorporate a minimum of 105.4 ha of native understorey vegetation and threatened species habitat.

8. Significance assessments

Previous assessments of the Project area do not include the proposed modification study area assessed in this report. Therefore, additional significance assessments have been completed to consider cumulative impacts of works associated with the proposed modification. In addition, a small area of three threatened ecological communities (Weeping Myall Woodland, Plains Grassland and River Red Gum Riveriana woodlands and forest) and potential habitat for a further four threatened species of plant and 28 species of animal, including nine listed under the EPBC Act were identified therein.

The threatened ecological communities and threatened 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 native understorey vegetation and habitat loss associated with the construction and operation of the proposed modification.

The findings of the significance assessments completed for this proposed modification are that while the additional impacts will add incrementally to the loss of native understorey vegetation and habitat loss for threatened biodiversity, it is unlikely to be a significant impact such that any of the assessment threatened biodiversity will be placed at risk of extinction. The significance assessments are included as Appendix E.

Table 8.1 Significant impact assessments completed for the proposed modification

Threatened biodiversity	Potential habitat in the proposed modification area	Recorded in the proposed modification area	Recorded in Approved Project Boundary	TSC Act[1]	EPBC Act[2]	Likely significant impact
Ecological Communities						
Weeping Myall	Yes	Yes	Yes	E	E	No
Plains Grassland	Yes	No	Yes	E	CE	No
River Red Gum Riparian Forest	Yes	Yes	Yes	E (FM Act)	-	No
Plants						
Digitaria porrecta[3]	Yes	No	No	E	-	No
Diuris tricolor[4]	Yes	No	No	V	-	No
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	Yes	No	No	-	CE	No
Tylophora linearis[5]	Yes	No	Yes	V	E	No
Birds of Prey						
Spotted Harrier	Yes	No	Yes	V	-	No
Little Eagle	Yes	No	Yes	V	-	No
Black Falcon	Yes	Yes – previous observation.	No	V	-	No
Square-tailed Kite	Yes	No	No	V	-	No
Bats						
Greater Long-eared Bat – south eastern form	Yes	No	Yes	V	V	No
Large-eared Pied Bat	Yes	No	Potentially	V	V	No
Yellow-bellied Sheathtail -Bat	Yes	No	Yes	V	-	No
Eastern False Pipistrelle	Yes	No	Yes	V	-	No
Little Pied Bat	Yes	No	Yes	V	-	No
Eastern Cave Bat	Yes	No	Yes	V	-	No
Woodland Birds						
Brown Treecreeper	Yes	No	Yes	V	-	No
Grey-crowned Babbler	Yes	No	Yes	V	-	No
Hooded Robin	Yes	Yes	Yes	V	-	No
Speckled Warbler	Yes	No	Yes	V	-	No
Diamond Firetail	Yes	No	Yes	V	-	No
Painted Honeyeater	Yes	No	Yes	V	-	No

Threatened biodiversity	Potential habitat in the proposed modification area	Recorded in the proposed modification area	Recorded in Approved Project Boundary	TSC Act[1]	EPBC Act[2]	Likely significant impact
Black-chinned Honeyeater	Yes	No	No	V	-	No
Varied Sittella	Yes	No	Yes	V	-	No
Threatened blossom nomads						
Little Lorikeet	Yes	No	Yes	V	-	No
Turquoise Parrot	Yes	No	Yes	V	-	No
Swift Parrot	Yes	No	Yes	E	E	No
Masked Owl	Yes	No	Yes	V	-	No
Barking Owl	Yes	No	Yes	V	-	No
Superb Parrot	Yes	No	No	V	V	No
Regent Honeyeater	Yes	No	Yes	CE	E,M	No
Mammals						
Koala	Yes	No	Yes	V	V	No
Squirrel Glider	Yes	No	Yes	V	-	No
Reptiles						
Pale-headed Snake	Yes	No	Yes	V	-	No

Notes:

(1) TSC Act V = vulnerable, E = endangered. CE = critically endangered,
(2) EPBC Act,V = vulnerable, E = endangered, CE = critically endangered, M = migratory
(3) *Digitaria porrecta* delisted from the EPBC Act on 14 December 2013.
(4) *Diuris tricolor* delisted from the EPBC Act on 19 August 2011
(5) *Tylophora linearis* was listed from Endangered to vulnerable under the TSC Act

8.1 Matters of national environmental significance

The likely broad potential impacts of the proposed modification on Matters of National Environmental Significance listed under the EPBC Act include:

- Impacts on 18.8 ha of known and/or potential habitat for Threatened and/or Migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999*. This impact is considered to be minor due to retention of all native trees within the modification study area and vegetation removal will be limited small area of native ground layer. Furthermore, the placement of the water pipeline aboveground where land is not flood prone further decreases the impact to threatened biodiversity.

The impacts associated with the proposed modification will be minor in terms of loss of vegetation and habitat for Matters of National Environmental Significance. This clearing will result in a total of 18.8 ha of native vegetation and habitat for Matters of National Environmental Significance being affected, and will be limited to understorey vegetation.

8.1.1 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 Environment 2013). 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 Appendix E.

The findings of the significance assessments completed for the this modification are that the additional impacts will add incrementally to the loss of native understorey vegetation and habitat loss for threatened biodiversity, however it is unlikely to be a significant impact such that any of the assessment threatened biodiversity will be placed at risk of extinction.

9. Conclusions

This report assessed the ecological impacts associated with a proposed modification to the Boggabri Coal Project Approval (09_0182). Specifically the proposed modification includes construction and operation of production bores and associated electricity infrastructure, as outlined in Section 1.3 of this report.

The proposed modification includes impacts to areas outside of the existing Project Approval (09_0182) and will result in new impacts to 18.8 ha of native understorey vegetation and habitat, of which 1.4 ha is listed as a threatened ecological community under the FM Act, TSC Act and EPBC Act.

The native understorey vegetation proposed to be removed as part of the proposed modification is considered potential habitat for four threatened plants and 28 threatened animals, including nine species listed under the EPBC Act and would add to the cumulative removal of native understorey vegetation for the expansion of Boggabri Coal Mine.

Significance assessments have been completed in accordance with TSC Act and EPBC guidelines for the threatened biodiversity with potential to occur within, or use the proposed modification study area. The significance assessments concluded that the removal of understorey vegetation and habitat loss associated with the proposed modification is unlikely to impact significantly upon threatened biodiversity within the modification study area.

Whilst the majority of impacts associated with the proposal are able to be ameliorated, amendment of the existing BOS will be required. The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently removed as part of the proposed Project Boundary adjustments of the modification, will be replaced by an alternative offset. The quantum of this transfer will comprise up to 105.4 ha of native understorey vegetation and threatened species habitat In addition, the proposed modification impacts not previously assessed will also be offset in accordance with the final ratio of 5.6:1 specified in the approved BOS and therefore incorporate a minimum of 105.4 ha of native understorey vegetation and threatened species habitat.

The ecological and significance assessments concluded that, if the relevant management and mitigation measures identified in Section 6 of the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment and the additional measures outlined in Section 6 of this report are adhered to, significant impact upon any threatened community, population or species as a result of the proposed modification is unlikely.

10. References

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Appendix A

Plant species recorded

Appendix A – Plant species recorded

Family Name	Scientific Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Native
Adiantaceae	*Cheilanthes distans*	Bristly Cloak Fern			Y
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern			Y
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily			Y
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery			N
Apiaceae	*Daucus glochidiatus*	Native Carrot			Y
Apocynaceae	*Parsonsia eucalyptophylla*	Gargaloo			Y
Asteraceae	*Bidens pilosa*	Cobblers Pegs			N
Asteraceae	*Calotis cuneifolia*	Purple Burr-Daisy			Y
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy			Y
Asteraceae	*Carduus pycnocephalus*	Slender Thistle			N
Asteraceae	*Carthamus lanatus*	Saffron Thistle			N
Asteraceae	*Centaurea calcitrapa*	Star Thistle			N
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting			Y
Asteraceae	*Cirsium vulgare*	Spear Thistle			N
Asteraceae	*Conyza sp.*				N
Asteraceae	*Euchiton sphaericus*				Y
Asteraceae	*Hypochaeris radicata*	Catsear			N
Asteraceae	*Rhodanthe diffusa subsp. leucactina*				Y
Asteraceae	*Senecio madagascariensis*	Fireweed			N
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed			Y
Asteraceae	*Silybum marianum*	Variegated Thistle			N
Asteraceae	*Sonchus oleraceus*	Common Sowthistle			N
Asteraceae	*Vittadinia cuneata*	Fuzzweed			Y
Asteraceae	*Vittadinia pustulata*				Y
Asteraceae	*Vittadinia sp.*				Y
Asteraceae	*Vittadinia sulcata*				Y
Asteraceae	*Xanthium occidentale*	Noogoora Burr			N
Asteraceae	*Xerochrysum bracteatum*	Golden Everlasting			Y
Boraginaceae	*Echium plantagineum*	Pattersons Curse			N
Boraginaceae	*Echium vulgare*	Vipers Bugloss			N
Brassicaceae	*Brassica rapa*	White Turnip			N
Brassicaceae	*Brassica sp.*				N
Brassicaceae	*Lepidium africanum*	Common Peppercress			N
Brassicaceae	*Sisymbrium irio*	London Rocket			Y
Brassicaceae	*Sisymbrium thellungii*	African Turnip Weed			N
Cactaceae	*Opuntia stricta*	Prickly Pear			N

Family Name	Scientific Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Native
Campanulaceae	*Wahlenbergia sp.*	Bluebell			Y
Caryophyllaceae	*Petrorhagia dubia*	Velvety Pink			
Casuarinaceae	*Casuarina cristata*	Belah			Y
Chenopodiaceae	*Einadia nutans* subsp. *nutans*	Climbing Saltbush			Y
Chenopodiaceae	*Einadia polygonoides*				Y
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush			Y
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush			Y
Chenopodiaceae	*Sclerolaena birchii*	Galvinized Burr			Y
Chenopodiaceae	*Sclerolaena muricata*	Black Rolypoly			Y
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort			Y
Convolvulaceae	*Convolvulus erubescens*				Y
Convolvulaceae	*Dichondra repens*	Kidney Weed			Y
Crassulaceae	*Crassula colorata*	Dense Crassula			Y
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine			Y
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge			Y
Cyperaceae	*Eleocharis pusilla*	Small Spike-sedge			Y
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed			Y
Fabaceae (Faboideae)	*Glycine tabacina*				Y
Fabaceae (Faboideae)	*Medicago polymorpha*	Burr Medic			N
Fabaceae (Faboideae)	*Medicago sativa*	Lucerne			N
Fabaceae (Faboideae)	*Trifolium arvense*	Haresfoot Clover			N
Fabaceae (Faboideae)	*Trifolium repens*	White Clover			N
Fabaceae (Mimosoideae)	*Acacia dealbata*	Silver Wattle			Y
Fabaceae (Mimosoideae)	*Acacia decora*	Western Golden Wattle			Y
Fabaceae (Mimosoideae)	*Acacia pendula*	Weeping Myall			Y
Fabaceae (Mimosoideae)	*Vachellia farnesiana*	Mimosa Bush			Y
Geraniaceae	*Erodium crinitum*	Blue Storksbill			Y
Juncaceae	*Juncus usitatus*	Billabong Rush			Y
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush			Y
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush			Y

Family Name	Scientific Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Native
Loranthaceae	*Amyema pendulum*				Y
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow			N
Malvaceae	*Sida corrugata*	Corrugated Sida, Variable Sida			Y
Malvaceae	*Sida rhombifolia*	Paddys Lucerne			N
Malvaceae	*Sida sp.*				Y
Myoporaceae	*Eremophila debilis*	Amulla			Y
Myrtaceae	*Eucalyptus albens*	White Box			Y
Myrtaceae	*Eucalyptus pilligaensis*	Narrow-leaved Grey Box			Y
Myrtaceae	*Eucalyptus populnea*	Bimble Box			Y
Nyctaginaceae	*Boerhavia dominii*	Tarvine			Y
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis			N
Plantaginaceae	*Plantago debilis*	Shade Plantain			Y
Plantaginaceae	*Plantago lanceolata*	Lambs Tongues			N
Poaceae	*Aristida ramosa*	Cane Wire-grass			Y
Poaceae	*Aristida sp.*				Y
Poaceae	*Aristida vagans*	Threeawn Speargrass			Y
Poaceae	*Austrostipa aristiglumis*	Plains Grass			Y
Poaceae	*Austrostipa bigeniculata*				Y
Poaceae	*Austrostipa scabra*	Speargrass			Y
Poaceae	*Austrostipa verticillata*				Y
Poaceae	*Avena fatua*	Wild Oats			N
Poaceae	*Bothriochloa decipiens*	Red Grass			Y
Poaceae	*Bromus arenarius*	Sand Brome			Y
Poaceae	*Bromus molliformis*				N
Poaceae	*Chloris divaricata*				Y
Poaceae	*Chloris gayana*	Rhodes Grass			N
Poaceae	*Chloris truncata*	Windmill Grass			Y
Poaceae	*Chloris ventricosa*	Tall Chloris			Y
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass			Y
Poaceae	*Cynodon dactylon*	Common Couch			Y
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass			Y
Poaceae	*Digitaria breviglumis*				Y
Poaceae	*Elymus scaber*				Y
Poaceae	*Enteropogon acicularis*	Spider Grass			Y
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass			Y
Poaceae	*Lolium perenne*	Perennial Ryegrass			N

Family Name	Scientific Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Native
Poaceae	*Panicum queenslandicum*	Yadbil Grass			Y
Poaceae	*Panicum decompositum*	Native Millet			Y
Poaceae	*Panicum sp.*				Y
Poaceae	*Paspalum dilatatum*	Paspalum			N
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass			N
Poaceae	*Rytidosperma bipartitum*				Y
Poaceae	*Setaria gracilis*	Slender Pigeon Grass			N
Poaceae	*Sporobolus creber*	Slender Rats Tail Grass			Y
Poaceae	*Triticum aestivum*	Wheat			N
Poaceae	*Vulpia myuros*	Rats Tail Fescue			N
Polygonaceae	*Rumex crispus*	Curled Dock			N
Primulaceae	*Anagallis arvensis*	Scarlet/Blue Pimpernel			N
Rubiaceae	*Richardia stellaris*				N
Rutaceae	*Geijera parviflora*	Wilga			Y
Sapindaceae	*Dodonaea viscosa*	Sticky Hop-bush			Y
Sapindaceae	*Dodonaea viscosa subsp. angustifolia*				Y
Solanaceae	*Datura ferox*	Fierce Thornapple			N
Solanaceae	*Lycium ferocissimum*	African Boxthorn			N
Solanaceae	*Solanum nigrum*	Black-berry Nightshade			N
Solanaceae	*Solanum parvifolium*				Y
Verbenaceae	*Verbena officinalis*	Common Verbena			N

Appendix B

Animal species recorded

Appendix B – Animal species recorded

Family Name	Scientific Name	Common Name	Observation type	Native
Birds				
Artamidae	*Gymnorhina tibicen*	Australian Magpie	O	Yes
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	O	Yes
Cacatuidae	*Cacatua roseicapilla*	Galah	O	Yes
Cacatuidae	*Cacatua sanguinea*	Little Corella	O	Yes
Charadriidae	*Vanellus miles*	Masked Lapwing	O	Yes
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	O	Yes
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	O	Yes
Corcoracidae	*Struthidea cinerea*	Apostlebird	O	Yes
Corvidae	*Corvus coronoides*	Australian Raven	O	Yes
Dicruridae	*Grallina cyanoleuca*	Magpie-lark	O	Yes
Falconidae	*Falco berigora*	Brown Falcon	O	Yes
Falconidae	*Falco cenchroides*	Nankeen Kestrel	O	Yes
Meliphagidae	*Manorina melanocephala*	Noisy Miner	O	Yes
Muscicapidae	*Turdus merula*	Common Blackbird	O	Yes
Petroicidae	*Microeca fascinans*	Jacky Winter	O	Yes
Psittacidae	*Platycercus eximius*	Eastern Rosella	O	Yes
Sturnidae	*Acridotheres tristis*	Common Myna	O	No
Mammals				
Bovidae	*Bos taurus*	Cattle (feral)	O	No
Suidae	*Sus scrofa*	Pig (feral)	O	No

Notes: O = Observed

Appendix C

Threatened species of plant

Appendix C - Threatened species of plant known or predicted to occur within the Study Area

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Asclepiadaceae	*Tylophora linearis*		E	E1	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). This species has recently been recorded within Leard State Forest near Boggabri NSW (Pers. Obs.).	EPBC, PlantNet, Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate -** Marginal habitat recorded within the study area and has been recorded within the broader locality.	**Yes** – this species was recorded and will be impacted upon by the proposed modification an impact assessment has been undertaken in Appendix E.
Brassicaceae	*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. 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).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Brassicaceae	*Lepidium monoplocoides*	Winged Peppercress	E	E1	Widespread in the semi-arid western plains regions of NSW. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *E. largiflorens* (Black Box) or *E. populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus, Agrostis avenacea, Austrodanthonia duttoniana, Homopholis proluta, Myriophyllum crispatum, Utricularia dichotoma* and *Pycnosorus globosus*, on waterlogged grey-brown clay. Also recorded from a *Maireana pyramidata* shrubland. The species is highly dependent on seasonal conditions. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance. The number of plants at each site varies greatly with seasonal conditions, but sites tend to be small in area with local concentrations of the plant. Has been recorded as uncommon to locally common with hundreds of plants at sites (Department of Environment and Conservation 2005).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Cyperaceae	*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).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Eriocaulaceae	*Eriocaulon australasicum*		E	E1	Occurs within habitat typically described as 'wet places along the Murray towards the junction of Murrumbidgee' such as within swamps and sedgelands (Department of Environment and Conservation 2006).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Euphorbiaceae	*Bertya opponens (syn. Bertya sp. A Cobar-Coolabah)*		V	V	It occurs in a range of habitats which makes the identification of critical habitat difficult. The species grows predominantly in shallow soil on stony mallee ridges and cypress pine forest on the red soils in the west, to coastal cliff edges in open eucalypt forests in the east (Briggs & Leigh 1996).(Harden 2000).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low –suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Fabaceae (Faboideae)	*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 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).	EPBC, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Haloragaceae	*Myriophyllum implicatum*			CE	It occurs in moist microhabitats adjacent to fresh water (Callaghan *et al.* 2002; Orchard 1985; Thompson, D. & Sharp 2003a; Thompson, E. & Sharp 2003b). Previously presumed extinct in NSW it was rediscovered in 2008 in open inundated gilgai depression on cracking clays in an area dominated by open forest/woodland. In QLD t is located in the Moreton Bay area, sporadically along the east coast to Townsville and inland to the Desert Uplands.	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Malvaceae	*Commersonia procumbens*	V	V		This species is known to occur on sandy sites mainly confined to the Dubbo – Mendooran and Gilgandra region. It is also known in the Pilliga and Nymagee areas (Royal Botanic Gardens, 2015).	PlantNet	Low - No suitable habitat was recorded within the study area.	No

