APPENDIX 4

Flora, Fauna, Aquatic

Ecological Impact Assessment

Proposed Rail Loop

Ulan Wollar Road, Ulan

7 April 2009

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Ecological Impact Assessment
Proposed rail line loop
Moolarben Coal Project
Ulan Wollar Road, Ulan

7 April 2009

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DEFINITIONS AND ABBREVIATIONS

Terms used within this report are defined as follows:

DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DEWHA	Department of Environment, Water, Heritage and the Arts
Disturbed Vegetation	A mappable area containing a variable floristic assemblage of native and exotic plant species that is not reflective of naturally occurring described native vegetation communities.
CEEC	A critically endangered ecological community within the meaning of the definitions contained within the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Core habitat	Land containing resources capable of supporting both breeding and foraging activity.
EEC	An endangered ecological community within the meaning of the definitions contained within the *NSW Threatened Species Conservation Act 1995* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
EIA	Ecological Impact Assessment
EP	An endangered population within the meaning of the definitions contained within the NSW Threatened Species Conservation Act 1995 or Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GIS	Geographical Information System. Software enabling spatial database analysis.
Intact Vegetation	Refers to areas of native vegetation that are relatively continuous, relatively weed-free, contain natural habitat features, and which appear to function as a native ecological community. The term may be applied to areas of vegetation which have been previously disturbed and/or cleared, but have regenerated and recovered to the extent that natural functions have been restored, and the vegetation would be expected to progress unassisted towards a stable state.
Native Vegetation	A mappable area containing a structurally and floristically stable assemblage of plant species dominated by native flora species (i.e. greater than 50% native plant cover).
NES	National Environmental Significance
Patch	A mapped area of homogenous native vegetation cover that may form part of a larger remnant.
Potential subject species	Threatened flora and fauna species identified within the locality through database searches, literature reviews and GIS analysis.
Remnant	An area of continuous native vegetation cover that may contain more than one vegetation patch.
Secondary habitat	Land containing resources capable of supporting breeding or foraging activity but not both (refer to core habitat).
Locality	Land contained within a 10 km radius of the site, which has been used to analyse database and vegetation mapping. Results used as a basis for comparison with the sites ecological values to assess project impacts.
Site	Land being the subject of this Ecological Impact Assessment, which is marked with a blue outline on each figure.
Subject species	Species known to occur or having potential core or secondary habitat within the site, with development impacts potentially having an influence on these species.
Threatened Biodiversity	Species, population or communities listed as endangered or vulnerable within the meaning of the *NSW Threatened Species Conservation Act 1995* and/or the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

EXECUTIVE SUMMARY

A field survey sampling the ecological values of a proposed rail line loop located north of the Ulan Wollar Road Ulan (the site) was completed together with database searches and review of literature and baseline ecological data in preparation for this ecological impact assessment (EIA) report. This new alignment is modification to the rail loop infrastructure approved for Stage 1 of the Moolarben Coal Project, with new previously unaffected lands now impacted by approximately 6 ha.

The focus of this EIA report is threatened species, endangered populations (EPs), endangered ecological communities (EECs) and their habitats (collectively referred to as *threatened biodiversity*) as listed on the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Other considerations presented in this report include the State Environment Planning Policy – Koala Habitat (SEPP 44).

Methods

This assessment is based on desktop and field derived data collected from the site and locality in accordance with relevant survey methods specified in the Department of Environment Conservation's (DECs) working draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004). Flora surveys were conducted on 6 February 2009 targeting threatened species likely to occur within the locality, a list determined by searches of DECCs Wildlife Atlas database (DECC, 2008), EPBC Act Protected Matters Search (DEWHA, 2008), spatial analysis of Wildlife Atlas database records against relevant Mitchell Landscapes/ vegetation types and literature review. Flora surveys involved systematic (i.e. quadrat) and non-systematic (targeted) techniques to sample the sites floristic species richness and diversity.

Previous fauna surveys of the locality (i.e. baseline data) involving extensive seasonal opportunistic diurnal sampling regimes, targeted surveys of important habitats and systematic fauna surveys such as microchiropteran bat surveys, mammal trapping and bird surveys were relied on in this assessment. Diurnal site observations collated during the flora survey were also noted and considered. Assessments were completed in accordance with relevant legislation.

Results

The Wildlife Atlas database search identified 514 flora species within the locality consisting of 467 native and 47 exotic species. According to the same database there are 497 fauna species records within the locality (i.e. 474 natives and 23 exotics) (DECC, 2008). The baseline field survey identified 256 fauna species comprising 170 avian, 37 mammal, 32 reptile and 7 amphibian species (Ecovision Consulting, 2008).

Site surveys identified 60 plant species, consisting of 51 natives and 9 exotics, forming two vegetation types (i.e. Lowlands Ironbark Forest and Secondary Grasslands and Shrublands). The intact native vegetation of the site, this being Lowlands Ironbark Forest, is locally characterised by Narrow-leaved Ironbark. Elements of Blakely's Redgum – Rough-barked Apple Forest on course sands is evident in low ephemeral drainage swales by the presence of Blakely's Redgum and Yellow Box. Habitats contained within these vegetation formations include grasses (seeds), tree branches, hollows and fallen timber. Potential aquatic habitats occurs onsite in the form of open ephemeral swales, although these were dry at the time of survey.

Biodiversity Analysis

The sites ecological value was classified using key indicators of ecological health such as native/exotic species richness, tree hollow abundance and vegetation structural condition. In general, the sites ecological value was reported for the main vegetation formation(s) identified for the site. These are as follows:

> *Lowland Ironbark Forest - Moderate to high ecological condition (i.e. vegetation cover consisting mostly native trees, shrubs, grasses and herbs, few to many exotics. Contains complex fauna habitat features that meets reported benchmarks for this vegetation type (e.g. tree hollows, fallen timber, diverse array of native plants). Moderate availability of core habitat values for most common species. Ecological value moderated by edge: area ratio and/or patch size.*

Secondary open grassland - Low to Moderate ecological condition (i.e. vegetation cover consisting a mix of native and exotic trees, shrubs, grasses and herbs, with exotics often high in abundance. Contains reduced fauna habitat features that are below reported benchmarks for this vegetation type (e.g. general absence of tree hollows, fallen timber, low native plant richness). Habitat values predominantly suiting common species. Ecological value substantially compromised by edge: area ratio and/or patch size.

It is important to note that areas of modified native vegetation cover may potentially offer important contributions to the life cycles of threatened species such as woodland birds and threatened plants despite the influence of past/ current anthropogenic processes.

Threatened Biodiversity

Identified from database searches, literature reviews and baseline field surveys were a total of 30 threatened plant species/ EPs that have known or potential occurrence within the locality (DECC, 2008; Ecovision Consulting, 2008). However, targeted surveys failed to locate the presence of any threatened flora species within the site. Potential habitat for the Tiger Orchid (*Cymbidium canaliculatum*) occurs within the site, however, no populations were observed.

Analysis of spatial databases and relevant literature identified the potential for 36 threatened fauna and/or their habitats to occur within the locality (DECC, 2008; Ecovision Consulting, 2008). Potential threatened species habitat exists primarily throughout areas of native vegetation cover with intact structure and floristics. Threatened species capable of utilising the resources contained within the site are mostly restricted to woodland birds such as the Diamond Firetail, Hooded Robin, Grey-crowned babbler and Speckled Warbler. The potential threatened biodiversity values contained within areas of intact native vegetation of moderate to high value due the presence of tree hollows and moderately intact native vegetation cover (i.e. floristics). The quantum of local threatened fauna records (Ecovision Consulting, 2008) supports this view.