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Orchidaceae	*Diuris tricolor*	Donkey Orchid		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).	Atlas of NSW	**Moderate -** Suitable habitat was recorded in within the derived native grassland within the study area.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Orchidaceae	*Prasophyllum sp. Wybong (C. Phelps ORG 5269)*	a leek orchid	CE		*Prasophyllum* sp. Wybong (C. Phelps ORG 5269) is known from seven populations in open eucalypt woodland and grassland in NSW. The species' area of occupancy is estimated to be 1.5 km2 with an estimated population size based on surveys in 2006 of 460 mature individuals. This species occurs within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes IBRA Bioregions and the Border Rivers-Gwydir, Namoi, Hunter-Central Rivers and Central West Natural Resource Management Regions. The distribution of this species overlaps with the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland EPBC Act-listed threatened ecological community (Department of Sustainability Environment Water Population and Communities 2011)	EPBC	**Moderate -** Suitable habitat was recorded in within the derived native grassland within the study area.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Orchidaceae	*Pterostylis cobarensis*		V	V	Grows among rocks on low hills and on slopes above streams; chiefly from Nyngan to Bourke district (Royal Botanic Gardens 2005). Western plains of NSW, chiefly in Nyngan - Cobar - Bourke region; favours stony ridges, often growing under *Eucalyptus morisii* (Grey Mallee) (Bishop 2000). Habitats are eucalypt woodlands, open mallee or *Callitris* shrublands on low stony ridges and slopes in skeletal sandy-loam soils. It has been recorded from ridge tops as well as steep exposed slopes and sheltered east slopes. Soils include shallow red clay-loam, skeletal red loam on metaquartzite, shallow sandy-loam on conglomerate and sandstone, and skeletal gritty organic loam on microgranite. Associated species include *Eucalyptus morrisii, E. viridis, E. intertexta, E. vicina, Callitris glaucophylla, Geijera parviflora, Casuarina cristata, Acacia doratoxylon, Senna* spp. and *Eremophila* spp. (Department of Environment and Conservation 2005).	PlantNet	Low - No suitable habitat was recorded within the study area.	No.
Poaceae	*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 2007).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Poaceae	*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 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).	PlantNet, Namoi – Liverpool Plains (B) CMA	**Moderate -** Suitable habitat was recorded in within the derived native grassland within the study area.	**Yes** – as potential habitat was recorded and impact assessment has been undertaken in Appendix E.
Poaceae	*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)	EPBC, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Polygalaceae	*Polygala linariifolia*			E1	Grows in dry sclerophyll communities from Warialda area to Weebah gate on the Qld border (Royal Botanic Gardens 2005).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Rhamnaceae	*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).	PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.
Rutaceae	*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).	Namoi CMA	Low - No suitable habitat was recorded within the study area.	No.
Santalaceae	*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).	Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Family Name	Species Name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data Source[3]	Likelihood of occurrence[4]	Impact assessment required?
Scrophulariaceae	*Euphrasia orthocheila* subsp. *orthocheila*			E1	Grows in moist open situations such as swamps north from Walcha districts and west to Mt Kaputar N.P., also at Orange and possibly in Sydney area.	PlantNet	Low – No suitable habitat was recorded within the study area.	No.
Surianaceae	*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).	EPBC, PlantNet, Namoi – Liverpool Plains (B) CMA	Low - No suitable habitat was recorded within the study area.	No.

Notes:

1. Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the EPBC Act.
2. Listed as an Endangered Population (EP), Vulnerable (V), Endangered (E1), Critically Endangered (CE) or Extinct (E4) under the TSC Act.
3. EPBC = EPBC Act Protected Matters Search Tool Report
   Atlas of NSW Wildlife = Office of Environment and Heritage Bionet Atlas – 10 km buffer of study area
   PlantNet = The Royal Botanic Gardens PlantNet database – 25 km buffer of study area
   Namoi CMA = OEH Namoi CMA Liverpool Range (Part B) regional search
4. Refer to Section 4 of the main report

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Appendix D

Threatened species of animal

Appendix D - Threatened species of animal known or predicted to occur within the Study Area

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Amphibians							
Litoria booroolongensis	Booroolong Frog	E	E1	Confined to mountain streams of the Great Dividing Range (Cogger 2000). Usually found on or under boulders and debris in and beside the rocky beds of mountain streams; breeds in summer (Anstis 2002).	EPBC	Low – No preferred habitat recorded.	No.
Birds							
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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 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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Falco subniger	Black Falcon		V	Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna {NSW Scientific Committee, 2013 #4096}.	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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, 1997 #24}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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 2006a). 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 2006b).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Ardea ibis	Cattle Egret	M		Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands and very rarely in arid and semi-arid regions. High numbers may occur in moist, poorly drained pastures with high grass; it avoids low grass pastures but has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. It is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora (Marchant & Higgins 1990; Morton *et al.* 1989).	EPBC	**Moderate –** preferred habitat recorded.	**Yes –** impact assessment conducted in Section 4.5 of the main report.
Stagonopleura guttata	Diamond Firetail		V	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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Tyto longimembris	Eastern Grass Owl		V	Typically found in tussock-grasslands but also occur in heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, grassy gaps between trees and crops. Nest on the ground generally under tussocks. They generally feed on rodents but will also eat insects {Pizzey, 1997 #24}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Pandion cristatus	Eastern Osprey	M	V	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish {Pizzey, 2007 #24}.	EPBC	Low – No preferred habitat recorded.	No.
Ardea modesta	Eastern Great Egret	M		Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. Great Egrets can be seen alone or in small flocks, often with other egret species, and roost at night in groups. In Australia, the breeding season of the Great Egret is normally October to December in the south and March to May in the north. This species breeds in colonies, and often in association with cormorants, ibises and other egrets. (Australian Museum 2003).	EPBC	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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 (Department of Environment Climate Change and Water 2010a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Apus pacificus	Fork-tailed Swift	M		Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land (Higgins 1999).	EPBC	Low – Likely to occur over study area on intermittent basis but no terrestrial habitat.	No.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat was recorded.	**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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Recorded.**	**Yes –** as this species was recorded in the vicinity of the modification study area and potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Gallinago hardwickii	Latham's Snipe	M		Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett & Crowley 2000).	EPBC	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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. 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).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Certhionyx variegatus	Pied Honeyeater		V	Inhabits wattle shrub (primarily Mulga, *Acacia aneura*), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (*Eremophila* spp.); also from mistletoes and various other shrubs (e.g. *Brachysema* spp. and *Grevillea* spp.); also eats saltbush fruit, berries, seed, flowers and insects. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times. Constructs a relatively large cup-shaped nest , usually robust, although occasionally loose, constructed of grasses and fine twigs, bound with spider webs, in the fork of a shrub or tree up to 5 m above the ground (Higgins and Marchant 2001).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
Merops ornatus	Rainbow Bee-eater	M		Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins 1999).	EPBC	**Moderate –** preferred habitat recorded.	**Yes –** impact assessment conducted in Section 4.5 of the main report.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	EPBC, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Myiagra cyanoleuca	Satin Flycatcher	M		Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey & Knight 2007).	EPBC	Low – No preferred habitat recorded.	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 (Department of Environment Climate Change and Water 2010b; Higgins & Peter 2002). 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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**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 the Spotted Harrier includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Department of Environment Climate Change and Water 2010b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**High –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded immediately adjacent.	**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).	EPBC, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**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 2010b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Haliaeetus leucogaster	White-bellied Sea-Eagle	M		Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey & Knight 2007).	EPBC	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
Hirundapus caudacutus	White-throated Needletail	M		Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey & Knight 2007).	EPBC	Low – Likely to occur over study area on intermittent basis but no terrestrial habitat.	No.
Fish							
Tandanus tandanus	Eel-tailed Catfish		E2	Occupies a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons. It inhabits flowing streams but prefers slow and still waters and can be found in clear or turbid water over substrates including mud, gravel and rock (NSW Fisheries Scientific Committee 2008).	Fisheries	Low – No preferred habitat recorded.	No.
Maccullochella peelii	Murray Cod	V		The Murray Cod occurs in lower reaches of the Murray-Darling Basin, where the water temperature is warm. The diverse range of habitats frequented by the Murray Cod includes slow moving rivers, murky billabongs and clear, rocky rivers (Threatened Species Scientific Committee 2011).	EPBC, Fisheries	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Craterocephalus fluviatilis	Murray Hardyhead	V	CE	Murray hardyhead live along the edges of slow-flowing lowland rivers, as well as in lakes, billabongs and backwaters. They are often found amongst aquatic weeds, in both fresh and quite saline waters. They were once widespread and abundant in the Murray and Murrumbidgee river systems in southern NSW and northern Victoria; however, they have suffered a serious population decline, and now seem to be limited to a few sites, mainly in northern Victoria. Since 2000, only one individual has been collected in extensive surveys in NSW (NSW Fisheries Scientific Committee 2008).	Fisheries	Low – No preferred habitat recorded.	No.
Bidyanus bidyanus	Silver Perch		V	The most abundant remaining natural population occurs in the central Murray River downstream of Yarrawonga Weir as well as several of its anabranches and tributaries (including the Edward River, an anabranch of the Murray which flows through Deniliquin, and the Murrumbidgee River). The central Murray population is considered secure and self-sustaining. There have also been reports of self-sustaining populations in other rivers, including the MacIntyre and Macquarie Rivers in northern NSW and the Warrego River in Queensland, mostly from recreational anglers. Little is currently known about the status of these populations (Department of Trade and Investment Regional Infrastructure and Services 2011).	EPBC, Fisheries	Low – No preferred habitat recorded.	No.
Mammals							
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
Onychogalea fraenata	Bridled Nailtail Wallaby	E	E4	The species is recorded in habitats west of the Great Dividing Range in a mixture of tall shrubland and grassy woodland, and on the fertile soils which support open eucalypt forest and woodland, and Brigalow scrub. The species has a preference for scrub edges and adjacent vegetation, grazing and sheltering in the shrubland and grazing the grassy woodland {Strahan, 1995 #185}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
Bettongia penicillata penicillata	Brush-tailed Bettong (SE Mainland)	X	E4	Occurs in open forests and woodlands with clumped, low understorey of tussock grasses or clumped low woody scrub. Feeds on underground fungi, bulbs, tubers, seeds, insects and resin (probably from Hakeas). Nest is an elaborate dome of grass, shredded bark that is built over a shallow depression scraped in the ground under a bush or other cover {Strahan, 1995 #185}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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 for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003a).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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 2011b).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill 2008)	Previous assessment	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Mormopterus norfolkensis	Eastern Freetail-bat		V	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures {Churchill, 2008 #2904}.	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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.	Atlas of NSW, EPBC, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
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 2011b). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage 2011b). Thought to forage below the forest canopy for small flying insects (Churchill 1998).	EPBC, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Rattus villosissimus	Long-haired Rat	V	E4	Predominately found in mesic and densely vegetated habitats in north-western NSW, with more scattered populations throughout western NSW. With adequate rainfall or flooding, plagues of Long-haired Rat can extend from these areas southwards along river channels and inhabit most areas. After water supply ceases, the population can die off quickly (Department of Environment and Climate Change 2007).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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 2011a). 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 2011a).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Pseudomys australis	Plains Rat		V	The species lives in complex burrow systems dug into hard rock gibber or the softer soil built up around the bases of the stunted bushes on the inland slopes of the Great Dividing Range (Strahan, 1995).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.
Nyctophilus corbeni (syn. N. timoriensis)	South-eastern Long-eared Bat (Corben's Loong-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 & Bennet 2003; 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).	Atlas of NSW, EPBC, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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 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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Atlas of NSW, Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.
Reptiles							
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).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	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).	Namoi – Liverpool Plains (B) CMA	**Moderate –** preferred habitat recorded.	**Yes –** as potential habitat was recorded an impact assessment has been undertaken in Appendix E.

Scientific name	Common Name	EPBC Act Status[1]	TSC Act Status[2]	Habitat	Data source[3]	Likelihood of occurrence[4]	Impact assessment required?
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).	EPBC, Namoi – Liverpool Plains (B) CMA	Low – No preferred habitat recorded.	No.

Notes:

1. Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the EPBC Act.

2. Listed as an Endangered Population (E2), Vulnerable (V), Endangered (E1), Critically Endangered (CE) or Extinct (E4) under the TSC Act.

3. EPBC = EPBC Act Protected Matters Search Tool Report

Atlas of NSW Wildlife = Office of Environment and Heritage Bionet Atlas – 10 km buffer of study area

Fisheries = Department of Primary Industries Fishing and Aquaculture Records Viewer

Namoi CMA = OEH Namoi CMA Liverpool Range (Part B) regional search

4. Refer to Section 4 of the main report

Fauna species considered extinct or greatly outside of their known distribution (such as) have been removed from the above table.

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Appendix E

Significance assessments

Appendix E – Significance assessments

Idemitsu Boggabri Coal Pty Limited (Boggabri Coal) is applying for a project area Modification to its current approval PA 09_0182.

Section 5A of the *Environmental Planning &Assessment Act 1979* (EP&A Act) requires that a 7 part test is undertaken to assess the likelihood of significant impact upon threatened species, populations or ecological communities under the *Threatened Species Conservation Act 1995* (TSC Act 1995) (Department of Environment and Climate Change 2007). Under Section 5A of the EP&A Act requires that a 7 part test is undertaken to assess the likelihood of significant impact upon threatened aquatic species, populations or ecological communities listed under Schedule 4, Part 3 of the *Fisheries Management Act 1994* (FM Act) (NSW Department of Primary Industries 2008).

For threatened 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 Environment 2013). Species listed under both the TSC Act and the EPBC Act has 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 proposed Modification area. A total of 18.9 ha of native vegetation will require removed as part of the proposed modification.

No threatened species or populations of plant or animal were recorded within proposed Modification Area. The proposed Modification study area did however contain three threatened ecological community listed under both the TSC Act and EPBC Act and potential habitat for four threatened species of plant and 28 species of animal. One threatened ecological community listed under the FM Act was recorded.

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1. Weeping Myall Woodland

Status

Weeping Myall Woodland is an Endangered Ecological Community listed under the EPBC Act and as Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions under the TSC Act.

Distribution, habitat and ecology

This community occurs as scattered remnants within the alluvial plains of the Murray-Darling river system within the Local Government Areas of Berrigan, Bland, Bogan, Carrathool, Conargo, Coolamon, Coonamble, Corowa, Forbes, Gilgandra, Griffith, Gwydir, Inverell, Jerilderee, Lachlan, Leeton, Lockhart, Moree Plains, Murray, Murrumbidgee, Narrabri, Narranderra, Narromine, Parkes, Urana, Wagga Wagga and Warren.

This community canopy layer is dominated by *Acacia pendula* (Weeping Myall) as low sparse woodland that reaches 10 m in height. The community typically occurs on textured red or brown alluvial soils that received approximately 375-500 mm mean annual rainfall (Office of Environment and Heritage 2015).

Threats

Threats for this EEC include (Office of Environment and Heritage 2015):

- Clearing and fragmentation associated with cropping
- Overgrazing by feral and domestic animals
- Weed invasion
- Herbivory by the processionary caterpillar *Ochrogaster lunifer* (Bag-shelter moth).

Specific impacts

The field surveys confirmed that 0.1 ha of Weeping Myall Woodland consistent with the endangered TSC Act and EPBC Act community will be impacted by the proposed Modification.

The proposed Modification would have indirect impacts on the Weeping Myall Woodland associated with utilisation of existing access tracks that already segment the community. Impacts may include increased exposure to exotic species and occasional disturbance of vegetation immediately adjacent the existing road.

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 the indirect disturbance to 0.1 ha of Weeping Myall Woodland.

The cumulative impact will reduce this community to a smaller extent but unlikely to place the local occurrence at risk of extinction due to the small area and nature of the indirect impacts that will occur to the Weeping Myall Woodland community.

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), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), 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

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland. This is in addition to the area being removed for the mine expansion (BCEP).

(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

The Weeping Myall Woodland EEC is a highly fragmented community across its former extent. The community already exists as a fragmented patch that runs immediately along Therribri Road in Boggabri which is intersected by the exiting access road into the agriculture residence. Although this remnant is already fragmented it does play an important role in maintaining linkages for both flora and fauna movement and genetic exchange across modified landscape.

The proposed Modification would have indirect impacts on 0.1 ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

(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 result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland. This remnant of Weeping Myall Woodland already exists as a fragmented remnant bounded by Therribri Road and other arterial unsealed access tracks. As a result the proposed Modification 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 large areas of this community occurring in the wider region 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 Weeping Myall Woodland.

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

A recovery plan has not been prepared for the Weeping Myall Woodland ecological community by the Office of Environment and Heritage. The Office of Environment and Heritage is developing a targeted strategy for the management of this endangered ecological community under the Saving Our Species program (SOS). In the interim the management actions outlined in Table 1.1 have been developed. The project is unlikely to significantly affect these actions.

Table 1.1 Management actions for Weeping Myall Woodlands

Management action	Likely to be impacted upon by the proposed modification
Identify and develop recovery actions that are necessary for the conservation of this species.	No
Survey key identified remnants on public land in order to identify remnant in high condition and protect sites as demonstration areas for EEC management.	No
Review and delineate distribution of the community from existing vegetation maps.	No

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 the key threatening processes of clearing on native vegetation. 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 native vegetation, existing trees will be retained, were possible.

Conclusion

The proposed Modification will result in the indirect disturbance to 0.1 ha of Weeping Myall Woodland EEC. The Weeping Myall Woodland recorded on site exists as a fragmented patch which is already being indirectly impacted upon by existing road infrastructure in the immediate area. Whilst the overall occupancy area will be reduced, it is unlikely that indirect impacts associated with the Modification on 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.

1.2 EPBC Act significance assessment

The following assessment has been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment 2013) and is related to those remnants of the endangered ecological community as defined by the EPBC Act Policy Statement – Weeping Myall Woodlands (Department of the Environment Water Heritage and the Arts 2009).

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

Reduce the extent of an ecological community

The proposed Modification would result in indirect impacts on Weeping Myall Woodland within the Modification study area. A total of 0.1 ha of the EPBC listed community would be disturbed. As this is a relatively small amount and given the nature of works in the vicinity impacts associated with proposed Modification are unlikely to be significant.

Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The proposed Modification within the EPBC listed community may result in minor increases in fragmentation. The Weeping Myall Woodland recorded on site is highly fragmented and disturbed as a result of past land uses which include road construction, grazing and other agricultural practices. Given the highly fragmented state of the community this incremental increase is unlikely to be significant.

Adversely affect habitat critical to the survival of an ecological community

No critical habitat has been listed for the Weeping Myall Woodland ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment and Heritage 2006b).

Habitat critical to the survival of an ecological community may, however, 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 Environment 2013).

The area of woodland to be disturbed currently occurs as roadside remnant vegetation along Therribri Road. This vegetation has been heavily degraded and is subjected to weed invasion as a result of edge effects. Nevertheless given that over 89% of the original extent has already been removed all representations of the community are important (Eco Logical Australia 2008). However, it is unlikely that the area within the proposed Modification Area is critical to the survival of the community compared to larger more intact areas.

Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Given the small amount of Weeping Myall Woodland to be disturbed (0.1 ha), it is unlikely this would have a substantial alteration to groundwater levels or surface water drainage. In addition, the soil will not be significantly impacted.

Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of to date functionally important species for example through regular burning or flora or fauna harvesting?

The species composition of the Weeping Myall Woodland to be removed is believed to be similar to that elsewhere in the patch. It is unlikely that disturbing 0.1 ha of the vegetation would cause a substantial change in the species composition of the vegetation elsewhere within the patch.

Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**

Much of the landscape surrounding the proposed Modification study area is already weed invaded. With the implementation of appropriate weed management practices (such as those detailed in Section 6 of the main Ecological Assessment), the proposed Modification study area will not significantly increase weed levels from that which already exist in the landscape and within the Weeping Myall Woodland patch.

Will the action interfere with the recovery of an ecological community

The disturbance or removal of any occurrence of Weeping Myall Woodland will contribute to the continual decline of the community, and therefore will interfere with its recovery. However given the small size to be removed this is not likely to be significant.

Conclusions

The proposed Modification would result in a disturbance of Weeping Myall Woodland by 0.1 ha. Although the loss of 0.1 ha is not significant in itself due to the small size, this contributes incrementally into loss of this community.

Impacts to the woodland area can be minimised through design by utilising existing tracks and avoiding woodland stands where possible. The proposed Modification will utilise the existing access track and likely indirect impacts that are unlikely to have significant impacts on the Weeping Myall Woodland EEC.

2. Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River

Status

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River is listed as an Endangered Ecological Community under the *Fisheries Management Act 1994* (FM Act).

Distribution, habitat and ecology

The lowland catchment of the Darling River ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams, and associated lagoons, billabongs, lakes, flow diversions to anabranches, and the floodplains of the Darling River including Menindee Lakes and the Barwon River. Specifically, these areas include the main Barwon-Darling channel from Mungindi (Qld-NSW border) to the confluence with the Murray River, the arid zone intermittent intersections streams (Warrego, Culgoa, and Narran Rivers), Border Rivers (Macintyre, Severn and Dumaresq Rivers), and regulated tributaries of the Gwydir, Namoi, Macquarie, Castlereagh, and Bogan Rivers (NSW Fisheries 2003).

Threats

Threats identified by the NSW Department of Primary Industries for this EEC include:

- Modification of natural flows as a result of river regulation (dams, weirs etc.), leading to reduced habitat quality and complexity, loss of spawning cues, and reduced opportunities for dispersal and migration of aquatic species.
- Spawning failures and habitat loss resulting from cold water releases from dams.
- Degradation of the riparian (riverbank) zone through clearing of native vegetation and stock trampling, leading to loss of shelter and increased sedimentation.
- Clearing of floodplain vegetation for agriculture also increases sedimentation, and reduces carbon inputs to the river, which are an important food source for instream invertebrates.
- Removal of in-stream large woody debris, which is an important habitat component and territory marker for many fish and invertebrates.
- Predation, competition, diseases and habitat modification associated with introduced fish species, such as carp, goldfish, redfin perch, mosquitofish and the snail *Physa acuta*.
- Agricultural practices, such as irrigation, clearing, grazing and the use of fertilisers and pesticides, which affect water quality.
- Over-fishing has probably contributed to declines in some fish species, such as Murray cod and golden perch. Illegal fishing activities, together with hooking injuries in accidentally caught fish, still pose a threat to some species.

Specific impacts

The Namoi River and the Namoi River Floodplain occurs within the proposed modification study area and the Namoi River is part of this EEC. The field surveys confirmed that 1.3 ha of low to moderate condition River Red Gum Riparian Woodlands and Forests are consistent with this endangered FM Act community and will be impacted by the proposed Modification.

The proposed Modification would have direct and indirect impacts on the River Red Gum Riparian Woodlands and Forests associated with utilisation of existing access tracks that already segment the community. Impacts may include increased exposure to exotic species and occasional disturbance of vegetation immediately adjacent the existing road.

2.1 FM 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 Namoi River and the surrounding associated floodplain fall within the broad catchment, and therefore, form part of this ecological community. The proposed modification will remove 1.3 ha of vegetation.

The project would require minor modification of riparian vegetation of the Namoi River and the associated floodplain to facilitate the proposed modification. However, the Namoi River and the associated floodplains do not contain unique or important assemblages of species and are in poor condition. As such the impacts on this community are not considered to be significant.

(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), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), if adhered to, should minimise any impacts to abiotic characteristics that affect composition.

The proposed modification will remove some of the riparian vegetation associated with Namoi River floodplain which is likely to add to the overall disturbance regimes within the Namoi River. However, the waterways within the modification study area are currently affected by riparian vegetation clearance, erosion and sedimentation, alteration of flow and bank instability due to stock access and riparian removal. Given that suitable habitat exists up and downstream of the watercourses, no long-term impacts from the proposed modification, and sufficient erosion and sediment controls are implemented in accordance with best practice management (Department of Environment and Climate Change 2008b). It is therefore unlikely that the proposed modification will place this community at risk of extinction.

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 approximately 1.3 ha of River Red Gum Riparian Woodland and Forests vegetation which is commensurate with this community. This is in addition to the area being removed for the mine expansion (BCEP).

(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

The Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC is a highly fragmented and disturbed community across its former extent. The community already exists as a fragmented patch that exists as remanent riparian vegetation along the Namoi River and its floodplain. Although this remnant is already fragmented it does play an important role in maintaining linkages for both flora and fauna movement and genetic exchange across modified landscape.

The proposed Modification would have indirect impacts on 1.3 ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

(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 result in the indirect disturbance to 1.3 ha of Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River. This remnant of already exists as a fragmented patch that exists as remanent riparian vegetation along the Namoi River and its floodplain. As a result the proposed Modification 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 large areas of this community occurring in the wider region of equal or greater value.

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

The Department of Primary Industries 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 this EEC. The Department of Primary Industries maintains a register of critical habitat. Water bodies within the subject site are generally in poor condition, are not listed as a critical habitat and are not considered critical to the survival of the ecological community.

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

A recovery plan has not been prepared for the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River ecological community by the Department of Primary Industries. The Department of Primary industries have developed Priority Action Statements and recovery strategies for this community. These are outlined in Table 2.1 below. The proposed modification is unlikely to significantly affect these actions.

Table 2.1 Recovery strategies and Priority Action Statements

Priority Action Statement	Recovery Strategy	Priority
Advice to consent and determining authorities	Provide local councils, government agencies and Local Land Service's (LLS's) with resource materials and training regarding habitat protection and threatened species provisions of the *NSW Fisheries Management Act 1994* to support planning, determination, impact assessment and concurrence decision making processes. This may include impact assessment guidelines, mitigating prescriptions, offsets, and generic consent conditions.	Medium
	Distribute guidelines regarding flow requirements of key characteristic species to relevant Natural Resource Management (NRM) agencies.	Medium

Priority Action Statement	Recovery Strategy	Priority
Collate and review existing information	Compile existing records of characteristic native species occupying the Endangered Ecological Community (EEC) and map their current known distribution.	Medium
Community and stakeholder liaison, awareness and education	Develop and disseminate advisory materials on priority issues relevant to the recovery of the EEC **(Medium priority)**.	Medium
	Actively encourage community involvement in aspects of the recovery of the EEC including for example, research, reporting, monitoring and management activities **(Medium priority)**.	Medium
	Encourage community reporting of key species through the Protected, Threatened and Pest Species Sighting Sheet Program **(Low priority)**.	Low
Compliance / enforcement	Implement and enforce relevant fishing regulations (e.g. seasonal closures, bag and size limits, gear restrictions etc.) **(High priority)**.	High
	Undertake and continue targeted enforcement activities by regional Fisheries Officers **(High priority)**.	High
	Identify and implement measures to improve the reporting of illegal activities and enhance feedback to stakeholders (such as anglers) on actions taken **(Medium priority)**.	Medium
Enhance, modify or implement NRM planning processes to minimize adverse impacts on threatened species	Ensure information on the location of characteristic native species within the EEC is considered in state and national management programs for introduced species and diseases **(Medium priority)**.	Medium
Habitat protection	Review regulatory and voluntary incentive based mechanisms available in the EEC to enhance protection for key habitat areas and apply as required. This may include the use of critical habitat provisions, aquatic reserves, environmentally sensitive land provisions, voluntary conservation agreements etc **(Medium priority)**.	Medium
Habitat rehabilitation	Advocate appropriate allocation and improved management of environmental flows, particularly in areas known to support remnant natural populations of threatened species and reduced diversion volumes during the spawning and larval period **(High priority)**.	High
	Improve fish passage at major regulating structures through existing programs **(High priority)**.	High
	Identify and prioritise the most significant barriers to fish passage within the geographic area of the EEC having regard to relevant existing programs **(Medium priority)**.	Medium
	Work with LLS's to encourage implementation of relevant aquatic habitat rehabilitation / threatened species actions outlines in catchment action plans **(Medium priority)**.	Medium
	Determine key threatening processes within each zone and prioritise zones for action according to management capability, ecological function and threatened species considerations **(Medium priority)**.	Medium
	Work with local councils and relevant government agencies to mitigate the impacts of cold water pollution within the EEC **(Medium priority)**.	Medium
	Develop a NSW Cold Water Pollution Program including a program of works and funding options **(Medium priority)**.	Medium

Priority Action Statement	Recovery Strategy	Priority
	Support and assist community groups, NRM authorities, local councils and landholders to protect and rehabilitate riparian vegetation and instream habitats along key river reaches where populations of threatened species are known to occur **(Medium priority)**.	Medium
	Develop new projects in consultation with community groups, relevant natural resource management agencies, local councils and landholders to address key water quality issues within the EEC (e.g. sedimentation, algal blooms, salinity, and agricultural chemicals) **(Medium priority)**.	Medium
Pest eradication and control	Assess information on current management techniques for pest species and their application in the EEC **(Medium priority)**.	Medium
	Reduce the risk of disease and pest species introduction from aquaculture operations by ensuring compliance with the Hatchery Quality Assurance Program and appropriate grow-out facility permit conditions **(Medium priority)**.	Medium
	Monitor populations of introduced fish species at key sites and undertake eradication and/or control programs where appropriate **(Medium priority)**.	Medium
Research / monitoring	Develop and implement a targeted investigation program to quantify the distribution and abundance of native species in the EEC, focusing on threatened species and populations. The investigation program should form the basis for monitoring over time **(High priority)**.	High
	Develop and implement research projects investigating key areas of the biology and ecology of characteristic native species within the EEC to inform the recovery program. Projects are to include for example, investigation into flow requirements, taxonomic status, levels of genetic diversity, migration, habitat requirements, factors critical to the successful spawning and recruitment, interactions between trophic guilds, interactions with introduced species and environmental tolerances **(High priority)**.	High
	Develop guidelines and principles to help determine the ecological needs of key characteristic species within the EEC and the flow levels required to complete their lifecycle **(High priority)**.	High
	Develop and implement a research program to investigate the impacts of introduced species and diseases that affect native species occupying the EEC, and assess their potential impacts **(High priority)**.	High
	Develop reference criteria for each river management zone to allow meaningful insights into ecological condition and changes over time to be made **(High priority)**.	High
	Review the available evidence on the impacts of fishing activities on characteristic native species within the EEC, and the current fishing regulations to determine the need for changes **(High priority)**.	High
	Investigate available evidence on the impacts of commercial and recreational fishing activities on key native species in the EEC **(High priority)**.	High
	Disseminate results from investigation and research activities to inform recovery and threat abatement efforts for threatened species and populations in the EEC **(Medium priority)**.	Medium
	Investigate the contribution of smaller impoundments (e.g. weir pools) to reductions in river temperatures, and low-cost options for their management **(Medium priority)**.	Medium
	Identify the characteristic native species likely to be sensitive to cold water pollution and the extent of instream habitat affected **(Medium priority)**.	Medium

Priority Action Statement	Recovery Strategy	Priority
	Design and implement targeted monitoring programs linked to river management zones to enable the effectiveness of recovery actions to be evaluated **(Medium priority)**.	Medium
	Identify opportunities for collaboration on monitoring and evaluation activities in the EEC **(Medium priority)**.	Medium
	Investigate the impacts of water diversion on fish larvae **(Low priority)**.	Low
Stocking / translocation	Implement the NSW Hatchery Quality Assurance Program and the NSW Freshwater Fish Stocking Fishery Management Strategy to ensure that harvest and conservation stocking activities are carried out in a manner that will not adversely impact wild populations of native fish **(High priority)**.	High
	Where appropriate enhance and/or initiate conservation stocking programs for threatened species within the ECC **(Medium priority)**.	Medium
Survey / mapping	Develop mapping products for stakeholders regarding the distribution and abundance of native species in the EEC to assist in targeting habitat rehabilitation projects **(High priority)**.	High
	Establish a system of distinct river management zones for the EEC, consistent with other strategies and plans (where possible), in conjunction with stakeholders including LLS's and natural resource management agencies **(Medium priority)**.	Medium

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

There is currently one key threatening process listed under the FM Act which affects this EEC being, degradation of native riparian vegetation along New South Wales water courses. 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 disturbance of 1.3 ha of low to moderate condition Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River EEC. Whilst this small area will add incrementally to the loss of this community it is small in comparison to larger areas of this community present in the wider region. 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.

3. Plains Grassland

Status

The Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland is listed as a Critically Endangered Ecological Community under the EPBC Act and the Native vegetation on cracking clay soils of the Liverpool Plains is listed as an Endangered Ecological Community under the TSC Act.

Distribution, habitat and ecology

This community occurs from the Darling Downs in Queensland to Dubbo in NSW and includes the Liverpool and Moree Plains. This community has a strong affiliation with the soil type and occurs on fine textured often cracking clays derived from either basalt or quaternary alluvium, on flat to very low slopes (Department of Environment Water Heritage and the Arts 2008c). In NSW these include the Mooki River, Coxs Creek and their tributaries which drain into the Namoi Catchment (NSW Scientific Committee 2001a). The floristic structure is that of native Grassland, with a canopy of less than 10% projective foliage cover. The community is dominated by *Austrostipa aristiglumis,* with other native grasses such as *Dichanthium sericeum, Panicum queenslandicum* and *Aristida leptopoda* are often present as co-dominants.

The original extent and floristic composition of plains grassland has been the subject of a recent study by (Lang R. D. 2008). This study found that the treeless nature of the community was attributed to a mixture of fine-textured soil, climate and topography restricting water availability. The distribution of the grasslands has been mapped to Old Warrah in the south-east, to Boggabri in the North and to Goolhi in the west. Review of historical records found that the dominance *Austrostipa aristiglumis* could possibly be a result of agricultural practices and that the original areas of grasslands before European settlement could have been dominated by grasses such as *Eulalia aurea, Astrebla lappacea* and *Themeda avenacea* (Lang R. D. 2008). If agriculture techniques are altered to mimic kangaroo grazing these three aforementioned native grass species become dominant over *Austrostipa aristiglumis*. This finding could have implications for further management of this community.

Threats

The Office of Environment and Heritage list a number of threats for this community:

- Clearing and fragmentation of habitat for cropping and grazing.
- Roadworks.
- Grazing by domestic stock.
- Salinity and soil erosion.
- Weed invasion.