A preliminary risk analysis identified 21 threatened biodiversity as ‘Subject Species’ for consideration in the impact assessment. The selected ‘Subject Species’ have distributional ranges that overlap the locality and are capable of potentially utilising broad habitats contained within the site (i.e. dry sclerophyll woodland and open grassland environs). Site survey confirmed that these areas of potential habitat would be impacted by the proposed development.

An analysis of survey data identified site vegetation as representing high potential habitat for locally occurring threatened biodiversity, particularly those of woodland areas, particularly for threatened species such as the Diamond Firetail, Hooded Robin, Grey-crowned babbler and Speckled Warbler. The Diamond Firetail was recorded onsite during the site survey. The assessment has assumed that these and other threatened species may utilise the habitats contained within the site vegetation for various life cycle functions. EECs/ CEECs known to occur within the locality, namely White Box Yellow Box Blakely's Redgum Woodland, have also been considered in this assessment with elements of this community confirmed within ephemeral drainage swales of the site (0.2 ha).

Review of Impacts

Compared to the existing consent for Stage 1 of the MCP, the new proposed rail loop alignment requires a revised impact assessment for an area totalling 6 ha. No part of the approved rail loop made redundant by the proposed new alignment is covered by intact native vegetation, rather secondary grasslands. Thus any vegetation clearing arising from this new alignment represents permanent clearing works in addition to the Stage 1 approval.

The impact footprint arising from the proposed development includes the area directly impacted by the proposed rail loop construction works (i.e. clearing, fill and side roads). The alteration of soil conditions and availability of macro nutrients from these changed conditions, combined with a disturbed edge, could result in the introduction of weeds in adjoining uncleared native vegetation (i.e. indirect impact). Altered surface water movements arising from the modification are likely to have indirect impacts downslope of the infrastructure emplacement (i.e. increased water interception and/or channelled water flows).

Proposed Impact Management Actions

In response to the above impact scenario and threatened species issues the following impact management actions are recommended to offset the proposed developments impact on the natural environment:

- Avoid one of the two hollow being trees contained within the proposed rail loop alignment. The eastern tree is to be retained whilst the western tree is to be removed;
- Avoid construction works during the breeding cycle of known and potential threatened woodland species that occur within the locality (i.e. construction during autumn – early winter months preferable);
- Implement a plan of management for the removal of the second hollow bearing tree. This is to include removal techniques, hollow salvage, compensatory measures and monitoring;
- Undertake local revegetation works to minimise the cumulative impact of vegetation loss from the locality, hence the maintenance of fauna habitats;
- Establish a 'like for like' offset for vegetation directly impacted by the proposed development. The extent of this offset is to be determined by the Consent Authority and government agencies, with the extent of this offset to have regard for other actions such as offsite revegetation works.

In relation to predicted indirect impacts on offsite WBYBBRW and Derived Grasslands EEC/ CEEC, matters such as weed control, water/ erosion management and exclusion of livestock represent important management themes for impact minimisation. The offsite impacts are to be managed within the framework of any approved management plans prepared in response to the conditions of consent for Stage 1 of the Moolarben Coal Project where they apply.

EP&A Act

The impact assessment (i.e. Assessment of Significance) concluded that no significant impact on threatened species, EPs, EECs, CEECs or their habitats would occur should the proposed impact management actions be implemented. Accordingly, no further impacted assessment is warranted for the proposed development.

SEPP 44 – Koala Habitat Protection

SEPP 44 applies to the Mid Western Regional Council local government area (LGA) and is therefore relevant to the site. Surveys identified the tree canopy to not constitute 'potential' koala habitat (i.e. preferred foraging species less than 15% total cover). No evidence of koalas or koala activity was detected within the site during the survey period. No further consideration of this matter is required under SEPP 44.

EPBC Act

Matters of national environmental significance (NES) occurring within the locality were considered in the review of impacts to determine whether further environmental investigation is warranted under this Act.

Assuming the implementation of the proposed mitigation actions, it is considered that adequate measures will be taken to offset the developments impact on threatened biodiversity, native vegetation cover and fauna habitats. Accordingly, it is considered that a referral to the Department of Environment, Water, Heritage and the Arts (DEWHA) is not required, as the development of the site would have a low impact on relevant 'Protected Matters' of NES as listed on the EPBC Act.

Conclusions

This assessment report has considered the magnitude of the developments impact on the receiving environment and in light of the proposed mitigation actions it is concluded that the proposed development would result in a low net impact on the relevant threatened biodiversity values. In this respect, it is expected that there would be no significant impact on TSC Act and/or EPBC Act listed threatened biodiversity. Within the context of the locality there would be no significant impact on SEPP 44 habitats or native vegetation cover.

1.0 INTRODUCTION

This Ecological Impact Assessment (EIA) report was prepared to assess the impacts of the proposed rail line loop, this being a s75W amendment to the approved Stage 1 of Moolarben Coal Project (MCP) Ulan Wollar Road, Ulan (the site). The location of the site is illustrated in **Figure 1**. An understanding of the project and assessment tasks, including a brief site description, is provided in the following sections.

1.1 The Project

1.1.1 Background

The proposed development is a permissible development activity under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The consideration of matters of National Environmental Significance (NES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* is also relevant.

As the proposed development is to occur within an area coinciding with native vegetation and fauna habitats, matters such as threatened biodiversity and their habitats requires consideration prior to the granting of development consent. The purpose of this report is to provide the determining authority with sufficient information to assess these environmental matters during the assessment of the proposed development application.

1.1.2 The Proposal

The proposed rail line loop involves the development of approximately 6 ha of land involving the construction of a single rail track, a service road and batter. Native vegetation cover and important remnant trees are to be permanently removed. **Figure 2** shows the layout of the proposed development, as presented for assessment.

1.2 Site Description

The site is located at Ulan in Mid Western Regional Council local government area. The site is a 25 m wide linear tract of land along the northern edge of the Ulan – Sandy Hollow rail line and is approximately 6 ha in area. The approved MCP – Stage 1 is located to the west of the site [infrastructure placements], with the proposed MCP Stage 2 being located to the south.

The site is located near the headwaters of an unnamed creek that drains into the Upper Wilpingjong Creek. The Goulburn River National Park is located nearby the site to the northeast. Aerial photography, as shown in **Figure 1**, identifies treeless and treed land cover within this area, with the latter implying the presence of native vegetation.

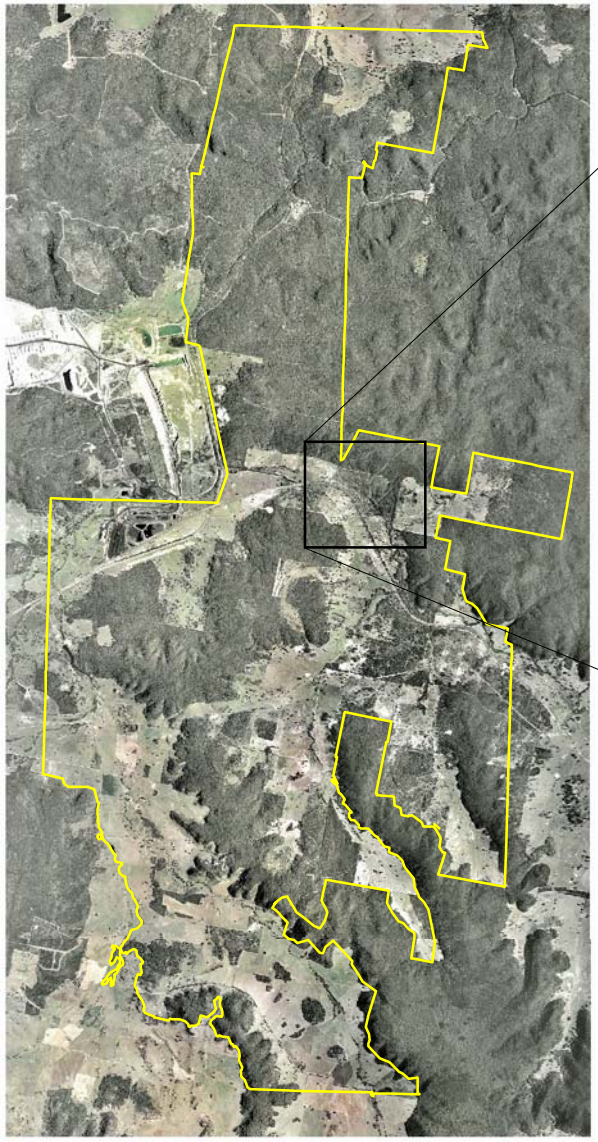
1.3 Legislative Framework

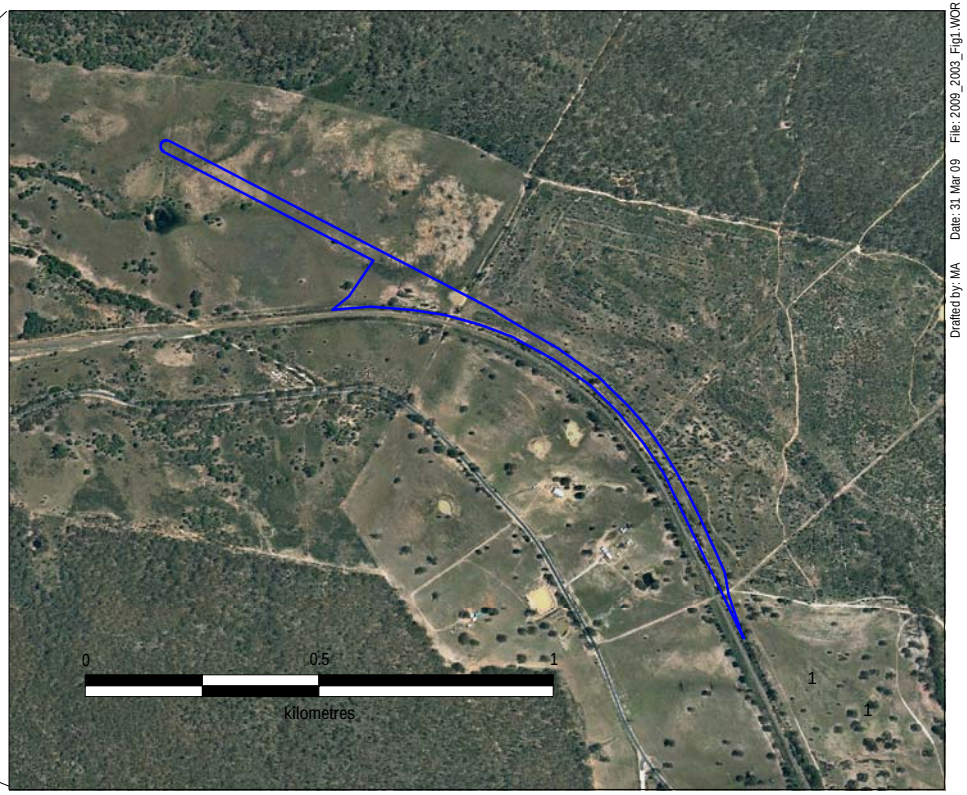
For the purposes of assessment the legislative framework used in this EIA report is Section 5A of the EP&A Act to assess threatened biodiversity listings under the *Threatened Species Conservation Act, 1995* (TSC Act). A review of impacts on *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened biodiversity has also been prepared to determine the requirement for a referral.

1.4 Project Tasks

The principal tasks undertaken as part of the EIA were:

- Undertake a background review of biodiversity values occurring within a 50km radius of the site;
- Identify the flora and fauna communities present within the site using systematic survey methods;
- Complete targeted surveys and habitat assessments for threatened species, endangered populations (EPs) and endangered ecological communities (EECs) of the locality;
- Quantify the ecological values of the site;
- Consider the implications of development on the sites ecological values, including any consequential indirect impacts;





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Legend

The Site

EL 6288

FIGURE 1

Location of the Site and EL6288

Sources
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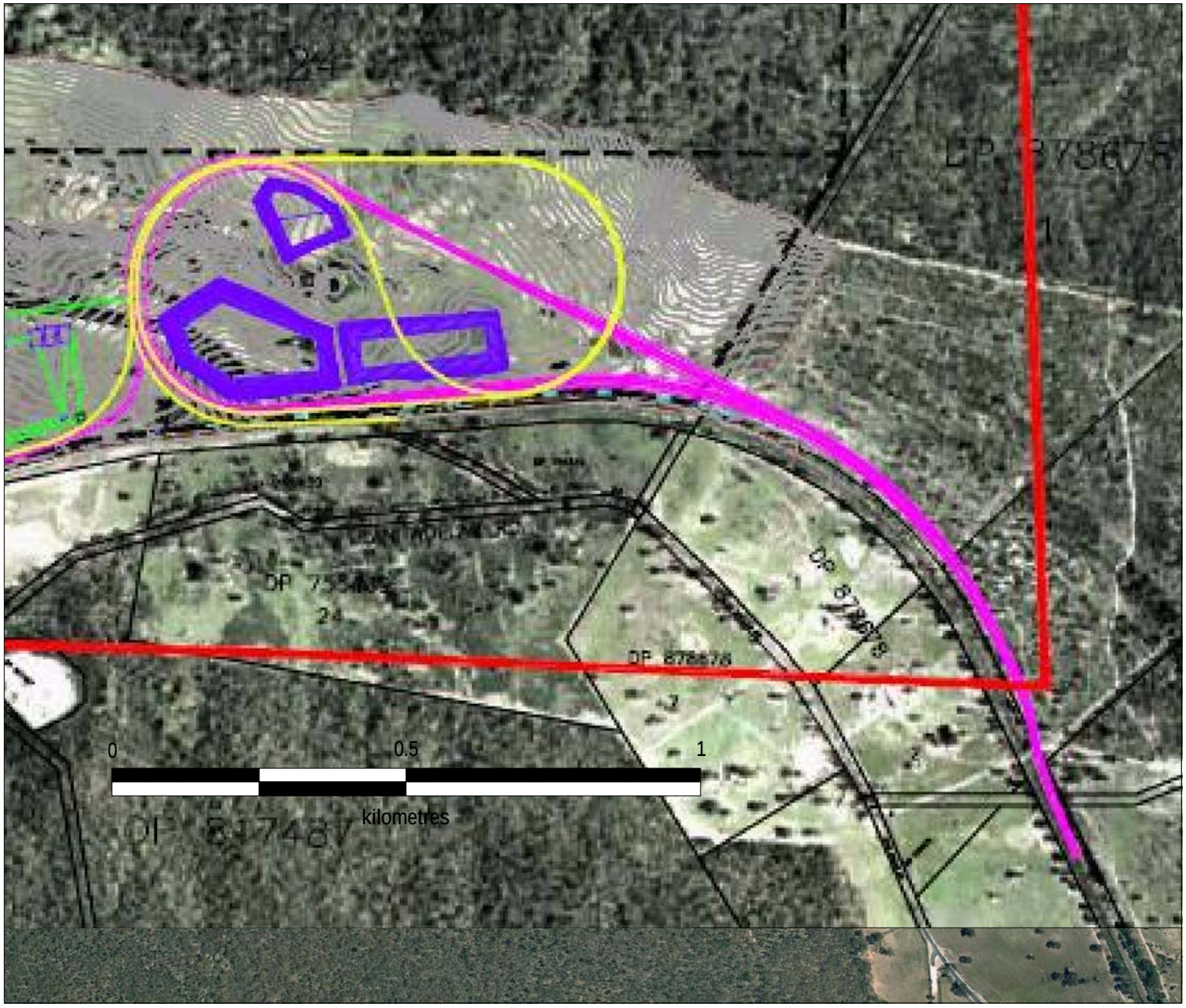

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FIGURE 2

Proposed Development

Note: Pink markings represents the proposed new rail loop. Yellow markings represents the approved rail loop for Stage 1 of the MCP. Areas where pink does not coincide with yellow represent the site for the purposes of this assessment.