Specific impacts

Within the proposed modification boundary the Plains Grassland vegetation type is consistent with the TSC Act listing and the EPBC Act listing of this community. This community occurred to the north-east of Belleview and is associated with areas of recent clearing for agricultural land uses and Boggabri Coal Mine. This community encompassed 0.1 ha within the proposed modification boundary. Of this approximately 0.1 ha of this community will be removed and/or disturbed as part 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

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

The proposed Modification will result in the disturbance to 0.1 ha of Plains Grassland.

The cumulative impact will reduce this community to a smaller extent but unlikely to place the local occurrence at risk of extinction due to the small area of removal and nature of the indirect impacts that will occur to the plains grassland.

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), Modification 3 (Parsons Brinckerhoff 2013) and Modification 4 (Parsons Brinckerhoff 2014), 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

The proposed modification will result in the removal of approximately 0.1 ha of plains grassland. This is in addition to the area being removed for the mine expansion (BCEP).

(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

The plains grassland EEC is a highly fragmented as a consequence of previous agricultural practices across its former extent. The community already exists as an isolated patch within an agricultural patch near Belleview groundwater bore.

The proposed Modification would have impact on xx ha which may reduce the occupancy area of the EEC. This is considered unlikely to contribute significantly to the fragmentation currently experienced by the EEC.

(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 result in the disturbance to 0.1ha of Plains Grassland. This remnant of Plains Grassland already exists as a fragmented remnant as a result of past agricultural practices. As a result the proposed Modification 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, as this area represents a small proportion of the total area of this community in the region (0.002%).

The area of plains grassland to be removed is unlikely to be important for the long term survival of the community in the locality.

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 Plains Grassland.

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

No recovery plans have been developed for this community. The Office of the Environment and Heritage is currently developing a targeted approach for managing Ecological Communities as part of the Saving Our Species program. In the interim, the management actions have been identified for this community (Table 3.1). The proposed modification will not significantly affect any of these actions.

Table 3.1 Management actions for the Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland

Management Actions	Likely to be impacted upon by the proposed modification
Identify, map the locations and assess the conservation values of remnant areas of the EEC, particularly where it occurs on TSRs.	No
Undertake weed control in areas where required.	No
Provide advice and support, including locale maps, to local and state govt depts to ensure appropriate environmental assessment and targeting of conservation action.	No
Erect fences if necessary to protect the EEC from stock grazing where it occurs on TSRs.	No
Provide advice, support and encouragement to local bushcare groups to restore remnant areas of degraded EEC - field days, tube stock, advice on species to re-plant, brochures.	No
Identify areas suitable for restoration and initiate restoration works.	No
Erect signage and/or fences around the EEC where it occurs along roadsides, to protect it from roadworks.	No
Encourage landholders to enter into a VCA where the EEC occurs on their property.	No

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 the key threatening processes of clearing on native vegetation. It may also encourage the invasion of native plant communities by exotic perennial grasses.

The proposed modification would include clearing of native vegetation, however, the extent required to be removed is not considered significant in terms of the areas to be retained within the study area and the surrounding landscape.

The proposed modification also has the potential to spread weeds, including perennial grasses. The most likely causes of weed dispersal associated with the proposed modification would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. Mitigation measures have been provided to minimise the likelihood of weed spread. Furthermore, the majority of works are within already disturbed areas and the majority of the vegetation within the study area already has considerable weed growth; therefore, the overall extent of habitat modification is not likely to increase significantly.

Conclusion

The proposed Modification is likely to remove approximately 0.1 ha of Plains Grassland EEC. The Plains Grassland recorded on site exists as a fragmented patch which is already being impacted upon by existing agricultural practices in the immediate area. Whilst the overall occupancy area will be reduced, it is unlikely that the impacts associated with the Modification on 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.

3.2 EPBC Act Significance assessment

The following assessment has been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment 2013) and is related to those remnants of the endangered ecological community as defined by the EPBC Act Policy Statement – Nationally Threatened Ecological Communities (Department of Sustainability Environment Water Population and Communities 2012).

Under the EPBC Act, an action is likely to have a significant impact on a CEEC if there is a real chance or possibility that it will:

Reduce the extent of an ecological community?

The proposed Modification would result in approximately 0.1 ha of Plains Grassland being affected within the Modification study area. Therefore the action will reduce the extent of this community. The area of plains grassland proposed to be removed represents a small proportion of this community in the study area and surrounding landscape. Approximately 25,000 ha of this CEEC has been mapped within the Liverpool and Moree Plains (Carter *et al.* 2003), with the removal of approximately 0.1 ha within the modification study area equating to 0.002 % of plains grassland within the region. As this is a relatively small amount and given the nature of works in the vicinity impacts associated with proposed Modification are unlikely to be significant.

Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The proposed Modification within the EPBC listed community may result in minor increases in fragmentation. The plains grassland recorded on site is highly fragmented and disturbed as a result of past land uses which include road construction, grazing and other agricultural practices. Given the highly fragmented state of the community this incremental increase is unlikely to be significant.

Will the action adversely affect habitat critical to the survival of an ecological community?

No critical habitat has been listed for the plains grassland ecological community under the *Environment Protection and Biodiversity Conservation Act 1999*.

Habitat critical to the survival of an ecological community may, however, 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 Environment 2013).

The area of plains grassland to be disturbed currently occurs as a single patch within the study area. This vegetation has been heavily degraded and is subjected to weed invasion as a result of edge effects. Nevertheless given that over 96% of the original extent has already been removed all representations of the community are important (Eco Logical Australia 2008). However, it is unlikely that the area within the proposed Modification Area is critical to the survival of the community compared to larger more intact areas.

Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

The proposed modification would not modify or adversely affect abiotic factors necessary for the survival of plains grassland within the study area. Soil would be disturbed in the construction footprint; however the extent of this area is not essential for the survival of the ecological community.

Plains grassland is located on the lower lying plains and this community is considered to be associated with shallow perched water tables over impermeable clay lenses rather than groundwater fed by subsurface aquifers. Therefore this community has been classed as having some proportional dependence upon groundwater. The proposed modification would require the excavation and shaping of the upper soil profile and minor alterations to the existing surface water drainage however is unlikely to require groundwater extraction or significant impacts on the existing subsurface aquifers and their associated groundwater dependent ecosystems. Therefore it is unlikely that the proposed modification will modify the groundwater levels such to an extent to effect this community's survival.

The proposed modification would result in some localised modification to surface water hydrology, however not to an extent that would affect the survival of the ecological community. These impacts include a potential increase in sediment and water runoff from the construction footprint and the potential for oil spills. Therefore it is considered that there is potential for the proposed modification to modify abiotic factors; however the modifications are unlikely to be of a significant impact that they would affect the survival of this community.

Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species for example through regular burning or flora or fauna harvesting?

The proposed modification is not likely to cause a substantial change in the species composition of the plains grassland within the modification study area. The plains grassland within the modification study area is characterised by a dominance of native grasses but has minor pasture weed invasion as a result of past land-uses, and edge effects from the adjoining exotic grasslands. Edge effects from the existing tracks and road reserves are currently having a small impact with minor pasture weed incursions occurring. The proposed modification will not substantially change the species composition within this community.

Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the ecological community, to become established; or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?**

The plains grassland has been subjected to numerous past land use activities including vegetation clearing, grazing, and pasture improvement. Therefore, it is highly unlikely that the plains grassland within the modification study area is in the pre-european condition. However, in saying this it is likely that very few examples of this community remain relatively intact throughout its range. The construction and operation of the proposed modification may amplify the conditions that have resulted in the modification of the community.

Will the action interfere with the recovery of the ecological community?

The removal of approximately 0.1 ha of plains grassland is unlikely to interfere with the recovery of the community given the extent of clearing in relation to the broader extent within the region. However at the local scale, small patches of plains grassland vegetation do contain important species such as those that are grazing sensitive and may function as an important source of species for the wider area.

Conclusion

The proposed modification would remove approximately 0.1 ha of plains grassland. However, given that over 5,980 ha has been mapped within the region, the proposed modification is not likely to have a significant impact on this community.

4. Digitaria porrecta

Status

Digitaria porrecta (Finger Panic Grass) is listed as Endangered under the TSC Act 1995. The species was delisted from the EPBC Act on 14 December 2014.

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 within the proposed Modification study area was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 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 *Digitaria porrecta* within the proposed Modification 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 18.9 ha of potential habitat for this species. This is in addition to 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 porrecta* 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.

18.9 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, research actions and conservation actions have been developed to assist in the recovery of this species by the Office of Environment and Heritage. Digitaria porrecta has been designated as a data-deficient species as part of the Saving Our Species Program and therefore the following two research actions have been developed by the Office of Environment and Heritage to further knowledge in the species:

- Assess population size through survey of known locations.
- Identify threats acting on populations in order to inform management.

The following state wide conservation actions have been developed to assist in the recovery of this species:

- Conduct media publicity campaign to highlight implementation of recovery actions.
- Control rabbit grazing near high density populations (best practice: locally efficient and effective).
- Determine if and/or where an ecological burn is required.
- Develop EIA guidance for consent and determining authorities with regard to development and other activities.
- Encourage livestock management so as to maintain or improve habitat for this species.
- Clearly identify roadside populations and ensure no impact by road maintenance.
- Discourage fertilizer drift into populations.
- Ensure OEH is advised of any consents or approvals that affect the species.
- Negotiate with landholders (and neighbouring properties where relevant) to prepare and implement site management plans that address threats.
- Fence sites with high density populations to prevent grazing.
- Conduct weed control, especially of invasive exotic grasses.
- Encourage landholders to enter VCAs and other site management agreements.
- Opportunistically monitor populations after wildfire to determine fire ecology.
- Ensure awareness by managers and users of Travelling Stock Routes of the species' location and identification and requirements.
- Monitor Queensland Recovery Plan and effort for guidance.
- Conduct targeted surveys in potential habitat.

The proposed Modification will not interfere with any of the identified research or conservation 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 18.9 ha of potential habitat was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

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.

5. Diuris tricolor

Status

Diuris tricolor (Pine Donkey Orchid) is listed as Vulnerable under the TSC Act 1995. The species was delisted from the EPBC Act 1999 on 19 August 2011.

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 (*Callitri*s 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 period, 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 proposed Modification area was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 ha of potential habitat will be removed as a result of the proposed Modification.

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

Diuris 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 18.9 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 *Diuris tricolor* within the proposed Modification 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 18.9 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 18.9 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* by the Office of Environment and Heritage.

As part of the SOS program being developed by the Office of Environment and Heritage *Diuris tricolor* has been assigned as a keep watch species. Threatened species assigned as Keep Watch species require no immediate investment because they are either naturally rare, have few known threats, or are more abundant than previously assumed. Ten state wide conservation actions for managing the recovery of this species have been identified by Office of Environment and Heritage (2014b). These are as follows:

- conduct baseline surveys to locate new populations and extend the ranges of currently known populations. Surveys should include all State Forests where suitable habitat occurs
- following surveys, assess the current conservation status and prepare and submit a nomination for de-listing if required
- annually monitor at least five populations that represent the spatial distribution of the species
- collect seed and soil for NSW Seedbank. Develop collection program (including mycorrhizal symbiont) in collaboration with BGT - multiple provenances
- conduct experimental trials into the effects of fire, grazing and weed disturbances
- erect rabbit, goat and stock-proof fences around populations that are highly threatened from trampling and grazing by feral animals and stock
- develop a fact sheet and distribute via community newsletters, regional shows and field days and by promoting the DEC threatened species website
- conduct surveys and assessments of less known sites to confirm presence of species and develop and implement conservation management agreements with landholders for high priority sites
- develop an expression of interest (EOI) for incentives targeted towards private landowners to locate new sites for conservation
- investigate seed viability, germination, dormancy and longevity (in natural environment and in storage) (+ symbionts and soil for orchids, gentians).

The project is unlikely to affect the above conservation 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 involves the clearing of native vegetation, a known threating process for this species. As the area proposed to be removed is small (18.9 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 18.9 ha of potential habitat will be removed by the proposed Modification. This includes the following vegetation communities identified within the proposed Modification area:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.

- Derived native grassland

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.

6. Prasophyllum sp Wybong

Status

Prasophyllum sp. Wyobong (C. Phelps ORG 5269) is listed as a Critically Endangered species under the EPBC Act.

Distribution, habitat and ecology

Prasophyllum sp. Wybong is a terrestrial orchid species that grows to approximately 30cm high. The species has a dull green basal leaf that is tubular and fleshy. The single flower spike has numerous fragrant flowers.

The species is endemic to NSW and is known to occur near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals.

The orchid is perennial appearing as a single leaf over winter and spring. The species flowers in spring and dies back to a tuber over the summer and autumn. The known habitat of the species is open eucalypt woodland and grassland (Office of Environment and Heritage 2014a).

Threats

Threats for this species include habitat clearing including mining, weed invasion (especially exotic grasses), vehicle traffic, roadside maintenance, inappropriate disturbance regimes, chemical drift from agriculture, illegal collection and chance extinction of small populations due to the few number of individuals in most populations (Office of Environment and Heritage 2014a).

Specific impacts

No *Prasophyllum sp. Wybong* was during the field survey, however habitat for the species within the proposed Modification area was identified in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 ha of potential habitat will be removed as a result of the proposed Modification.

6.1 EPBC Act significance assessment

Prasophyllum sp. Wybong is listed as a Critically Endangered species under the EPBC Act. The following assessment has been undertaken following the Principal Significant Impact Guidelines 1.1 (Department of Environment 2013).

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

No *Prasophyllum sp Wybong* was recorded within the proposed Modification area. However, if present the proposed Modification would lead to a decrease in the size of a local population. Given the higher quality habitat within the broader the locality the removal habitat is considered unlikely to lead to a long term decrease.

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

If present the proposed Modification would reduce the area of occupancy for a local population of *Prasophyllum sp. Wybong*.

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

No *Prasophyllum sp Wybong* was recorded within the proposed Modification area. Therefore, 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 *Prasophyllum sp. Wybong* 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 Environment, 2013)

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

Will the action disrupt the breeding cycle of a population?

If present, the population of *Prasophyllum sp. Wybong* within the boundaries of the proposed Modification 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 18.9 ha. Given the condition of habitat present, availability of higher quality habitat in the broader locality and the extent likely to be impacted (18.9 ha) the proposed Modification is not considered likely to cause the species to decline.

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

The proposed Modification area is already subject to high weed invasion as a result of agricultural activities. Doe to the high number of weeds existing in the study area and if the appropriate weed management actions were implemented the establishment of additional weeds 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 *Prasophyllum sp. Wybong*.

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

No *Prasophyllum* sp. *Wybong* were recorded within the proposed Modification area, however suitable habitat for the species does occur. The condition of habitat present is highly degraded as a result of agricultural activities. Due to the condition of habitat to be affected, greater quality habitat within the broader locality the removal of 18.9 ha of habitat is unlikely to substantially interfere with the recovery of the species.

Conclusion

Based on the above assessment, the reduction of potential *Prasophyllum sp. Wybong* habitat by 18.9 ha is unlikely to significantly impact upon the species.

7. *Tylophora linearis*

Status

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

Description

The species is an herbaceous climber in the Apocynaceae 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, Callitris endlicheri, Callitris glaucophylla, Allocasuarina luehmannii, 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 proposed Modification area at Piliga West State Forest occurred within woodland dominated *by Eucalyptus pilligaensis* 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* have been recorded within the Modification study area however it has been previously recorded within the Project Approval 09_0182.

Potential habitat has been recorded within the proposed Modification area in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

A total of 18.9 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 lifecycle of *Tylophora linearis* within the proposed Modification 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 18.9 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 specie s 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 18.9 ha of potential habitat for this species. This is in addition to the vegetation being removed by the BCEP. As a large area of potential habitat remains in the locality and a relatively large population remains within 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 18.9 ha of potential habitat within the proposed modification area 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 number of individuals to be removed and the 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 state wide conservation 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.

State Wide Conservation Actions for *Tylophora linearis*:

- Protect all known sites immediately from any type of disturbance (fire, grazing, forestry operations,etc) until such time as its conservation status is fully known and recovery actions are better developed.
- Determine the full extent, distribution and viability of surviving populations and identify at least 6 populations across the species range for implementation of recovery actions.
- Following targeted surveys, reassess the conservation status and if required, prepare and submit a nomination for listing as "Critically Endangered".
- Establish a comprehensive monitoring program for the 6 identified populations to determine the success or otherwise of recovery actions and to guide future actions.
- Conduct research to determine ecological requirements and undertake field studies to monitor seedling establishment and survivorship.
- Understand the species response to disturbance regimes by conducting experimental research into the effects of fire and grazing disturbance, in order to guide recovery actions.
- Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).
- Collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - multiple provenances.
- Provide relevant landcare & community groups with information, support and guidance to assist in identifying the species and selecting appropriate sites for tree planting and other bush regen activities that will not impact on the species.
- Liaise with local indigenous groups to ascertain the importance or relevance of this species to indigenous cultures and seek their assistance in understanding the ecology of the species and in developing recovery actions.
- Ensure that local govt, DNR, Forestry and other planning agencies are kept informed of all known populations in order to assist them in making informed planning decisions regarding clearing, forestry and other development activities.

- Implement sympathetic habitat management on-park and ensure consideration of the species ecology and habitat in all forms of management planning. .

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* was recorded within the proposed Modification study area however the species has previously been recorded within the previously approved project boundary. The proposal will remove approximately 18.9 ha of potential habitat identified within the modification area. Habitat for this species occurs in the following vegetation communities:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

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.

7.2 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 recorded within the Modification study area however the species has been previously observed within the previously approved project boundary. The proposed modification will not result in the removal of any known individuals. Over the long-term it is unlikely to lead to the extinction of this species as a result of the proposed Modification because of the minimal disturbance (18.9 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 18.9 ha of potential habitat with the proposed modification area for *Tylophora linearis* would be affected by the proposed Modification. As the vegetation to be cleared (within the proposed modification area) are 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* individuals were identified within the proposed modification area. 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.