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- Consider and recommend any relevant impact management actions;
- Prepare an impact assessment in accordance with Section 5A of the EP&A Act in light of the recommended impact management actions; and
- Review the impact of the development against matters of national environmental significance as listed on the EPBC Act in light of the recommended impact management actions.

1.5 Report Structure

The following table indicates the structure of this EIA.

Table 1: Report Structure

Section	Component	Content
2	Applicable Legislation	Relevant legislation
3	Survey Methodology	Details survey approach
4	Local Environment	Broad discussion of local environment and relevant threats
5	Impact Analysis	A review of the development and its impacts
6	Survey Results	Discussion of sites ecological character
7	Data Interpretation	A review of the sites biodiversity values against regional vegetation and wildlife data.
8	Ecological Significance	Discussion of threatened species, EPs, EECs and sites significance
9	Proposed Mitigation	Identifies extent of mitigation works to compensate for the developments impacts
10	Impact Assessment	Reviews the developments impact against relevant legislation and the proposed mitigation.
11	Conclusions	Summary
12	References	Resources used to prepare EIA

1.6 Limitations

Survey and Assessment

This EIA has quantified the biological character of the site through literature reviews, database searches, field survey, baseline biodiversity data for the locality (Ecovision Consulting, 2008) and data interpretation. Field surveys have focused on threatened species and their habitats, particularly those known to occur within the locality.

The field survey and assessment presented in this investigation have been undertaken in a manner reflecting the impacts of the proposed development in the context of the locality. Modifications to field survey design have been introduced, where necessary, to reflect the nature of the development impacts on the receiving environment. For instance, targeted orchid surveys were not undertaken due to the confidence placed in the baseline biodiversity dataset for the locality.

An understanding of temporal variation resulting from seasonal change is based on the experience of the principal investigator and information contained within existing databases for the locality. Irreconcilable limitations placed on this report by data gaps and/or inaccuracies in these databases/ vegetation maps have been identified and quantified where relevant for consideration by the determining authority. Targeted surveys for cryptic and/or seasonal species such as ground orchids may be recommended should field survey indicate the potential presence of these species. Similarly, projects with substantial impact envelopes that overlap sensitive environments may attract survey repetition to sample local seasonal variability.

Report Validity

The compilation of this report is limited by its focus this being impact assessment against current and relevant legislation, associated regulations and guidelines. Government and/ or government authorities periodically review this underlying planning framework and as such are subject to amendment and/ or alteration. Hence, amendments to the assessment framework that arise after the published date of this report may potentially invalidate the stated conclusions. Accordingly, no warranty is placed on the contents of this report or its conclusions where it can be demonstrated that the planning framework has been sufficiently amended or altered subsequent to the reports' published date.

2.0 APPLICABLE LEGISLATION AND GUIDELINES

This section provides an overview of relevant State and Commonwealth legislation and guidelines concerning the assessment of flora and fauna matters.

2.1 State Legislative Framework

Development in NSW is subject to various planning instruments that regulate the use of lands containing vegetation and threatened species. The following are relevant to the development.

Environmental Planning and Assessment Act, 1979

The approved Stage 1 of the MCP was declared a Part 3A Major Project under the EP&A Act and thus is subject to the assessment protocols prescribed by this part of the Act. Approval for these projects the responsibility of the NSW Minister for Planning.

Matters pertaining to significant impacts on threatened species that arise from proposed development declared as a Major Project are no longer subject to the preparation of a Species Impact Statement (SIS) under the *Threatened Species Conservation Act 1995* (TSC Act) or the *Fisheries Management Act 1994* (FM Act). Notwithstanding, both these Acts provide context for impact assessment of Part 3A Major Projects, as these Acts contain listings of threatened species, populations and ecological communities.

For the purposes of assessment Section 5A of the EP&A Act has been used as the test for deciding whether there is the likelihood of a significant impact on threatened species, EPs, EECs and their habitats. This assessment is referred to as the "Assessment of Significance" with the terms of reference for this assessment restricted exclusively to the developments impacts on sites biological values.

Threatened Species Conservation Act, 1995

In addition to prescribing the requirements for preparation of a SIS, the TSC Act contains schedules listing threatened species (i.e. endangered or vulnerable), EPs, EECs and key threatening processes. It also provides for the keeping of a critical habitat register, the granting of licences authorising actions leading to the harm of any threatened species, EP or EEC, the handling of a threatened species, EP or EEC or damage to critical habitat and/or habitat of a threatened species, EP or EEC.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

This State Environmental Planning Policy (SEPP) encourages the conservation and management of koala habitats in certain local government areas. This policy applies to lands located within Mid Western Regional Council LGA.

2.2 Commonwealth Legislative Framework

Environment Protection and Biodiversity Conservation Act, 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prohibits actions that are likely to have a significant impact on matters of national environmental significance (NES) in the absence of an approval for such actions. Matters of National Environmental Significance protected by the EPBC Act include, but are not restricted to:

- Declared World Heritage properties;
- Ramsar wetlands;
- Listed threatened species and communities;
- Listed migratory species;
- Nuclear actions; and
- Actions in a Commonwealth marine area.

It is an offence to carry out an action that will or is likely to have a significant impact on NES matters without first obtaining an approval from the Commonwealth Environment Minister except where an exemption in the

EPBC Act applies or the action is assessed in accordance with an approved bilateral agreement. A person who is proposing to carry out an action that may have a significant impact on one of the above NES matters (and which is not the subject of an exception) is required to refer the proposed action to the Commonwealth Environment Minister. The Minister will determine as to whether the project is a "controlled action" (i.e. an action that requires the approval of, or the environmental assessment nominated by, the Environment Minister).

2.3 Survey Guidelines

Survey design was structured around relevant industry standards, this currently being the Working Draft Guidelines *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*' (DEC 2004). As it is a guideline, various modifications to the survey protocols were applied where justification permits.

2.4 Relevant Matters

This EIA report is to consider the direct and indirect impacts of the proposed rail line loop through site data collected from field survey and relevant databases. Impact assessment will follow Section 5A of the EP&A Act. Recommendations for further environment assessment under the EPBC Act (i.e. referral to DEWHA) will be provided in this report should it be predicted that the proposed development is likely to have a significant impact on matters of NES listed under this act.

3.0 SURVEY AND ASSESSMENT METHODOLOGY

3.1 Desktop Analysis

3.1.1 Database Searches

DECCs Wildlife Atlas database records contained within a 50 km radius of the site were analysed to identify the threatened biodiversity of the locality (DECC, 2008). Similarly, a 50 km point search of the EPBC Act online 'Protected Matters Database' (i.e. DEWHA, 2008) was also generated to identify relevant matters of NES. These searches have resulted in a list of threatened biodiversity collectively referred to as 'Potential Subject Species'. The results summary of this search is provided in **Appendix 1**.

3.1.2 Literature Review

A review of recent flora and fauna reports of the locality was completed to compliment the database searches, assist the classification of the sites biological values and 'Subject Species'. Data and literature reviewed in addition to standard biodiversity references include:

- Baseline biodiversity surveys and vegetation mapping for Exploration License 6288 (EL6288) (Ecovision Consulting, 2008);
- Ecological Impact Assessment – Stage 2 of the Moolarben Coal Project (Ecovision Consulting, 2008);
- NSW ecosystems study: background and methodology (Mitchell, 2002); and
- Mitchell Landscapes with per cent cleared estimates, listed by CMA (http://www.nationalparks.nsw.gov.au/npws.nsf/Content/BioMetric_tool).

Threatened biodiversity identified from sources other than the above mentioned literature will also be considered 'Potential Subject Species' (e.g. species that do not have known database records within locality but are known to occur within landscapes and/or vegetation types that occur within locality).

3.2 Impact Analysis

The impacts arising from the proposed development were spatially and temporally quantified to assist the establishment of assessment assumptions, hence represent the foundation of the impact assessment. Impacts were quantified using area statements and terms such as 'direct', 'indirect', 'temporary' and 'permanent', with the overall classification of these impacts termed 'Impact Intensity'.

Impacts quantified in this manner have been translated into a 'Likelihood' and 'Consequence' scale to assist preliminary ecological risk analysis. The purpose of the 'Preliminary Ecological Risk Analysis' is to relate the threatened biodiversity identified during the desktop analysis against the sites general ecological values and expected development impact regime. A risk scale ranging from 'low' to 'extreme' assists the determination of the scope of field survey works, hence focusing survey and assessment resources on threatened biodiversity relevant to the development and its implied impacts.

3.2.1 Preliminary Ecological Risk Analysis

The likely impacts attributable to the proposed development were used to identify/ refine the 'Subject Species' list, as required by DECC in the DGRs. Facilitating this was an ecological "risk" analysis, which conservatively evaluates the impact of the development by taking into consideration the intensity of the impact on a species habitat (i.e. likelihood – see also **Table 2**) and the effect on its occurrence (i.e. consequence – see also **Table 3**). This process of risk evaluation is based on the Australian Standard for risk management (AS/NZS 4360).

The ecological risk analysis was completed by attributing a 'Likelihood' and 'Consequence' label to each of the threatened biodiversity identified through database searches, spatial analysis, literature reviews and field survey. This analysis considered the extent of habitat values within the site, the extent of overlap between this habitat and the developments impacts and the legal status of the species. Threatened biodiversity having a preliminary ecological risk classification exceeding 'low' are considered 'Subject Species' for this assessment, with those classified as having low ecological risk regarded as inconsequential in terms of the development. Note that this analysis also in part validates the extent of field surveys applied to relevant threatened biodiversity identified in this report.

Impact Likelihood

Impact Intensity attempts to define the temporal and spatial extent of direct and indirect impacts on the receiving environment as they relate to threatened biodiversity. For the purposes of the ecological risk analysis, Impact Intensity was translated into a 'Likelihood' label, as defined in **Table 2**.

Table 2: Likelihood Scale

Likelihood Label	Description
A	Impact on known core and/or source habitat (e.g. breeding and foraging habitat)
B	Impact on known secondary and/or sink habitat (e.g. breeding or foraging only)
C	Impact on potential core and/or source habitat (e.g. breeding and foraging habitat)
D	Impact on potential secondary and/or sink habitat (e.g. breeding or foraging only)
E	Impact on habitats other than core/ secondary and/or source/ sink habitat.

Likelihood was calculated by comparing the broad habitat values and landscape attributes of the impact area against those prescribed for relevant threatened biodiversity. Broad habitat types, as guided by the literature, were categorised as follows:

- Known natural distributions including survey results;
- Geological preferences;
- Specific habitat requirements (e.g. aquatic environs, seasonal nectar, tree hollows etc);
- Climatic considerations; and
- Topographical preferences (e.g. ridgetops, coastal headlands, midslopes etc).

Impact Consequence

'Impact Consequence' defines the predicted response of a threatened species to impacts arising from the development, this ranging from 'no impact' to 'local extinction'. In the context of this assessment, consequence is directly related to the legal status of a species and is defined as follows in **Table 3**.

Table 3: Consequence Scale

Consequence Label	Predicted Event	Description
5	Locally Extinct	Classification applies to species listed as 'extinct' within the meaning of the TSC Act.
4	Extinction imminent	Classification applies to species listed as 'Critically Endangered' within the meaning of the TSC Act.
3	Extinction within 10 years	Classification applies to species listed as 'Endangered' within the meaning of the TSC Act.
2	Extinction within 50 years	Classification applies to species listed as 'vulnerable' within the meaning of the TSC Act.
1	No foreseeable extinction	Classification applies to species not listed as threatened within the meaning of the TSC Act.

The last classification described as 'no foreseeable extinction' relates to all species not classified as threatened. This is particularly relevant to undescribed species where it is likely there is limited knowledge of the species conservation status.

Subject Species Evaluation

Using the ecological risk analysis to evaluate the likely impact of development on threatened biodiversity permitted for a distinction between threatened biodiversity relevant to the assessment from those that are not (i.e. identification of Subject Species). The ecological risk analysis matrix used for this purpose is shown as follows in **Table 4**.

Table 4: Ecological Risk Matrix

Likelihood Label	Consequence Label				
	1	2	3	4	5
A	High	Extreme	Extreme	Extreme	Extreme
B	Medium	High	Extreme	Extreme	Extreme
C	Low	Medium	High	Extreme	Extreme
D	Low	Low	Medium	High	Extreme
E	Low	Low	Low	Low	Low

From the above table it is clearly apparent that both vulnerable and endangered species are considered 'Subject Species' where known and/or potential habitat is identified. Threatened biodiversity classified as having a 'Low' ecological risk rating are species that are unlikely to be impacted by the development (i.e. no known and/or potential habitat within the impact area), and are hence deemed irrelevant to the assessment.

Extinct species listed on the TSC Act that have historical affiliation with the region are considered on the assumption that knowledge on habitat values is likely to have been limited by an absence of records and/or any targeted research. Similarly, undescribed species likely to be impacted by the development will also receive consideration (i.e. ecological risk classification of A1 – High').

3.3 Field Survey

The field survey was conducted in accordance with DECs working draft *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004), as modified by the preliminary risk assessment. The details of the survey extent are as follows.

3.3.1 Flora Survey Methods

An investigation of the sites floristic content and spatial distribution was completed via a sampling regime involving systematic and opportunistic survey methods defined as follows:

Systematic: Observations collected within predefined sample areas (i.e. quadrats) through a stratified random sampling regime restricted to landscapes with relatively homogenous aspect, slope, soil type/ geology, vegetation cover and topographic position. Sample locations were predominantly defined through image analysis (i.e. satellite and/or aerial imagery). Sample replicates were used to assist the identification of characteristic species, with increased replicate samples obtained from native vegetation types with large aerial extent. Edges or boundaries between homogenous landscapes were not sampled due to potential edge effects.

Biodiversity Searches: Observations collected from heterogeneous landscapes such as disturbed areas or edges/ boundaries/ecotones between homogenous landscapes. These observations are generally biased by the observer's position within the landscape and/or perception of species importance (*i.e.* observer bias). Biodiversity searches may also represent the result of targeted surveys for threatened and/or seasonal species such as ground orchids. While these observations may not meaningfully define homogenous vegetation units, they are useful in ascertaining floristic variability particularly in disturbed areas or ecotones (i.e. edges) that are unsuited to systematic survey methods.

The combination of these two sampling methods provides opportunity to define the floristic character of the site vegetation cover and the extent of floristic diversity

Minimum Sampling

A minimum of three systematic samples (*i.e.* quadrat or transect) were placed within each survey unit. Non-systematic survey methods (*i.e.* biodiversity searches) were generally restricted to areas linking systematic survey sites and/or areas designed to target cryptic, seasonal and/or threatened biodiversity.