Potential habitat within the proposed modification area are likely to be 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 18.9 ha of habitat within the proposed modification area 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 proposed Modification 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, management actions as part of the saving our species program have been identified by Office of Environment and Heritage (2013). The proposed Modification will not interfere significantly with any of the identified management actions.

Conclusion

The proposed Modification will require the removal of 18.9 ha of potential habitat identified in the following vegetation communities present within the proposed Modification area:

- Weeping myall Woodland.
- River Red Gum riparian woodlands and forests.
- Plains Grassland.
- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland

Based on the relatively small area of habitat to be removed within the proposed modification area, 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.

8. Threatened 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 cucullata*).
- 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 2006b; Reid 1999; Trail & Duncan 2000).

Specific impacts

One threatened bird species was recorded during the site inspections (Grey-crowned Babbler). The proposed Modification will remove approximately 7.5 ha of potential habitat. This is made up of all the Woodland habitats in the proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum riparian woodlands and forests (Moderate Condition).
- Weeping Myall 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 2006b), 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 2006b). 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 2006b). 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 2001b). 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 2006b). 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.

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

One threatened woodland species of bird was recorded during recent field surveys (Grey-crowned Babbler). Previous field studies associated with Boggabri Coal have recorded all of these species in the locality. It is therefore assumed that approximately 7.5 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 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 7.5 ha of potential threatened 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 threatened 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 proposed Modification 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 threatened 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 threatened 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

One threatened woodland bird species was recorded during the surveys. In previous studies conducted for Boggabri Coal eight threatened woodland species have been 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 7.5 ha of potential habitat would be affected by the proposed Modification. This is made up of the following vegetation communities within the proposed Modification area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum riparian woodlands and forests (Moderate Condition).
- Weeping Myall 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.

9. 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 proposed Modification area. The proposed Modification would disturb 69.2 ha of potential habitat for this species, including all the vegetation communities present in the proposed Modification area.

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

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

Approximately 69.2 ha of potential foraging habitat would be affected by the proposed Modification 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 69.2 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 habitat, it is not likely that the lifecycle of this species would be affected. Potential nesting and nesting 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

Approximately 69.2 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. In the interim, the Office of Environment and Heritage have identified 2 management actions for the Spotted Harrier (refer to Table 9.1). The project is not likely to affect any of these management actions.

Table 9.1 Management actions for Spotted Harrier

Management action for Spotted Harrier	Likely to be affected by the project
Raise awareness about poisoning of non-target species from baiting and rodenticides (Spotted Harrier).	No
Encourage retention of intact foraging and breeding habitat through PVP process(Spotted Harrier).	No

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 proposed Modification area. 69.2 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.

10. Black Falcon (*Falco subniger*)

Status

The Black Falcon is listed as a Vulnerable species under the TSC Act.

Distribution, habitat and ecology

The Black Falcon is widespread but sparsely distributed throughout most of inland NSW. This species generally occurs as solitary individuals, in pairs or in family groups of parents and offspring.

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 and disturbances to nesting activity from over-abundant ravens and cockatoos (NSW Scientific Committee 2013).

Specific impacts

This species has been previously recorded in agricultural land associated with BCEP during previous field studies and is occasionally observed within and around the proposed Modification area. The proposed Modification would remove 69.2 ha of potential habitat for this species, including all the vegetation communities present in the proposed Modification area.

10.1 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 Black Falcon has been recorded in agricultural land associated with BCEP during previous field studies.

Approximately 69.2 ha of potential foraging habitat would be affected by the proposed Modification 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 69.2 ha of potential foraging habitat, similar habitat would remain and exist in the area after consturction. This area is considered known foraging habitat due to sightings during previous field surveys.

While the proposed Modification would remove foraging habitat, it is not likely that the lifecycle of this species would be affected. Potential nesting and nesting 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

Approximately 69.2 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

Black Falcon is widespread throughout most of inland NSW, 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 Black Falcon to access adjacent habitat would remain. As such, it is unlikely that the proposed Modification will fragment or isolate the Black Falcon 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 Black Falcon. In the interim, the Office of Environment and Heritage have identified 8 management actions for the Black Falcon (refer to Table 10.1). The project is not likely to affect any of these management actions.

Table 10.1 Management actions for Black Falcon

Management action for Black Falcon	Likely to be affected by the project
Protect and monitor known nest sites (Black Falcon).	No
Protect old stick nests (e.g., those of corvids and raptors) that have the potential to be used as nest sites (Black Falcon).	No
Protect and facilitate the recruitment of large old trees, a resource that is critical for nesting and hunting (Black Falcon).	No
Protect and expand potential nesting habitat, especially riparian and floodplain woodlands (Black Falcon).	No
Identify Black Falcon nesting territories and engage landholders in the management of habitat in these areas (Black Falcon).	No
Promote the reporting of any signs of disease that are unusual or clusters of deaths in raptors or their prey to the NSW Environment Line on 131 555 (Black Falcon).	No
Investigate the dietary importance of terrestrial ground birds and rabbits, and the potential for agricultural activities to benefit or negatively impact on falcon populations (Black Falcon).	No
Increase community awareness of the Black Falcon through the preparation and distribution of educational material, including an identification guide (Black Falcon).	No

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 Black Falcon has been previously recorded foraging over grassland and agricultural crops within the Modification areas on occasions within the grasslands. 69.2 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.

11. 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 2011c).

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 the survey. The species is considered to have a moderate likelihood of occurring in the areas of the proposed Modification. The proposed Modification will remove 7.5 ha of potential habitat for this species. Vegetation communities within the proposed Modification area which are considered potential habitat for this species are;

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

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

A total of 7.5 ha of potential habitat will be removed as a result of the proposed 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

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 7.5 ha it is unlikely that the lifecycle of this opportunistic species would be significantly affected, considering that there is larger areas of foraging and breeding habitat for this species within the wider region.

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 7.5 ha of potential foraging habitat for the assessed species will be affected by the proposed Modification. 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 7.5 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 under the TSC Act. In the interim, the Office of Environment and Heritage have identified 2 management actions for the Little Lorikeet (refer to Table 11.1). The project is not likely to affect any of these management actions.

Table 11.1 Management actions for Little Lorikeet

Management action for Little Lorikeet	Likely to be affected by the project
Encourage retention of old-growth and hollow-bearing trees through community engagement and other mechanisms including PVPs, BioBanking and EIA (Little Lorikeet)	No
Avoid burning woodland with old-growth and hollow-bearing trees (Little Lorikeet)	No

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 proposed Modification area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

7.5 ha of potential habitat for the little lorikeet would be affected by the proposed Modification. However, given the species high mobility and ability to access 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.

12. Swift Parrot (*Lathamus discolour*)

Status

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

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. The species is considered to have a moderate likelihood of occurring in the areas of the proposed Modification. The proposed Modification will remove 7.5 ha of potential woodland habitat for this species including the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

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

The Swift Parrot is an opportunistic blossom nomad dependent on flowering resources across a wide range of habitats (woodlands and forests). The removal of 7.5 ha of habitat containing suitable foraging trees for these species is highly unlikely to disrupt their lifecycle. However, given the species high mobility and ability to access remnant woodland in the locality and region, it is not likely that this species would be significantly affected by 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 7.5 ha of potential foraging habitat for the assessed species will be affected by the proposed Modification. 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 7.5 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

No recovery plan has been prepared for the Swift Parrot under the TSC Act. In the interim, the Office of Environment and Heritage have identified 13 management actions for the Swift Parrot (refer to Table 12.1). The project is not likely to affect any of these management actions.

Table 12.1 Management actions for Swift Parrot

Management action for Swift Parrot	Likely to be affected by the project
Identify and map the extent and quality of Swift Parrot foraging and roosting habitat on private and public land	No
Protect, manage and restore Swift Parrot habitat on private land through conservation agreements, management agreements and incentive payments.	No
Develop and distribute EIA guidelines to decision makers (Swift Parrot)	No
Enhance habitat for Swift Parrots by planting suitable tree species to complement natural regeneration or to enhance remnants	No
Develop and distribute Swift Parrot habitat identification, management and enhancement guidelines	No
Reduce the incidence of Swift Parrot collisions by raising community awareness of the threat of man-made hazards	No
Coordinate volunteer surveys at known and potential Swift Parrot sites on private and public land	No
Conduct Swift Parrot habitat research on both private and public land	No
Employ community liaison officer to coordinate conservation actions for the species, including maintenance of community and volunteer networks (Swift Parrot)	No
Consult and involve indigenous community through employment of community liaison officer (Swift Parrot)	No
Compile, produce and distribute the annual Swift Parrot volunteer newsletter “Swifts Across the Strait”	No
Manage the recovery process through the continued operation of the National Swift Parrot Recovery Team	No
Finalise review of National Recovery Plan by 2007 (Swift Parrot)	No

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 proposed Modification area within the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

It is estimated that 7.5 ha of potential winter foraging habitat for the Swift Parrot would be affected by the proposed Modification. 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.

12.2 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 proposed Modification 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 7.5 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 proposed Modification 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 Environment, 2013).

The proposed Modification would remove 7.5 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 proposed Modification 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 2006b). 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 7.5 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 7.5 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 proposed Modification area within the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

This species is considered to have a moderate-high likelihood of occurrence within the proposed Modification area. The proposed Modification would remove 7.5 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.

13. 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 proposed Modification 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 2006a).

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 2006b). 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 2006b).

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 2006b).

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 proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

Approximately 7.5 ha of potential habitat will be removed as a result of the Modification. Whilst this small area will add incrementally to the loss of habitat for the Regent Honeyeater it is small in comparison to larger areas of this community present in the wider region.

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

It is assumed that 7.5 ha of potential habitat for this species, including foraging, roosting and nesting resources would be affected by the proposed. The proposed Modification 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 proposed Modification 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:

(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

7.5 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 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

The habitat within the project area is already largely fragmented. Removal of 7.5 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.

(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.

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 Office of Environment and Heritage has established four management sites for conservation and management of this species, including Bundarra-Barraba (Gunnedah/Gwydir and Tamworth region), Lower Hunter Valley (Cessnock), Capertee Valley (Lithgow) and Taronga Zoo. The Bundarra-Barraba management site is located to the east of the proposed modification area and does within any of the remaining identified management sites and the proposed modification is not likely to adversely affect any of the recovery actions of the Regent Honeyeater.

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 7.5 ha of potential habitat will be removed by the proposed Modification. This is made up of the following vegetation communities present within the proposed Modification area:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

It is unlikely that removal of this small amount of woodland would have a significant impact upon the Regent Honeyeater.

13.2 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 area 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 7.5 ha of potential habitat would reduce the area of occupancy for the Regent Honeyeater. However this is unlikely to be significant due to the small area of removal.

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 Modification supports *Eucalyptus albens* and *E. crebra*, and thus, with the Modification occurring 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 Modification study area, 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 7.5 ha of potential habitat for this species, including foraging and nesting resources. Furthermore, the Modification study area 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 study area on at least a transient basis, the removal of 7.5 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 modification study area 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 7.5 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 this species.

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 proposed 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 removal of a small area of habitat for the proposed modification.

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 proposed modification 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 7.5 ha of potential habitat, including:

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

- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

Whilst a small area of habitat for this species will be removed it is unlikely that this will lead to a significant impact for this species.

14. Superb Parrot (*Polytelis swainsonii*)

Status

The Superb Parrot is listed as Vulnerable under both the EPBC Act 1999 and TSC 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 2006b). 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 2006b).

Specific impacts

This species was not recorded during surveys for the BCEP project or the proposed Modification; however habitat exists within the woodlands and open forest habitat of the proposed Modification area, including the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

Approximately 7.5 ha of potential habitat will be removed as a result of the Modification.

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

Habitat likely to be affected by the proposed Modification provides foraging, roosting and breeding resources. It is unlikely that removal of 7.5 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 habitat for this species within 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

(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

Superb Parrot is a highly mobile, remnant habitat occurring outside the boundaries of the proposed Modification is likely to support local populations. It is unlikely that removal of 7.5 ha of potential habitat would have a significant impact upon the species, however it adds to the loss of habitat 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

The habitat within the project area is already fragmented. Removal of a total 7.5 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.

(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.

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 Superb 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 in the long term.

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 a national recovery plan for the Superb Parrot that outlines 4 broad recovery actions for the species. The proposed modification is unlikely to interfere with these recovery objectives 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 Superb 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

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

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

It is unlikely that removal of 7.5 ha of grassy woodland would have a significant impact upon the species.

14.2 EPBC Act Significance Assessment

The Superb Parrot is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment 2013). 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.

Is this part of 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 and Conservation 2006c). 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 2006c) (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 7.5 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 be a key source for breeding or dispersal.

The Superb Parrot is found throughout all regions of eastern inland NSW. 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 2006c). Although the proposed Modification area essentially occurs outside the normal range of where this species migrates; any identified species potentially occurring within the proposed Modification 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.

Potential occurrences of this species within the modification study area are not at the limits of the species' distribution and as such the site can only be considered to represent a part of the range of widely occurring individuals. For these reasons, if present within the site, individuals of this species would not be considered to be part of an important population.

An action is likely to have a significant impact on a vulnerable 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 an important population of a species

Not applicable, not part of an important population see above.

Reduce the area of occupancy of an important population of the species

Not applicable, not part of an important population see above.

Fragment an existing important population into two or more populations

Not applicable, not part of an important population see above.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for this 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 (Department of Environment 2013).

The relatively small area of potential habitat likely to be affected by the Modification (7.5 ha) represents a relatively small component of locally occurring resources that would be accessible to this species. Therefore, the removal of about 7.5 ha of potential habitat would not be considered critical to the survival of this species.

Disrupt the breeding cycle of an important population

Not applicable, not part of an important population see above.

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 Modification would remove approximately 7.5 ha of potential habitat for this species. It is not expected that the Modification will significantly modify, destroy, remove, isolate or decrease the availability or quality of habitat for the Superb Parrot to cause the species to decline. Approximately 7.5 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 2006c). Therefore, no breeding habitat would be affected by the Project.

Vegetation occurring within the proposed Modification 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 2006c). Although Leard State Forest essentially occurs outside the normal range of where this species migrates; the removal of approximately 21.9 ha of potential foraging habitat might reduce the area of occupancy of this species. However, given that this species was not recorded in the proposed Modification 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 proposed Modification area; it is considered that the Modification would not reduce the area of habitat for this species.

The Modification area is located within the locality and Boggabri Mine Biodiversity Offset properties which contain similar and higher quality habitat than that contained within the Modification area. This species is known to highly mobile in which to seek out preferable feeding resources and the Modification area would represent a small portion of this foraging area. The area of potential habitat likely to be affected (7.5 ha) represents a small component of locally occurring resources that would be accessible to this highly mobile species. Therefore, the removal of about 7.5 ha of potential habitat, is unlikely to cause the Superb Parrot to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat

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

Introduce disease that may cause the species to decline

It is not likely that diseases that are potentially harmful to the Superb Parrot would become further established or introduced as a result of the Modification.

Will the action interfere with the recovery of the species?

The National Recovery plan for the Superb Parrot (Baker-Gabb 2011) has been approved and outlines that the long-term objective of recovery is to minimise the probability of extinction of the Superb Parrot in the wild, and to increase the probability of important populations becoming self-sustaining in the long term.

Specific objectives of recovery for the Superb Parrot (Baker-Gabb 2011) are to:

1. Determine population trends in the Superb Parrot.
2. Increase the level of knowledge of the Superb Parrot's ecological requirements.
3. Develop and implement threat abatement strategies
4. Increase community involvement in and awareness of the Superb Parrot recovery program.

Based on the potential ecological impacts of the Modification on this species, as discussed above, it is likely that the Modification would be in conflict with the third objective above as this objective has actions to retain potential habitat of River Red Gum and Box Gum Woodlands, by removing approximately 7.5 ha of potential habitat for the Superb Parrot. However, the habitat to be removed is relatively low quality with habitat compensatory programs including biodiversity offsetting involving habitat rehabilitation and conservation is being undertaken on Boggabri Mine Offset properties in the vicinity of the Modification.

Due to the largely low quality habitat likely to be affected by the Modification and the abundance of similar, and likely better quality habitat in the locality and greater region, the Modification is not likely to interfere with the recovery of the this species.

Conclusion

Although the Superb Parrot was not recorded in the proposed Modification area however within the proposed Modification 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 7.5 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 the modification area. While vagrant records of this species may occur within the vicinity of the proposed Modification area, it is not likely that this species would be significantly affected by the Modification.

15. 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 2006b). 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 proposed Modification area, potential habitat exists within the following vegetation communities:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

Approximately 7.5 ha of potential habitat would be modified as a result of the Modification.

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

Habitat likely to be affected by the proposed Modification provides foraging, roosting and breeding resources. It is unlikely that removal of 7.5 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

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:

(iii) 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 7.5 ha of potential habitat would have a significant impact upon the species.

(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, and

The habitat within the project area is already fragmented. Removal of a total 7.5 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.

(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.

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 management actions (see below). Owing to the small extent of potential habitat to be removed, the proposed Modification is not considered inconsistent with any identified management action statements.

- Identify three targeted populations (per year over initial three years); focus recovery actions and adaptive management at these sites.

- Identify sites where the species is commonly observed and target for incentives and habitat management.
- Encourage management of livestock grazing so as to improve understorey (foraging) habitat at priority sites.
- Select targeted areas where large populations occur and liaise with landholders to protect hollow-bearing trees.
- Control feral cats and foxes near high density populations (best practice: locally efficient and effective).
- Control feral goats and pigs of known or potential habitat.
- Control weeds at priority sites.
- Encourage bird observer groups to undertake spot monitoring surveys at previously recorded locations. Enter data collected into Wildlife Atlas.
- Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.
- Develop an Expression of interest targeted towards private landowners to locate new sites and from this negotiate, develop and implement conservation management agreements for high priority sites.

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

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

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests (Moderate condition).

It is unlikely that removal of 7.5 ha of habitat would have a significant impact upon the species.

16. 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 proposed Modification area and adjoining landscapes. As all the vegetation communities are considered potential habitat for the Little Eagle, The proposed Modification would require clearing of 69.2 ha of potential breeding and foraging habitat for this species.

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

Approximately 69.2 ha of known and potential foraging and breeding habitat for Little Eagle would be affected by the proposed Project Boundary Modification.

The proposed Modification would not require the removal of hollow-bearing trees, which are a requirement for this species to build a nest – therefore not reducing potential breeding habitat. Also 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 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

69.2 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 69.2 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 proposed Modification 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 (69.2 ha) and considering the remaining habitat within the locality and the wider region 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

No recovery plan has been prepared for the Little Eagle under the TSC Act. In the interim, the Office of Environment and Heritage have identified 3 management actions for the Little Eagle (refer to Table 16.1). The project is not likely to affect any of these management actions.

Table 16.1 Management actions for Little Eagle

Management actions for Little Eagle	Likely to be affected by the project
Raise awareness non-target poisoning from baits (Little Eagle).	No
Identify and secure appropriate habitat and improve management by erecting fences, adding supplementary planting, managing or reducing grazing, increasing size of habitat patches, planting stepping-stone linking patches and encourage the retention or placement of fallen logs, coarse woody debris and standing dead trees (Little Eagle).	No
Raise awareness of loss of habitat through population pressure and implement appropriate controls in areas subject to urban expansion, including identification of appropriate habitat and implementation of improved management (Little Eagle).	No

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

The proposed Modification would impact upon 69.2 ha of known foraging habitat. 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 and the wider region of the proposed Modification.

17. 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), *C. 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 proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland
- Plains Grassland.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests.
- Exotic Grassland.

The proposed Modification would clear 69.2 ha of habitat for this species in addition to the habitat cleared for the BCEP project.

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

The Square-tailed Kite has been anecdotally recorded in Leard State Forest (David Robertson 2009). Approximately 69.2 ha of potential foraging and breeding habitat for Square-tailed Kite would be affected by the proposed Modification.

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 69.2 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 and the wider region 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 proposed Modification 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 management 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.

Management actions for Square-tailed Kite:

- Ensure implementation of management strategies that reduce disturbance of riparian areas.
- Identify and protect nest trees, and monitor reproduction.
- Liaise with local field ornithologist to obtain data on the Square-tailed Kite in the area.

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 69.2 ha of potential foraging 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 proposed Modification area, which is likely to provide foraging and nesting opportunities.

18. 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 proposed Modification 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 69.2 ha of potential habitat, in the form of the Woodlands within the proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- Derived native grassland
- Plains Grassland.
- Weeping Myall Woodland.
- River Red Gum riparian woodlands and forests.
- Exotic Grassland.

Habitat likely to be affected provides foraging, roosting and breeding resources for these species.

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

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 and breeding resources in the proposed Modification area include dense clumps of canopy leaves in large Eucalypts for the Barking Owl and large hollows in Eucalypts for the Masked Owl. No hollow-bearing trees will be removed by the proposed Modification.

It is unlikely that the removal of 69.2 ha for the proposed Modification would significantly impact upon the lifecycle of the 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

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

The proposed Modification would remove 69.2 ha of potential habitat in total. It is unlikely this would significantly impact upon the species. However, it contributes to the loss of known habitat 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, and

Much of the habitat within the proposed Modification area and locality is already fragmented. Removal of 69.2 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).

(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 important for the long term survival of the species, as additional breeding and foraging habitat will remain in the locality, and 69.2 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

A recovery plan has been prepared for Large Forest Owls (Department of Environment and Conservation 2005a), in which a number of recovery actions are listed (refer to Table 18.1). The plan covers the Powerful Owl, Masked Owl and Sooty Owl. The overall objective of the NSW Large Forest Owl Recovery Plan is to ensure that large forest owls persist in the wild in NSW in each region where they presently occur.

Table 18.1 Recovery actions for Large Forest Owls

Objective	Recovery action	Likely to be affected by project
Recovery action 1: To assess the Distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.	Update and refine existing owl habitat models using the best available information.	No
	Map the amount of modelled habitat across forested land in NSW.	No
	Design a sampling strategy to test the modelled habitat for the presence of owls and locate identified sites.	No
	Field validation of modelled habitat for the presence of owls.	No
	Estimate the areal amount of mapped modelled habitat for each owl species that is occupied (based on the proportion of sample sites with owls in them) and use this estimate to further estimate the number of owl territories present within different land tenures (based on home range data).	No
Recovery action 2: To monitor trends in population parameters (numbers, **Distribution**, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories.	Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols.	No
	Seek cooperative involvement of other agencies, researchers and the community in the implementation of the regional monitoring program.	No
	Implement a regional monitoring program.	No
Recovery action 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use	Investigate the implementation by DPI (Forests NSW) of the forestry TSL owl prescriptions by carrying out proactive audits targeting these prescriptions (DEC) and through IFOA monitoring and reporting DPI (Forests NSW).	No

Objective	Recovery action	Likely to be affected by project
this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.	Carry out post-harvest surveys in locations where owls were detected prior to logging to determine if they are continuing to occupy the habitat.	No
	Encourage student radio tracking projects examining the use of logged and unlogged forest by the three owl species.	No
	Make an assessment of the implementation and effectiveness of forestry owl prescriptions using data collected in this action.	No
	If necessary, refine the prescriptions and negotiate changes to the forestry TSLs.	No
Recovery action 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes	Prepare environmental impact assessment guidelines to assist consent and determining authorities and environmental consultants to assess impacts of developments on the large forest owls.	No
	Monitor and report on the effectiveness of concurrence and licence conditions that have previously been applied to reduce the impacts of developments on the three large forest owl species or their habitats. This will involve keeping a record of such conditions, selecting case studies and then checking for the presence of owls at long intervals post development.	No
	Use this information to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the three large forest owls.	No
	Provide up to date and accurate large forest owl and habitat information in the 'PVP Developer Threatened Species Tool', ensuring that broad-scale clearing is only approved under the NV Act if 'improve or maintain' test is met.	No
	Facilitate the adequate consideration of large forest owls during biodiversity certification of environmental planning instruments.	No
	Provide up to date information and data for the Bio Banking assessment methodology	No
Recovery action 5: Minimise further loss and fragmentation of habitat by protection and informed management of significant owl habitat (including protection of individual nest sites)	Prepare guidelines addressing issues associated with habitat protection and management, and survey assessment. Guidelines would provide detailed information on identification of significant owl habitat, appropriate strategies for its protection and for habitat creation as part of revegetation programs.	No
	Encourage CMAs to invest in actions that actively manage and/o or conserve large forest owl habitat and promote owl conservation on private lands.	No

Objective	Recovery action	Likely to be affected by project
	Encourage private landholders to undertake management options to conserve and/ or actively manage large forest owl habitat (and particularly nest sites) through incentive property management plans, voluntary conservation agreements and management incentives.	No
Recovery action 6: To improve the recovery and management of the three large forest owls based an improved understanding of key areas of their biology and ecology	Promote awareness and involvement of the research and management needs of the three large forest owls among scientific and academic community.	No
	Seek an Australian Research Council Linkage grant or other joint funding opportunity to initiate research into identified key areas of the biology and ecology of large forest owls.	No
	Seek scholarship funds for an aboriginal student to investigate the cultural and historic significance of the three species.	No
Recovery action 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology.	Encourage and coordinate the involvement of community-based groups (e.g. the Australian Bird and Bat Study Association) and animal care groups (e.g. WIRES) in the implementation of recovery actions.	No
	Set up a website linked to the DEC internet site and targeted specifically at the community that will serve to provide information on owl identification (including photographs and samples of calls), habitat identification and protection, any current activities that they can be involved in as well as information on how and where to report sightings and other relevant information. Ensure this site has links to other key internet sites such as the Australasian Raptor Association.	No
Recovery action 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives	Coordination of implementation of actions.	No
	Review of plan and rewrite in final year.	No
	Convene a threatened owl workshop with relevant experts and stakeholders to reassess the State conservation Status of the three large forest owls. This action will be undertaken upon Conclusion of the implementation of all of the above actions.	No

The project is not likely to significantly affect any of these recovery actions regarding the Masked Owl.

Seventeen management actions have been developed by Office of Environment and Heritage; for the Barking Owl (as listed below). None of these management actions will be affected by the proposed modification.

- Assess the size, viability and status of the Barking Owl population in NSW using existing survey data and known information on distribution, preferred habitat, home range size and population density.
- Establish a program to monitor the NSW Barking Owl population and study its demographics, including the development, trial and establishment of a protocol for high-quality surveys to monitor the Barking Owl across land tenures and habitat types in NSW.

- Investigate conservation management strategies that act to manage known threats and restore habitat.
- Support biological and ecological studies e.g. preferred diet, reproductive strategies, home range, population viability.
- Support population genetics studies particularly between the eastern and south-western populations of Ninox connivens connivens and within the eastern population.
- Investigate the cultural and historic significance of the Barking Owl.
- Develop and distribute the Barking Owl information package. This will contain the species profile, environment assessment guidelines and prescriptions to minimise potential impacts.
- Prepare a poster and undertake a community survey and media campaign in rural and regional NSW to raise community awareness of the Barking Owl. The importance of each individual owl, and particularly breeding sites will be stressed.
- Establish formal conservation arrangements for properties with Barking Owls, which can be used to protect wildlife habitat.
- Negotiate with individual land managers to achieve appropriate measures to protect all known Barking Owl nest sites in NSW. Protection will need to address threats such as human disturbance, collision with wires, secondary poisoning from chemicals.
- Assess forestry prescriptions and Threatened Species Licences for their effectiveness in conserving the Barking Owl in State Forests.
- Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment.
- Research is required into the effects of agricultural poisons upon the species.
- Maintain the threatened owl working group and links with owl researchers.
- Facilitate the establishment and maintenance of links with community involved in Barking Owl conservation.
- Coordinate the implementation of the recovery plan.
- Complete the final recovery plan for Barking Owls by 2006.

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 69.2 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 known habitat within the locality.

19. Microchiropteran bats

Threatened 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. Microchiropteran bats considered for this impact assessment are:

Hollow-bearing microchiropteran bats:

- Greater Long-eared Bat – south eastern form (*Nyctophilus timoriensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).

Cave dwelling microchiropteran bats:

- Eastern Cave Bat (*Vespadelus troughtoni*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Little Pied Bat (*Chalinolobus picatus*).

Greater Long-eared Bat

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 proposed Modification 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).

Eastern Cave Bat

The Eastern cave bat is listed as listed as Vulnerable under the TSC Act 1995.

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 2011b).

This species was not recorded within the Modification study area are however a maternity cave has been recorded within 5 km of the Modification study area which is considered likely to contain only marginal foraging habitat for the species.

Large-eared Pied Bat

The Large-eared Pied Bat is listed as Vulnerable under the TSC Act 1995 and EPBC Act 1999.

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 2011b). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage 2011b). Thought to forage below the forest canopy for small flying insects (Churchill 1998).

This species was not recorded within the Modification study area are however has potentially been recorded within the Project Boundary during previous surveys. The Modification study area is considered likely to contain only marginal foraging habitat for the species.

Little Pied Bat

The Little Pied Bat is listed as Vulnerable under the TSC Act 1995.

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 2011a). 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 2011a).

This species was not recorded within the Modification study area are however has potentially been previously recorded within the Project Boundary during previous surveys. The Modification study area is considered likely to contain only marginal foraging habitat for the species.

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.

Specific Impacts

The proposed Modification would remove 69.2 ha of potential foraging and roosting habitat (hollow-dependent species only), in the form of all vegetation communities identified within the proposed Modification area. Habitat likely to be affected provides foraging, roosting and breeding resources for these species.

19.1 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 proposed Modification area contains hollow-bearing trees but does not contain any cave like roost structures. During previous studies conducted for the BCEP four threatened species of microchiropteran bat, Eastern False Pipistrelle, Little Pied Bat, Large-eared Pied Bat (potentially) 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 a maternity cave has been recorded within the vicinity which contains a populations of Eastern Cave Bat.

The proposed Modification will not require the removal of any hollow bearing trees but will require the removal of 69.2 ha of native vegetation, all of which is considered foraging habitat. As no hollow bearing trees will be removed as a result of the proposed Modification and that a large number of hollow bearing trees will remain in the locality 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 proposed Modification 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

69.2 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 foraging and roosting habitat being impacted

(ii) (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 (69.2 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 remove 69.2 ha of moderate to good value habitat that provides foraging 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 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 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

Considering the cumulative impact the BCEP and proposed Modification, these key threatening processes could negatively impact the 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.

Conclusion

Field surveys identified numerous hollow bearing trees within the proposed Modification area however no caves were recorded. During previous studies, conducted for the Continuation of Boggabri Coal Mine - Biodiversity Impact Assessment (Parsons Brinckerhoff 2010), four threatened species of microchiropteran bat, Eastern False Pipistrelle, Little Pied Bat, Large-eared Pied Bat (potentially) 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 a maternity cave for the Eastern Cave Bat has been recorded within the locality (approximately 5 km from Modification study area).

In addition to the habitat being affected by the BCEP, 69.2 ha of moderate to good habitat would be removed. Therefore, whilst it is considered that the proposed Modification would reduce the area of occupancy and add incrementally to processes that threaten these species, it is unlikely to be a significant impact upon these species.

19.2 EPBC Act significance assessment – Greater Long-eared Bat & Large-eared Pied Bat

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 69.2 ha of habitat for these species, including potential 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 and Large-eared Pied Bat would not be restricted to habitat resources in the proposed Modification area. A relatively small patch (69.2 ha) of potential foraging and roosting habitat for this species would be affected by the proposed Modification. As similar habitat resources will remain in the surrounding landscape the proposed Modification is not considered likely to reduce the area of occupancy of an important population of Greater Long-eared Bat or the Large-eared Pied 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 Large-eared Pied 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 Environment, 2013).

The proposed Modification would remove approximately 69.2 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 proposed Modification 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 proposed Modification 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 69.2 ha. However, important habitat resources such as tree hollows have similar densities inside and outside the proposed Modification area (Parsons Brinckerhoff 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 or the Large-eared Pied 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 and Large-eared Pied 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 and Large-eared Pied Bats potentially occurring in the proposed Modification 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 69.2 ha of potential habitat to be removed for the proposed Modification.

20. 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 2005b)

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 the field survey however, this species is considered with a moderate or higher likelihood to utilise the Woodland habitats within the proposed Modification area, due to the presence of numerous habitat trees which provide suitable tree hollows and foraging resources. A total of 7.4 ha of potential habitat will be removed as a result of the Modification. No hollow-bearing trees will be removed. This is made up of all the Woodland habitats in the proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum riparian woodlands and forests.

The removal of 7.4 ha of potential habitat 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.

20.1 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 7.4 ha of potential foraging and breeding resources.

If present within the proposed Modification area, this species is likely to persist in similar habitats outside the proposed Modification 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 it will add incrementally to the impact to this species. The proposed modification is unlikely to have a significant impact upon this species due to the small area of removal.

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

7.4 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 proposed Modification area during the field survey, 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 7.4 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 proposed Modification 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 proposed Modification 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 resources.

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 Office of Environment and Heritage maintains a register of critical habitat. Land within the proposed Modification 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 and Heritage has identified the Squirrel Glider as a Landscape Species as part of the Saving Our Species program. In regard to the Squirrel Glider nine Management actions have been identified for this species (refer Table 20.1).

Table 20.1 Management actions for Squirrel Glider

Management action	Likely to be affected by the project
Conduct surveys on the Far South Coast, from Murramarong National Park south to Eden, to determine population size and extent and connectivity of populations (surveys should incorporate potential habitat on public as well as private land).	No
Model and predict the distribution of Squirrel Gliders across the south west slopes.	No
Delineate boundaries of population to identify the extent to which populations are interconnected (to determine propensity to move across cleared land).	No
Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools.	No
Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity. Give priority to largest hollow bearing trees.	No
Investigate the effectiveness of logging prescriptions.	No

Management action	Likely to be affected by the project
Prepare a recovery plan for the Squirrel Glider.	No
Conduct surveys and assessments of less known sites to confirm presence of species and negotiate, develop and implement conservation management agreements for high priority sites.	No
Control feral horses at relevant sites to promote retention and growth of mid-storey shrubs.	No

The project is not likely to affect any of these management 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 have been recorded within the proposed Modification area. However potential habitat resources were identified in the form of hollow bearing trees and foraging trees with in the vegetation communities within the proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum riparian woodlands and forests.

It is assumed that 7.4 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.

21. 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 proposed Modification area. Potential habitat for Koalas exists in all the woodlands within the proposed Modification area, including:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum Riparian Woodland and Forest.

In total, 7.5 ha of potential habitat would be disturbed as a result of the proposed Modification.

21.1 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 proposed Modification 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 disturb a small area of 7.5 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 proposed Modification 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:

(i) 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 disturbance (approximately 7.5 ha) is insignificant in relation to the amount of undisturbed good quality habitat that will remain within 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

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, River Red Gum 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.

(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 survey area provides a relatively small amount of suitable foraging habitat for Koalas. Foraging opportunities occurring in the proposed Modification area (i.e. *Eucalyptus populnea* subsp.. *bimbil* and *E. pilligarensis* 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 Office of Environment and Heritage maintains a register of critical habitat. No critical habitat has been listed for this species to date. The land within the proposed Modification 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 2008c) 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 disturb a small area of fragmented habitat (6.5 ha) this is unlikely to affect the conservation of Koalas within the proposed Modification 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 21.1).