3.3.2 Fauna Survey Methods

An opportunistic investigation of the sites fauna composition was completed during the flora survey (i.e. diurnal survey methods). Data from relevant systematic diurnal and nocturnal surveys collected during baseline studies of the locality between summer 2004 and spring 2008 were also analysed. These surveys

included extensive seasonal sampling involving spotlighting, Elliott trapping, call broadcast, pitfall and hair tube trapping, microchiropteran bat surveys and timed quadrats for bird observations.

3.4 Statistical Analysis

In this assessment, a non-parametric multivariate statistical analysis was used to derive vegetation types from the flora quadrat samples, by clustering these samples according to their degree of similarity. This would allow for the vegetation in the study are to be compared with published classification (e.g. regional vegetation community descriptions and/or legal definitions such as EECs).

Data analysis involved a Non-Hierarchical Clustering method of 205 quadrats collected from the locality. The analysis used the Bray and Curtis/ Two-Step association measures to generate a dendrogram (i.e. classification tree) along with the use of non-metric multidimensional distance scaling (NMDS) techniques to graphically display these results (i.e. ordination plot) for the interpretation of data trends such as environmental gradients.

The systematically collected data was analysed using PATN v3.3, a non-parametric statistical software package based on agglomerative clustering and non-metric multidimensional distance scaling (NMDS) (Belbin, 1989). PATN extracts and displays patterns in complex (multivariate) data, this being a particularly useful analytical technique for understanding ecological data such as vegetation plot data. It has been used in this assessment to aid the categorization of vegetation plot data (i.e. quadrat) for comparative classifications with published vegetation community descriptions.

Data variables or intrinsic data collected for each sample location (i.e. quadrats) include species (i.e. plant) and an associated measure (i.e. cover abundance). Attribute data or extrinsic data for each sample location was evaluated included aspect, landscape position, soil type, geology and location (i.e. data used to interpret but not influence the results of the intrinsic data analysis).

Analysis initially focused on distinguishing between regional vegetation communities with regard to Keith (2004), which have known/ expected occurrences within or adjacent to the study area (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_veg.aspx). The Two-Step association measure was used for variables (i.e. species data) for the development of a two-way table defining groups (i.e. similar quadrats) and their components (i.e. species). Vegetation classifications are described from this two-way table and compared with those described by Ecovision Consulting (2008) for the proposed Stage 2 of the MCP.

4.0 LOCAL ENVIRONMENT

4.1 General Site Characteristics

Table 5 describes the general biophysical characteristics of the site.

Table 5: Biophysical Characteristics of the Site

Attribute	Comment
Landforms	Low rises and open drainage lines occur throughout the impact area.
Geology of the locality	Primarily of Permian aged sedimentary deposits including sandstone, mudstone, siltstone, shale and conglomerate with tuff, limestone and outcropping coal.
Mitchell Landscapes	Lees Pinch Foothills and Upper Goulburn Valleys and Escarpment.
Vegetation Cover	Site and adjoining landscape is generally classified by vegetation consisting of Ironbarks, Box and Redgum with cleared grassland areas also prominent.

4.2 Biological Characteristics

4.2.1 Mitchell Landscapes

The site transcends the Lees Pinch Foothills and Upper Goulburn Valleys and Escarpment Mitchell Landscapes (Mitchell, 2002) of the Hunter Central Rivers catchment area. Details of these Mitchell Landscapes and others occurring within the locality are listed in **Table 6**.

Table 6: Mitchell Landscapes of the Study Area

Landscape	Estimated Existing Vegetation Cover for entire Mitchell Landscape (km^2)	Percent Cleared
Lees Pinch Foothills	1,477	28%
Upper Goulburn Valleys and Escarpment	462	48%

Catchment Management Authorities (CMAs) consider Mitchell landscapes with existing vegetation cover of less than 30% pre-European conditions as being overcleared. In both cases these Mitchell Landscapes are not overcleared.

4.2.2 Keith Vegetation Classes

Keith (2004) vegetation classes known to occur within the Mitchell Landscapes of the site include Western Slopes Grassy Woodlands and Western Slopes Dry Sclerophyll Forests. Details of these vegetation classes are provided in **Table 7**.

Table 7: Predominant Vegetation Formations within the Locality

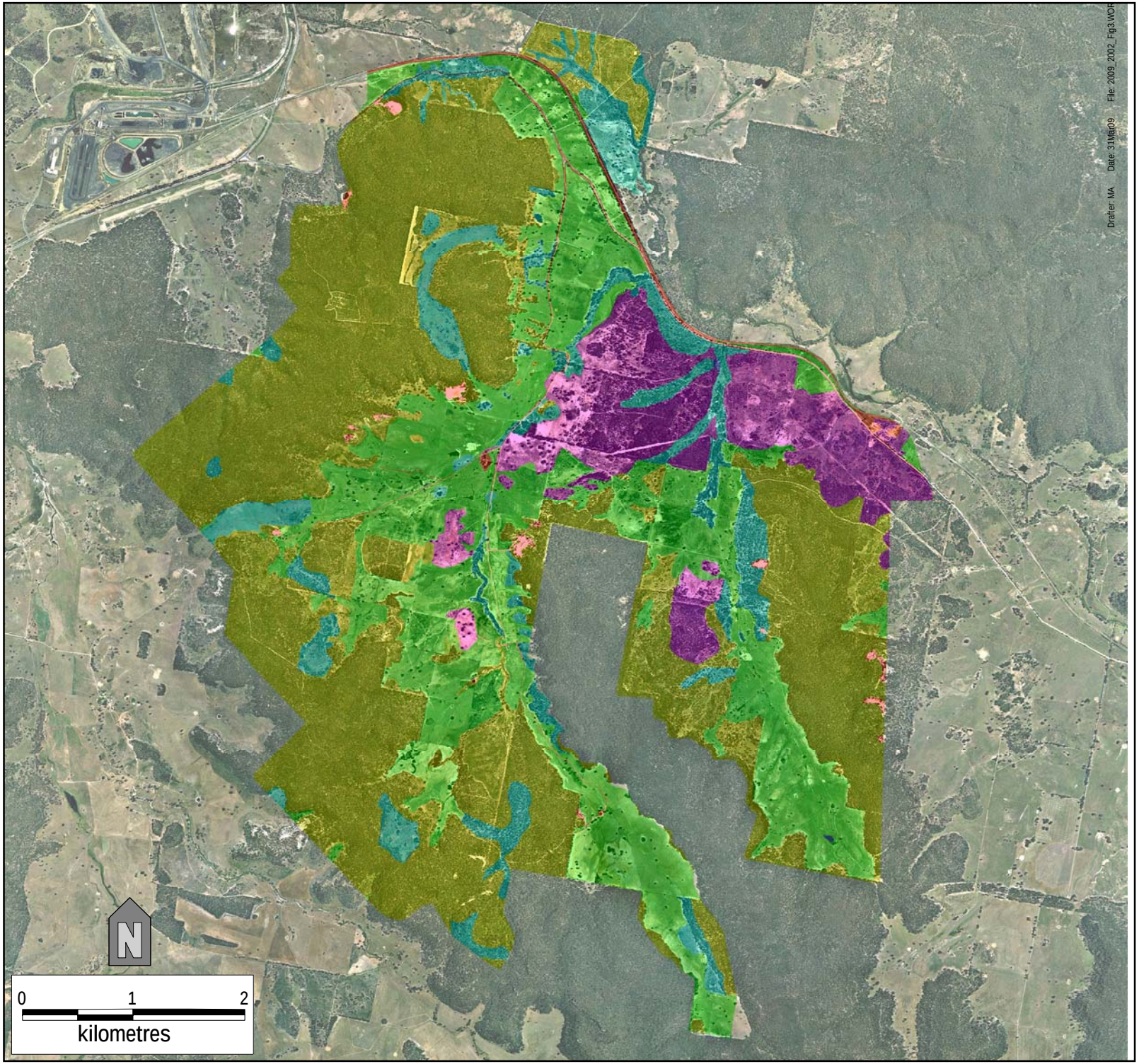
Vegetation Classes (Keith, 2004)	Native plant species richness	Native overstorey cover	Native mid Storey Cover %	Native Groundcover (grasses) %	Native Groundcover (shrubs) %	Number of Trees with Hollows
Western Slopes Dry Sclerophyll Forests	30	8-35	3-35	3-25	3-25	2
Western Slopes Grassy Woodlands	23	10-45	5-60	5-45	2-10	2