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* subsp. *bimbil* 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 21.1 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	No	No. No tree clearing will be

Threat to species	Key Threatening Process	Threat likely to increase as a result of the proposed Modification
habitat trees		required.
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. poplulnea* subsp. *bimbil* and *E. pilligaensis*) were identified therein. One Koala was recorded during field surveys for the associated BCEP in 2010.

The proposed Modification requires the disturbance of 7.5 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.

21.2 EPBC Act significance assessment

The Koala is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment 2013). 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.

Is this part of an important population?

The Koala occurs along the east coast of Australia and extends into Woodland, Mulga and River Red Gum forests west of the Great Dividing Range (Department of Environment and Climate Change 2008a). The range of the Koala covers all such suitable areas of NSW.

What is of most importance to this species is the presence of feed tree species as listed in Schedule 2 of the NSW SEPP 44. The survey area contains three feed tree species *E. Camaldulensis, E. poplulnea* subsp. *bimbil* and *E. pilligaensis.* These feed tree species also occur in abundance within the locality and greater region further afield. Although the site does provide potential foraging habitat due to the presence of feed tree species, similar suitable habitat occurs widely within the vicinity of the survey area and the wider locality. As a consequence, foraging habitat within the site is not considered critical to maintaining Koala populations.

Potential occurrences of this species within the survey area are not at the limits of the species' distribution and as such the site can only be considered to represent a part of the range of widely occurring individuals. For these reasons, if present within the site, individuals of this species would not be considered to be part of an important population.

An action is likely to have a significant impact on a vulnerable 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 an important population of a species

Not applicable, not part of an important population see above.

Reduce the area of occupancy of an important population of the species

Not applicable, not part of an important population see above.

Fragment an existing important population into two or more populations

Not applicable, not part of an important population see above.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for this 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 (Department of Environment 2013).

The relatively small area of potential habitat likely to be affected by the Modification (7.5 ha) represents a relatively small component of locally occurring resources that would be accessible to this species. Therefore, the disturbance of about 7.5 ha of potential habitat would not be considered critical to the survival of this species.

Disrupt the breeding cycle of an important population

Not applicable, not part of an important population see above.

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 Modification would disturb approximately 7.5 ha of potential habitat for this species. It is not expected that the Modification will significantly modify, destroy, remove, isolate or decrease the availability or quality of habitat for the Koala to cause the species to decline. The Modification area is located within the locality and Boggabri Mine Biodiversity Offset properties which contain similar and higher quality habitat than that contained within the Modification area. This species is known to highly mobile in which to seek out preferable feeding resources and the Modification area would represent a small portion of this foraging area. The area of potential habitat likely to be affected (7.5 ha) represents a small component of locally occurring resources that would be accessible to this highly mobile species. Therefore, the removal of about 7.5 ha of potential habitat, is unlikely to cause the Koala to decline.

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 potentially harmful to the Koala would become further established as a result of the Modification.

Introduce disease that may cause the species to decline

It is not likely that diseases that are potentially harmful to the Koala would become further established or introduced as a result of the Modification.

Will the action interfere with the recovery of the species?

The NSW Recovery plan for the Koala (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 Koala recovery plan (Menkhorst *et al.* 1999) include:

1. conserving koalas in their existing environment;
2. rehabilitating and restoring koala habitat and populations;
3. developing a better understanding of the conservation biology of koalas;
4. ensuring the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale;

5. managing captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care;

6. managing overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat; and

7. coordinating, promoting of implementation, and monitoring of the effectiveness of the NSW Koala Recovery Strategy across NSW.

Based on the potential ecological impacts of the Modification on this species, as discussed above, it is likely that the Modification would be in conflict with the second objective above, by disturbing approximately 7.5 ha of potential habitat for the Koala. However, the habitat to be removed is relatively low quality with scattered feed tree species and habitat compensatory programs including biodiversity offsetting involving habitat rehabilitation and conservation is being undertaken on Boggabri Mine Offset properties in the vicinity of the Modification.

Due to the largely low quality habitat likely to be affected by the Modification and the abundance of similar, and likely better quality habitat in the locality and greater region, the Modification is not likely to interfere with the recovery of the this species.

Conclusion

No Koalas were recorded during field surveys for the proposed Modification however habitat in the form of feed trees (*E. camaldulensis, E. poplulnea* subsp. *bimbil* and *E. pilligaensis*) were identified therein. One Koala was recorded during field surveys for the associated BCEP in 2010.

The proposed Modification requires the removal of 7.5 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.

While the Modification would add incrementally to the loss of suitable habitat for this species, given that the Modification is associated with the existing Boggabri Mine complex, the Modification is not likely to further fragment or isolate potential habitat for these species. Therefore, the proposal is not likely to have a significantly adverse effect on the Koala.

22. 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 2011c).

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 2011c).

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 behaviour 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 2011b).

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 2011c).

Specific impacts

No Pale-headed Snakes were recorded within the proposed Modification area. Potential habitat for the Pale-headed Snake exists in the riparian and woodland habitats within the proposed Modification area. These habitats include the following:

- Pilliga Box – Poplar Box White cypress pine grassy open forest.
- River Red Gum riparian woodlands and forests.

In total, 7.4 ha of potential habitat would be removed as a result of the proposed Modification.

22.1 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. No hollow bearing trees will be removed by the proposal. There are a number of trees within the area however these will not require removal. 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 the 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 7.4 ha of suitable habitat would be affected by the proposal. Although hollow-bearing trees do occur within the area none will be removed.

(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 7.4 ha of potential habitat is likely to be disturbed 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.

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 7.4 ha of potential habitat for the Pale-Headed Snake. 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 21.9 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 2011c).

The Office of Environment and Heritage has however; identified 13 management actions to help recover this species (refer Table 22.1). The proposal is not likely to adversely affect any of these management actions (refer Table 22.1).

Table 22.1 Management actions for the Pale-headed Snake

Management Actions for Pale-headed Snake	Likely to be affected by the proposal
Encourage the community (via incentives) to implement habitat rehabilitation and protection (especially of dead and mature trees).	No
Ensure the Threatened Species Hazard Reduction List is updated with the requirements of this species and that personnel undertaking burns are aware of its presence and fire sensitivity.	No
Develop EIA guidance for consent and determining authorities with regard to development and other activities.	No
Audit the success of and improve IFOA prescriptions.	No
Implement management strategies that reduce disturbance and recover riparian areas within the range of the species on the western slopes and plains.	No
Retain, rehabilitate or create corridors to reduce isolation between sub-populations.	No
Identify two targeted populations (per year over initial three years) and focus recovery actions there, applying adaptive management strategies to determine and ameliorate threats.	No
Conduct further research into the ecology and habitat requirements of the species in NSW.	No
Address the threat of illegal collection.	No
Develop management strategies for water flow regimes to sustain riparian habitat.	No
Review / include operational guidelines for Warrumbungles NP, Pilliga NR, Pilliga West, Kilarney and Merriwindi CCA's Reserve Fire Management Strategies to protect this species habitat from fire (add prescription if known).	No
Provide map of known occurrences to Rural Fire Service and seek inclusion of mitigation measures on Bush Fire Risk Management Plan(s), risk register and/or operation map(s).	No
Reserve Fire Management Strategy to include operational guidelines to protect this species from fire.	No

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

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.

Conclusion

Taking into consideration the significant impact criteria outlined above, and based on the fact that the potential habitat that would be affected (7.4 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

BioBanking field data sheets

ID - 1066

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma — Q2 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Site 30 Nth

Photo number:

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: 30.62485 150.03995 (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING
		0	
		0	

(9.)

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community: Pilliga Box - Poplar Box - White cypress pine grassy open forest.

Field Community:

Structure and composition ❖ : (14.)

Strata[!]:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	18-25 m	0-30 %.	Eucalyptus
Shrub	0.4-2 m	0-5 %.	~~Vac~~ Vachellia farnesiana
ground	0.1-1.8 m	50-90 %.	Austrostipa aristaglumis Circium vulgare Brassica Silybum marianum

❖ Community structure should be described as per Specht et al 1995
[!]: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q2 | 2.

	Species	Presence	Strata		Species	Presence	Srtata
1	Eucalyptus	4		42			
2	Vachellia farnesiana	2		43			
3	Austrostipa aristaglumis	3		44			
4	Cirsium vulgare	2		45			
5	Brassica	3		46			
6	Silybum marianum	2		47			
7	Echium plantaganeum	3		48			
8	Eucalyptus blakelyi	1	?	49			
9	Einadia polygonoides	2		50			
10	Petronagia dubia	1		51			
11	Lolium perenne	4		52			
12	Aristida ramosa	1		53			
13	Sporobolus creber	1		54			
14	Daucus glochinoides	1		55			
15	Dichanthium sericeum	2		56			
16	Panicum queenslandicum	1		57			
17	Sclerophylla birchii	2		58			
18	Eragrostis leptostachya	1		59			
19	Leptaum africanum	1		60			
20	Centaurea calcitrapa	2		61			
21	Sonchus olearaceus	2		62			
22	Chloris truncata	1		63			
23	Echium vulgare	1		64			
24	Oxalis cornicularis	2		65			
25	Callotis lappulaceae	1		66			
26				67			
27				68			
28				69			
29				70			
30				71			
31				72			
32				73			
33				74			
34				75			
35				76			
36				77			
37				78			
38				79			
39				80			
40				81			
41				82			

Transect Number	Number of hits (tally)	%
Native over-storey cover (%)	0, 0, 0, 0, 0, 0, 0, 0, 0, 25, 30,	
Native mid-story cover (%)	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	0
Native ground cover grasses (%)	𝍸 𝍸 𝍸 𝍸 ~~𝍸 𝍸~~ III	
Native ground cover shrubs (%)		
Native ground cover other (%)	II	
Exotic plant cover (%)	𝍸 𝍸 𝍸 𝍸 𝍸	

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	1

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

ID - 1072

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma — Q8 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, TB, PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Victoria Site 30

Photo number:

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: GPS 778 (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING	(9.)
		0		30.63324 150.12695.
		0		

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground 80-90%

Ground Cover %: (12.)

Bare soil	20
Litter	0
Timber	0
Rock (type)	0
Vegetation (type)	80
Total 100%	100

Vegetation community: (13.)

Mapped community: –

Field Community: Exotic Grassland.

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	–	–	–
Shrub	–	–	–
ground	0.1 - 0.6 m	40-90%	Lolium perenne. Centaurium calcitrapa Bothriola decepiens Sclerophylla birchii.

❖ Community structure should be described as per Specht et al 1995
! Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P2

Site ID: Q8

#	Species	Presence	Strata	#	Species	Presence	Strata
1	Chloris truncata		1	42			
2	Sonchus olearevs.		3	43			
3	Trifolium arvensis		3	44			
4	Dichathium sericium		3	45			
5	Centaurea calcitrapa		5	46			
6	Bothriochloa decipiens		2	47			
7	Cynodon dactylon		2	48			
8	Lolium perene		~~4~~ 5	49			
9	Sclerophylla burchilli		3	50			
10	Sida corrugata		1	51			
11	Daucus glochinoides		1	52			
12	Vittadinia cuneata		1	53			
13	Eragrostis leptostachya		2	54			
14				55			
15				56			
16				57			
17				58			
18				59			
19				60			
20				61			
21				62			
22				63			
23				64			
24				65			
25				66			
26				67			
27				68			
28				69			
29				70			
30				71			
31				72			
32				73			
33				74			
34				75			
35				76			
36				77			
37				78			
38				79			
39				80			
40				81			
41				82			

Transect Number	Number of hits (tally)	%
Native over-storey cover (%)	0 – 0	0
Native mid-story cover (%)	0 – 0	0
Native ground cover grasses (%)	卌 卌 卌	30
Native ground cover shrubs (%)	–	0
Native ground cover other (%)	–	0
Exotic plant cover (%)	卌 卌 卌 卌 卌 卌 IIII 34	68

BARE 1

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma — Q9 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Victoria Site 30

Photo number:

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: GPS 779 (8.)

Unique Point ID #	ZONE	EASTING	NORTHING	(9.)
		0		30.63970
		0		150.10851

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, (flat):

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community: —

Field Community: ~~Exotic Grassland~~ Derived Native Grassland (Piligar)

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	—	—	—
Shrub	—	—	—
ground			

❖ Community structure should be described as per Specht et al 1995
!: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
*: 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤: Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q9 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Rodanthe diffusa subsp leucactina	6		42		
2 Lolium perenne	4		43		
3 Sonchus olearus	2		44		
4 Trifolium sativa	3		45		
5 Trifolium arvensis	1		46		
6 Centaurea calcitrapa	3		47		
7 Austrostipa aristaglumis	3		48		
8 Aristida ramosa	2		49		
9 Lepidium africanum	1		50		
10 Sclerophylla brachilli	2		51		
11 Chloris divercatum	3		52		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)		%
Native over-storey cover (%)	0 →		
Native mid-story cover (%)	0 →		
Native ground cover grasses (%)	II	2	4
Native ground cover shrubs (%)			0
Native ground cover other (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII	34	68
Exotic plant cover (%)	𝍸 𝍸𝍸 𝍸 𝍸 I	21	42

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	
2. Proportion of canopy species regeneration	
3. Number of trees with hollows > 5 cm	

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

ID- 1074

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma: Q10 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Middle paddock Victoria

Photo number:

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: GPS 780 (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING	(9.)
		0		30.65073 150.10316
		0		

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community:

Field Community: Exotic Grassland

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	–	–	–
Shrub	–	–	–
Ground	0.1–0.4m	0–50 %	Centaurea calcitropa

❖ Community structure should be described as per Specht et al 1995
!: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q10 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Brassica rapa			42 3		
2 Trifolium arvensis			43 3		
3 Lolium perenne			44 4		
4 Bothriochloa decepiens			45 1		
5 Sporobolus caroli			46 1		
6 Chloris truncata			47 1		
7 Rhodanthe diffusa subsp leucactina			48 2		
8 Austrodanthonia			49 2		
9 Vittadinia cuneata			50 1		
10 Sclerophylla birchilli			51 2		
11 Centarria calcitropa			52 5		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)		%
Native over-storey cover (%)			0
Native mid-story cover (%)			0
Native ground cover grasses (%)	IIII	4	8
Native ground cover shrubs (%)			0
Native ground cover other (%)	II	2	4
Exotic plant cover (%)	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ IIII	44	88

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

N 1 a
E 49

ID-1075

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma — Q11 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Corner paddock

Photo number:

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: GPS 781 (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING	(9.)
		0		30.63959 150.06418
		0		

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community:

Mapped community: –

Field Community: ? Exotic Grassland.

782 (13.)
30.64321
150.05663

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	–	–	–
Shrub	–	–	–
Ground			

❖ Community structure should be described as per Specht et al 1995
!: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q11 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Brassica rapa		4	42		
2 Brassica iroq		2	43		
3 Trifolium sativa		3	44		
4 Avena fatua		3	45		
5 Sonchus oleareus		2	46		
6 Sclerophylla archilli		1	47		
7 Enchylaena tomentosa		1	48		
8 Lolium perenne	5		49		
9 Lepidium africanum		1	50		
10 Echium plantagoneum		3	51		
11 Chloris divercatum		2	52		
12 Solanum parviflorum		1	53		
13 Crassula colorata		3	54		
14 Vittadinia cuneata		2	55		
15 Trifolium arvensis		2	56		
16 centaurea calcitrapa		3	57		
17 Austrostipa anstaglumis	1		58		
18 Bromus arvensis		2	59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)		%
Native over-storey cover (%)	0 →		0
Native mid-story cover (%)	0 →		0
Native ground cover grasses (%)	1	1	2
Native ground cover shrubs (%)			0
Native ground cover other (%)	III	3	6
Exotic plant cover (%)	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ i	46	92

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

N 3
E 47

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma Q12 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
BORE

Photo number: GPS 782

Location recorded with GPS # or Tablet: (7.) 1:100,000 MAP NAME: (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING
		0	
		0	

-30.64321 (9.)
150.05663

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community:

Field Community: Cropping

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	–	–	–
Shrub	–	–	–
ground	0.1 – 1 m	80 – 100%	wheat

❖ Community structure should be described as per Specht et al 1995
! Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q12 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Wheat	7		42		
2 Brassica rapa	3		43		
3 Sisymbrium irio	2		44		
4 Medicago poly	3		45		
5 Anagallis arvens	2		46		
6 Vulpia myuros	1		47		
7 Lolium perenne	3		48		
8 Avena fatua	2		49		
9 Erodium cruten	1		50		
10			51		
11			52		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)	%
Native over-storey cover (%)	0 →	0
Native mid-story cover (%)	0 →	0
Native ground cover grasses (%)		0
Native ground cover shrubs (%)		0
Native ground cover other (%)		0
Exotic plant cover (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 50	100

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

10 – 1076

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma — Q13 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5.)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Site 6 - Middle Bore

Photo number: (6.)

Location recorded with GPS # or Tablet: GPS 783 (7.)

1:100,000 MAP NAME: (8.)

Unique Point ID #: (9.)

	ZONE	EASTING	NORTHING
		0	
		0	

30.64352
150.06668

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community: Exotic Grassland.

Field Community:

Structure and composition ❖ : (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:

❖ Community structure should be described as per Specht et al 1995
! Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q13 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Echium plantgonium	2		42		
2 Avenva fatua	2		43		
3 Lolium perenne	3		44		
4 Triticum aestivum	7		45		
5 Brassica rapa	4		46		
6 Brassica rop	3		47		
7 Sonchus olearus	2		48		
8 Trblium sativa	3	Medicago	49		
9 Enchymana tomentosa	1		50		
10			51		
11			52		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-story cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	100

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			**1 - 6 scale conversion**	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

10 - 1076

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14	1.
Site ID: both sides of proforma Q~~3~~14	2.
Survey type: BB Include quadrate size, search area, transect length etc.	3.
Recorders: AC, DL, (TB), PR, JS, SH, AR	4.
Stratification and patch ID:	5
Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure: Roma Bore Site 6	
Photo number:	
Location recorded with GPS # or Tablet: GPS 784	7
1:100,000 MAP NAME:	8.
Unique Point ID #: ZONE EASTING NORTHING: 30.64798 150.07594	9.
GPS accuracy: ± metres	10.
Note: All waypoints should be recorded in map datum WGS 84	

Habitat Assessment & other site description notes:

11.