4.2.3 Flora

Vegetation Communities

Vegetation mapping of the Ulan locality, as defined by baseline studies for EL6288 (Ecovision Consulting, 2008) indicates the vegetation cover of the site and adjoining landscape as largely characterised by open woodland, shrublands and grassy woodland vegetation types on the valley floor, with shrubby woodlands and open forest relative to the adjoining stepper slopes and ridgelines (Ecovision Consulting, 2008). Grassy woodlands characterised by Ironbarks, Box and Gum are generally restricted to the valley floor and lower slopes, this being the landscape context for the site.

Broad vegetation communities occurring within the locality are shown in **Figure 3** with **Table 8** identifying the various sub formations found within these vegetation types.



Legend

- Chronically Disturbed/ No Natural Vegetation
- Disturbed Vegetation
- Groundwater Dependant Cyperoid Forbland
- Murragamba Sands Woodland
- Western Slopes Dry Sclerophyll Forest
- Western Slopes Grassy Woodland

FIGURE 3

Broad Vegetation Types of the Locality

with regard to Keith (2004) classifications

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Table 8: Broad Vegetation Formations and Sub formations of EL6288 (Ecovision Consulting, 2008)

Vegetation Formation	Geology	Characteristic Species	Related Keith (2004) Vegetation Class	Comparable BioMetric Sub-Formation
Blakely's Redgum - Rough-barked Apple Woodland on course sands	Permian (Illawarra Coal Measures)	12	Western Slopes Grassy Woodland	Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281)
Lowland Ironbark Forest	Permian (Illawarra Coal Measures)	18	Western Slopes Dry Sclerophyll Forest	Blue-leaved Ironbark heathy woodland of the southern part of the Brigalow Belt South Bioregion
Lowland Box – Redgum Woodland	Permian (Illawarra Coal Measures)	11	Western Slopes Grassy Woodland	Blakely's Red Gum - Yellow Box - Rough-barked Apple grassy woodland of the Capertee Valley, Sydney Basin*
Footslope Ironbark – Gum –Box	Permian (Illawarra Coal Measures)	12	Western Slopes Dry Sclerophyll Forest	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin
Blakely's Redgum - Yellow Box – Rough-barked Apple Woodland	Permian (Illawarra Coal Measures)	19	Western Slopes Grassy Woodland	Blakely's Red Gum - Yellow Box - Rough-barked Apple grassy woodland of the Capertee Valley, Sydney Basin*
Grey Box – Narrow-leaved Ironbark Forest	Permian (Illawarra Coal Measures)	12	Western Slopes Grassy Woodland*	Grey Box - Narrow-leaved Ironbark shrubby woodland on hills of the Hunter Valley, North Coast and Sydney Basin
Rough-barked Apple - Banksia Woodland	Tertiary Paleochannel	25	n/a	n/a
Secondary Grasslands and Shrublands	Permian (Illawarra Coal Measures)	11	n/a	n/a
Shrubby White box Forest	Permian (Illawarra Coal Measures)	21	Western Slopes Dry Sclerophyll Forest	White Box shrubby open forest on fine grained sediments on steep slopes in the Mudgee region (Benson 273)
Grassy White Box Woodland	Tertiary Basalt	15	Western Slopes Grassy Woodland	White Box - Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South*
Ridgetop Broad-leaved Ironbark - Black Cypress Pine on shallow sands	Narrabeen Group	19	Western Slopes Dry Sclerophyll Forest	Grey Gum - Narrow-leaved Stringybark - Ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin
Broad-leaved Ironbark Grey Gum Forest	Narrabeen Group/ Illawarra Coal Measures	16	Western Slopes Dry Sclerophyll Forest	Grey Gum - Narrow-leaved Stringybark - Ironbark woodland on ridges of the upper Hunter Valley, Sydney Basin
Scribbly Gum Narrow-leaved Ironbark Woodland	Narrabeen Group	16	Western Slopes Dry Sclerophyll Forest	Scribbly Gum - Brown Bloodwood woodland of the southern Brigalow Belt South
Hardcap Scribbly Gum - Ironbark Woodland	Tertiary Paleochannel	18	n/a	Scribbly Gum - Brown Bloodwood woodland of the southern Brigalow Belt South
Crop/ Plantation	Permian (Illawarra Coal Measures)	n/a	n/a	n/a

These flora communities are predominantly restricted to the Upper Hunter Valley, where they form a mosaic of small, medium and large sized remnants amidst rural landscapes of the valley floor and extensive conservation reserves of the adjoining elevated lands. Connectivity between remnants varies in accordance with land use intensity, with local linkages throughout the valley floor fragmented by agriculture, mining, roads and rail lines. Native vegetation communities with mapped occurrences throughout the valley floor of the locality include:

- Lowland Ironbark Forest;
- Blakely's Redgum – Rough-barked Apple Forests on course sands; and
- Lowland Box – Redgum Woodland.

Threatened plant species known to occur within the locality within similar vegetation communities include:

- *Pomaderris queenslandica;* and
- *Diuris tricolor.*

White Box Yellow Box Blakely's Redgum Woodland and Derived Grasslands EEC/ CEEC also has known occurrences in the general locality (DEWHA, 2008; Ecovision Consulting, 2008).

Floristic Diversity

At least 514 flora species of mostly native origin (i.e. 467 natives and 47 exotics) have been identified within the locality (DECC, 2008), with three listed threatened species (Ausfields Wattle, Scant Pomaderris, Painted Diuris). Locally these threatened species have been observed in Lowland Ironbark Forest and Footslope Ironbark – Gum –Box Woodland (Ecovision Consulting, 2008; DEC, 2008).

4.2.4 Fauna

Wildlife Atlas Database records contains at least 497 fauna species observations within the locality (DECC, 2008). The baseline field survey identified 256 fauna species comprising 170 avian, 37 mammal, 32 reptile and 7 amphibian species (Ecovision Consulting, 2008). Thirty six of these species are currently listed as threatened. Lowland Ironbark Forest is known to contain 18 threatened species within EL6288 (Ecovision Consulting, 2008).

A range of broad fauna habitat classes occur throughout the locality that provide opportunity for a range of faunal activity such as seasonal foraging and breeding. These classes are listed as follows:

- Woodland and open forest tree canopy dominated by Eucalypt species of dry sclerophyll environs;
- Open to dense shrublands dominated mostly by species of dry to moist sclerophyll environs belonging to the families Myrtaceae (e.g. Eucalypts) and Mimosoidaceae (e.g. Wattles);
- Sparse to open groundcovers dominated by grasses and woody herbs of dry to moist environs;
- Semi-permanent to ephemeral open/closed depressions dominated by a mix of native and exotic sedges and herbs; and
- Exotic grasses and herbs of disturbed cleared environs.

Microhabitat features characterising these general habitat classes are listed as follows:

- Tree branches;
- Pollen and nectar producing plants, principally Wattles and Eucalypts;
- Sparse to moderate distribution of fallen timber and bark;
- Scattered hollow bearing trees; and
- Ephemeral drainage swales.