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: 12.

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community:

13.

Mapped community:

Field Community: Exotic Grassland - Crops.

Structure and composition ❖ :

14.

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:
Can	-	-	-
Shrub	-	-	-
Ground.			

❖ Community structure should be described as per Specht et al 1995
!: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
*: 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤: Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF **VEGETATION SURVEY PROFORMA P2** Site ID: Q14

Species	Presence	Strata	Species	Presence	Srtata
1 Avenva fatua	3		42		
2 Echium plantgonium	3		43		
3 Lolium perenne	4		44		
4 Trifolium arvensis	2		45		
5 Sonchus oleracus	2		46		
6 Brassica rapa	3		47		
7 Brassica rou	2		48		
8 Sclerophylla birchilli	1		49		
9 Erodium crinitum	1		50		
10 Wheat Triticum	6		51		
11			52		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)	%
Native over-storey cover (%)	0	0
Native mid-story cover (%)	0	0
Native ground cover grasses (%)	4	0
Native ground cover shrubs (%)	1	0
Native ground cover other (%)	6	0
Exotic plant cover (%)	94	100

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

ID- 1077

PARSONS BRINCKERHOFF

VEGETATION SURVEY PROFORMA P1

Date: 13.10.14 (1.)

Site ID: both sides of proforma Q #15 (2.)

Survey type: BB (3.)
Include quadrate size, search area, transect length etc.

Recorders: AC, DL, (TB), PR, JS, SH, AR (4.)

Stratification and patch ID: (5)

Location details: Property name, Lot Plan #, Road Name, Side of Road, land tenure
Site 6 - Nth of Bore 5m QS.

Photo number:

Location recorded with GPS # or Tablet: (7) 1:100,000 MAP NAME: GPS 785 (8.)

Unique Point ID #:	ZONE	EASTING	NORTHING	(9.)
		0		30.63827 150.07849
		0		

GPS accuracy: ± metres (10.)

Note: All waypoints should be recorded in map datum WGS 84

Habitat Assessment & other site description notes: (11.)

Slope:

Aspect:

Landform (Quadrat) e.g. hillside, flat:

landform (broad):

Nearest Drainage line / catchment:

Soil: e.g. Clay, Sand, Loam Geology type:

Evidence of disturbance:

Community age estimate:

Weeds %:

Canopy

Sub-canopy

Shrub

Ground

Ground Cover %: (12.)

Bare soil	
Litter	
Timber	
Rock (type)	
Vegetation (type)	
Total 100%	

Vegetation community: (13.)

Mapped community: Nothing - Cracking clay.

Field Community:

Structure and composition ❖ : Exotic Grassland (14.)

Strata!:	Height: range & median	% foliage cover*:	Dominant spp. and dominance¤:

❖ Community structure should be described as per Specht et al 1995
!: Emergent (E), >8m - tree layers (T1, T2…Tn), <8m - shrub layers (S1, S2…Sn), ground cover (gc)
* 100-70%(4), 70-30%(3), 30-10% (2), <10% (1)
¤ Dominant (d), Associated (a), co-dominant (cd), supressed (s) or combination

PARSONS BRINCKERHOFF

PARSONS BRINCKERHOFF | **VEGETATION SURVEY PROFORMA P2** | Site ID: Q15 | 2.

Species	Presence	Strata	Species	Presence	Srtata
1 Austrostipa aristiglumis	2		42		
2 Richardia stellaris	4		43		
3 Trifolium sativa	5		44		
4 Eleocharis pusilla	3		45		
5 Rumex crispix	1		46		
6 Anagallis arvensis	3		47		
7 Trifolium arvensis	3		48		
8 Medicago poly	2		49		
9 Vulpia myuros	3		50		
10			51		
11			52		
12			53		
13			54		
14			55		
15			56		
16			57		
17			58		
18			59		
19			60		
20			61		
21			62		
22			63		
23			64		
24			65		
25			66		
26			67		
27			68		
28			69		
29			70		
30			71		
31			72		
32			73		
33			74		
34			75		
35			76		
36			77		
37			78		
38			79		
39			80		
40			81		
41			82		

Transect Number	Number of hits (tally)		%
Native over-storey cover (%)	0 →		
Native mid-story cover (%)	0 →		
Native ground cover grasses (%)	𝍸	5	10
Native ground cover shrubs (%)			
Native ground cover other (%)	𝍸 𝍸 ||	12	24
Exotic plant cover (%)	𝍸 𝍸 𝍸 𝍸 ||| 𝍸 |||	34	68

Larger 50 X 20 m Plot	
1. Length of Woody debris >10cm wide & > 0.5 m long	0
2. Proportion of canopy species regeneration	0
3. Number of trees with hollows > 5 cm	0

Cover abundance scale 1-7			1 - 6 scale conversion	
1	<5% - Rare or few individuals	3 or less individuals	1	sparse <5%
2	<5% - uncommon	more than 3 - sparsely scattered	1	sparse <5%
3	<5% - common	consistent throughout plot	2	any no. < 5%
4a	<5% very abundant	many individuals throughout plot	2	any no. < 5%
4b	5% - 25%		3	5 - 25%
5	25% - 50%		4	25 - 50%
6	50% - 75%		5	50 - 75%
7	75% - 100%		6	75 - 100%

PB PARSONS BRINCKERHOFF

Survey Site Form - BioBanking		Site ID: Q18		Vegetation zone:		
Date	10-6-15	Surveyor(s): J. Bangel				
Waypoint ID	Q1	Photo numbers	6574 - 6580			
Coordinates	E 0217376 N 6606190	Photo direction	N	E	S	W
Mapped Vegetation type: Weeping Myall			Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):		Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace						
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?						
Soil type: sand, loam, clay, organic, gravel, skeletal, ?		Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?						
Vegetative Structure (formation) = Woodland		Ecologically Dominant Layer (EDL) - most biomass =				

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			x
T1	4 - 8	6	0-40%	A. pendula
T2	-			x
T3	-			x
S1	0.4 - 2	1	0-10	Juv A. pendula
S2	-			x
G	0.1 - 1.6	0.8	60-90	Sporobolus creber Enteropogon acicularis Austrostipa aristaglumis

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

~190°

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m	5	0	0
10m	10	0	↓
15m	15	10	↓
20m	15	10	↓
25m	25	5	
30m	10	0	
35m	5	5	
40m	25	10	
45m	35	20	
50m	10	0	
Total (sum / 10) =	15.5 %	5 %	0 %

Larger 50 x 20m plot

Length of woody debris >10cm wide & >0.5m long	3.4, 1.2
Proportion of canopy sp. regeneration	1
Number of trees with hollows >5cm	0

Ground cover tally sheet, 50 points along 50m transect
- every 1m record if plant intersects (hits) point

	Total (hits/50)
Native grass tally - 𝍸 𝍸 𝍸 𝍸 |	42%
Native other (herb, fern, sedge, etc) tally - 𝍸 |||	18%
Native shrub tally - —	0%
Exotic tally - 𝍸 𝍸 ||	24%
Bare 𝍸 |	6%

PARSONS BRINCKERHOFF

Site ID: Q1	Survey type:Quadrat 20m x 20m

Species	Cover	Strata	Species	Cover	Strata
1 Acacia pendula		7	41		
2 Lycium ferocissimum		3	42 EDGE OF VEGE		
3 A. aristaglumis		4	43		
4 E. articulans		3	44		
5 S. crebre		2	45		
6 Trifolium arvensis		2	46		
7 Sclerolaena muricata		3	47		
8 Einadia polygali		3	48		
9 Vittadinia sulcata		2	49		
10 Eolhiton spharaena		1	50		
11 Brassica sp		1	51		
12 Lepraum sp african		2	52		
13 Echium planteganeum		3	53		
14 Medicago poly		2	54		
15 ~~Sisymbrium~~			55		
16			56		
17			57		
18			58		
19			59		
20			60		
21			61		
22			62		
23			63		
24			64		
25			65		
26			66		
27			67		
28			68		
29			69		
30			70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic
Tree		
Shrub		
Grass (annual)		
Grass (perennial)		
Other (annual)		
Other (perennial)		

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter					
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Cover abundance scale
Modified Braun-blanquet 6 scale

1	<5% - rare
2	<5% - common
3	5 - 25%
4	25 - 50%
5	50 - 75%
6	75 - 100%

Plot Disturbance	Fire damage:
Clearing (inc. logging):	Storm damage:
Cultivation (inc. pasture):	Trampling:
Soil erosion:	Flood damage:
Firewood collection:	Feral herbivores:
Stock grazing:	Other:

PB PARSONS BRINCKERHOFF

Survey Site Form - BioBanking		Site ID: QZ19	Vegetation zone:			
Date	10-6-15	Surveyor(s): T. Bangel				
Waypoint ID	WP2	Photo numbers	NUMEROUS			
Coordinates	E / N	Photo direction	N	E	S	W
Mapped Vegetation type: Exotic Vegetation			Condition:		(Low)	Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):		Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace						
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?						
Soil type: sand, loam, clay, organic, gravel, skeletal, ?		**Soil disturbance:** intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / (No) Undecided?						
Vegetative Structure (formation) = Exotic Grassland		Ecologically Dominant Layer (EDL) - most biomass = GROUND				

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			X
T1	-			X
T2	-			X
T3	-			X
S1	-			X
S2	-			X
G	0.1 - 1	0.8	0 - 60%	PANICUM SPP SCLEROLEANA AVENUA FANA TRIFOLIUM REPENS

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover: I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

190°

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m	0	0	0
10m	↓	0	↓
15m	↓	0	↓
20m		5	
25m		0	
30m		0	
35m		5	
40m		0	
45m		5	
50m		0	
Total (sum / 10) =	0	1.5 %	

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	0
Proportion of canopy sp. regeneration	0
Number of trees with hollows >5cm	0

Ground cover tally sheet, 50 points along 50m transect - every 1m record if plant intersects (hits) point

	Total (hits/50)
Native grass tally - IIII IIII IIII	28%
Native other (herb, fern, sedge, etc) tally - III	6%
Native shrub tally - II	4%
Exotic tally - IIII IIII IIII IIII IIII IIII I	62%

PARSONS BRINCKERHOFF

Site ID: Q2	Survey type:Quadrat 20m x 20m

Species	Cover	Strata	Species	Cover	Strata
1 Sclerolaena muricata		2	41		
2 Sonchus oleraceus		3	42		
3 Brassica sp		1	43		
4 Dicanthium sericeum		3	44		
5 Lycium ferocissimum		1	45		
6 Trifolium arvensis		3	46		
7 Solanum sp.		2	47		
8 A. ramosa.		2	48 EXOTIC		
9 P. effusum		3	49		
10 B. pilosa		2	50		
11 Datura ferox (thornapple)		2	51		
12 Rumex sp		2	52		
13 Xanthium occidentale		3	53		
14 Apiacea weed (Foeniculum vulgare)			54		
15 Conyza sp		2	55		
16 P. aecompositum		1	56		
17 Petrorhagia dubia		2	57		
18 Trifolium repens		3	58		
19 Cirsium vulgare		3	59		
20 ~~EE~~ Avena fatua		3	60		
21 Sisymbrium thellungi		4	61		
22			62		
23			63		
24			64		
25			65		
26			66		
27			67		
28			68		
29			69		
30			70		
31			71		
32			72		
33			73		
34			74		
35			75		
36			76		
37			77		
38			78		
39			79		
40			80		

Sp. Richness	Native	Exotic
Tree		
Shrub		
Grass (annual)		
Grass (perennial)		
Other (annual)		
Other (perennial)		

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter					
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Cover abundance scale
Modified Braun-blanquet 6 scale

1	<5% - rare
2	<5% - common
3	5 - 25%
4	25 - 50%
5	50 - 75%
6	75 - 100%

Plot Disturbance	Fire damage:
Clearing (inc. logging):	Storm damage:
Cultivation (inc. pasture):	Trampling:
Soil erosion:	Flood damage:
Firewood collection:	Feral herbivores:
Stock grazing:	Other:

PARSONS BRINCKERHOFF

Survey Site Form - BioBanking		Site ID: QB20		Vegetation zone:		
Date	10-6-15	Surveyor(s): T. Bangel				
Waypoint ID		Photo numbers	9679	9680	9681	9682
Coordinates	E 0218873 N 6605853	Photo direction	N	E	S	W
Mapped Vegetation type: Pilliga Box - Pop Box - White Pine grassy.			Condition:		Low	Mod-good
Slope: Gentle, Mod, Steep	Aspect (degrees or cardinal):		Altitude:			
Topography: crest, ridge, upper slope, mid slope, down slope, gully, flat, depression, watercourse, escarpment, terrace						
Geology: basalt, granite, conglomerate, sandstone, siltstone/mudstone, shale, alluvium, limestone, metamorphics, gravel, ?						
Soil type: sand, loam, clay, organic, gravel, skeletal, ?		Soil disturbance: intact, topsoil removed, fill				
Remnant / Old growth (uncleared): Yes / No / Undecided?						
Vegetative Structure (formation) = Woodland		Ecologically Dominant Layer (EDL) - most biomass =				

Strata	Height interval	Median	Est. cover	Dominant Species & Dominance
E	-			X
T1	6 - 14	12	0-30	E. pop E. pilligaensis (nearby)
T2	-			X
T3	-			X
S1	1 - 2	1.5	<1	Juv eucs (x1)
S2	-			X
G	0.1 - 1.8	1-5	80-100	A. verticillata D. sericium Austrostipa bigeniculata.

Tree height (clino) level ground or top of slope = distance from tree x (top% + bottom%)
Tree height (clino) from bottom of slope = distance from tree x (top% - bottom%)

Definitions
Dominance: d = dominant; c = co-dominant; s = subdominant; a = associated
Estimated cover: I = isolated (0.2-2%); v = very sparse (2-20%); s = sparse (20-50%); m = mid dense (50-80%); d = dense (80-100%)

Walker & Hopkins height classes: 1-3m = dwarf; 3-6m = low; 6-12m = mid-high; 12-20m = tall; 20-35m = very tall; >35m = extremely tall
W&H Crown cover: <0.2% = isolated trees or clumps; 0.2-20% = open woodland; 20-50% = woodland; 50-80% = open forest; 80-100% = closed forest

5°

50m Transect	10 Points - Foliage Projective Cover		
Point	Canopy % (photos)	Midstorey %	Exotic %
5m	5	0	0
10m	15	0	
15m	0	0	
20m	0	0	
25m	0	0	
30m	10	0	
35m	25	0	
40m	10	0	
45m	5	0	
50m	0	0	
Total (sum / 10) =	7%	0%	0%

Larger 50 x 20m plot	
Length of woody debris >10cm wide & >0.5m long	2.7m
Proportion of canopy sp. regeneration	1
Number of trees with hollows >5cm	5

Ground cover tally sheet, 50 points along 50m transect - every 1m record if plant intersects (hits) point

	Total (hits/50)
Native grass tally - IIII IIII IIII IIII IIII IIII IIII	60%
Native other (herb, fern, sedge, etc) tally - IIII	10%
Native shrub tally - —	0%
Exotic tally - IIII IIII IIII	30%

PB PARSONS BRINCKERHOFF

Site ID: Q3	Survey type:Quadrat 20m x 20m

	Species	Cover	Strata		Species	Cover	Strata
1	E. pop	6		41			
2	A. verticillata	6		42			
3	E. ~~trignosis~~ nutans.	1		43			
4	E. polygonoides	2		44	FAUNA		
5	D. sericium	3		45	AGLAH		
6	A. arisnglumis	2		46	SULPUR-CRESTED		
7	A. bigeniculata	3		47	NOISY MINER		
8	Sieveleana birchillii	1		48			
9	Rhodosperma bipartitata	2		49			
10	E. articularis	2		50			
11	Lepidium africanum	1		51			
12	D. breviglumis	1		52			
13	Trifolium arvensis	2		53			
14	Panicum effuseum	1		54			
15	Sonchus oleaus.	4		55			
16	Echium plantagineum	3		56			
17	Medicado poly	2		57			
18	Sisymbrium thellungi	2		58			
19				59			
20				60			
21				61			
22				62			
23				63			
24				64			
25				65			
26				66			
27				67			
28				68			
29				69	MBTS		
30				70	NP 830 →		
31				71			
32				72			
33				73			
34				74			
35				75			
36				76			
37				77			
38				78			
39				79			
40				80			

Sp. Richness	Native	Exotic
Tree		
Shrub		
Grass (annual)		
Grass (perennial)		
Other (annual)		
Other (perennial)		

Ground layer % 1x1 plots	Q1	Q2	Q3	Q4	Q5
Native perennial grass					
Native other grass					
Native forb & other					
Native shrub (<1m)					
Exotic grass					
Exotic forb & other					
Leaf & stick litter					
Rocks					
Bare ground					
Cryptogams					
Total	100	100	100	100	100

Cover abundance scale
Modified Braun-blanquet 6 scale

1	<5% - rare
2	<5% - common
3	5 - 25%
4	25 - 50%
5	50 - 75%
6	75 - 100%

Plot Disturbance			
Clearing (inc. logging):	✓	Fire damage:	—
Cultivation (inc. pasture):	✓	Storm damage:	—
Soil erosion:	✓	Trampling:	—
Firewood collection:	—	Flood damage:	—
Stock grazing:	—	Feral herbivores:	—
		Other:	