Notably absent from the locality are wet sclerophyll forests and surface rock formations, which represent important habitat values for specific fauna species such as reptiles.

Presented below is a description of the local fauna habitats in terms of common local faunal assemblages.

Reptilian Habitat

Reptiles commonly use rock outcrops or loose surface rock as a shelter resource, which is largely absent from valley floor landscapes primarily due to the unfavourable geological setting (i.e. Permian formation). The absence of these habitat features disadvantages many small shelter dependent reptiles such as the Striped Skink (*Ctenotus robustus*), Copper-tailed Skink (*Ctenotus taeniolatus*) and Yellow-faced Whip Snake (*Demansia psammophis*).

However, the presence of scattered fallen timber and trees with hollows has partially compensated for the absence of this habitat feature, with isolated/ remnant reptile populations strongly tied to the availability of this habitat. Common species that utilise leaf litter and fallen timber are more common throughout the locality and include species such as Litter Skink (*Morethia boulenger)* and Rainbow Skink (*Carlia tetradactyla*). Arboreal species such as the Barred Skink (*Eulamprus tenuis*) and Wall Skink (*Cryptoblephrus virgatus*) occur spasmodically in response to the presence of rough-barked trees (i.e. ironbarks) and tree hollows.

Sandier soils found nearby riparian corridors and the tertiary paleochannel support habitat for burrowing reptiles such as blind snakes, the Bandy Bandy Snake (a predator of blind snakes) and Burtons Legless lizard. Also common snakes include the Red-bellied Black Snake and to a lesser extent the Brown Snake, with amphibian populations of lowland areas supporting the former mentioned species.

Amphibian habitat

The locality is described as a semi-arid environment, this generally being a hostile environment for amphibian species. However, burrowing species are locally common as these are well suited to the dry terrestrial environs of the locality. Baseline surveys identified numerous specimens of amphibians such as the Banjo Frog (*Limnodynastes dumerilii ssp. dumerilii*), Smooth Toadlet (*Uperoleia laevigata*), *Neobatrachus suddellii* and Brown Toadlet (*Psuedophryne bibronii*). 'Tree' dwelling species are also common throughout the locality, particularly in areas where a permanent water supply exist (e.g. farm dams) nearby trees with hollows. The Perons Tree Frog (*L. peronii*) is perhaps the most common arboreal amphibian species of the locality.

Avifauna habitat

Foraging resources for nectivores are abundant during the summer/ winter periods primarily in the form of various Eucalyptus species. Honeyeaters and small shrubland-heath avifauna species such as thornbills, robins and pardalotes are regularly observed throughout open forests and woodlands with a moderately dense shrub understorey. Other species regularly observed within these habitats including Whistlers, Grey-shrike Thrush, Yellow-rumped Thornbill, Weebill, Southern Whiteface and Double-barred Finch.

The low density of hollow bearing trees of the valley floor substantially limits the type and extent of avifauna activity to generalists capable of occupying a variety of modified habitats. Species dependant on trees with hollows for breeding events will be restricted to relatively undisturbed multiaged vegetation (e.g. Brown Treecreeper). Common hollow dependant species found within the locality include the Kookaburra, Brown-tree Creeper, Glossy-black Cockatoo and White-throated Treecreeper. Owls and various large parrots/ cockatoos will exhibit patchy local distributions governed by the presence of large tree hollows, a habitat feature that has been adversely influenced by past land use activities.

Specialist foraging resources for the Glossy-black Cockatoo, such as sheoaks (i.e. *Allocasuarina torulosa, A. distyla or A. littoralis*), are abundant throughout the adjoining Triassic ridgelines with limited foraging or breeding opportunities for this threatened species within the valley floor. Conversely, the locality appears to represent an important place for honeyeaters (e.g. Painted Honeyeater and Black-chinned Honeyeater). Foraging activity by these species is generally associated with nectar flows from White Box, Yellow Box, Grey Box and Grey Gum and sugary secretions from leaf insects (i.e. lerps) on Broad-leaved Ironbark.

Mammal Habitat

Mammalian habitat of the locality can be separated into three distinct types, these being:

- Woodlands and forest;

- Shrubland; and
- Open grasslands.

The first two habitat types consist of natural vegetation of varying structural complexity and floristic diversity. While both these habitat zones have been disturbed by past land uses, they provide foraging and breeding grounds for common ground-dwelling species such as the Common Dunnart and Yellow-footed Antechinus. Although, it should be noted that densities of these species is very low owing to the semi-arid character of the area.

Medium sized mammals such as the Red-necked Wallaby and Eastern Grey Kangaroo are notable, with the former being common to more densely vegetated areas. Swamp Wallaby (*Wallabia bicolor*) also occuers within the locality where it utilises more mesic habitats. Rabbits (*Oryctolagus cuniculus*) are also common, particularly along disturbed vegetation boundaries adjoining cleared grasslands in sheltered locations.

The woodland and forest habitats also provide foraging grounds for arboreal species such as microchiropteran bats and possums where hollow bearing trees occur. Foraging habitat within the tree canopy is suitable for two regionally common arboreal species being the Sugar Glider and Brush-tailed Possum.

4.3 Potential Subject Species

4.3.1 Flora

Database searches identified numerous threatened flora species within the locality for consideration (DEC, 2008; DEWHA, 2008). A spatial analysis of database records contained within the Lees Pinch Foothills and Upper Goulburn Valley and Escarpments Mitchell Landscape and Lowland Ironbark Forest vegetation type (Ecovision Consulting, 2008) identified a further threatened flora species respectively for consideration as 'Potential Subject Species'. **Table 9** lists the results of relevant species identified by the database and spatial analysis, with the distribution of those that occur within the locality shown in **Figure 4**.

Table 9: Potential Subject Species – Flora

Common Name	Scientific Name	TSC Act	EPBC Act	Database Records†			
				30 km	Mitchell	Geology	Total
	*Cynanchum elegans**	E	E	0	2	3	32
Hoary Sunray	*Leucochrysum albicans var tricolor***		E	1	1	0	1
	*Ozothamnus tessellatus**	V	V	8	8	9	9
Ausfield's Wattle	*Acacia ausfieldii*	V	-	2	1	0	2
Flockton Wattle	*Acacia flocktoniae*	V	-	1	1	1	1
Weeping Myall of the Hunter Catchment	*Acacia pendula*	E2	E	1	1	1	16
	*Kennedia retrorsa**	V	V	0	17	17	17
	*Swainsona recta**	E	-	0	0	0	0
Cannons Stringybark	*Eucalyptus cannonii****	V	-	3	3	3	3
River Redgum of the Hunter Catchment	*Eucalyptus camaldulensis*	E2	-	2	0	0	68
	Eucalyptus scoparia	E1	V	1	0	0	1
	Eucalyptus pumila	V	V	0	1	9	12
	*Homoranthus darwinioides**	V	-	4	4	4	4
Tiger Orchid of the Hunter Catchment	*Cymbidium canaliculatum*	E2	-	0	14	0	17
Painted Diuris	*Diuris tricolor (syn D. sheiffiana)**	V	V	3	5	4	23
	Diuris pedunculata	E1	E	0	2	0	4
	*Digitaria porrecta**	V	V	0	0	0	0
Silky Pomaderris	*Pomaderris sericea**	V	-	1	0	1	1
Scant Pomaderris	*Pomaderris queenslandica*	E1	-	0	18	18	21
Denman Pomaderris	*Pomaderris reperta*	E1	CE	0	17	17	17
	*Prostanthera discolor**	V	V	8	6	7	8
	Prostanthera cineolifera	V	V	0	1	1	1

Common Name	Scientific Name	TSC Act	EPBC Act	Database Records†			
				30 km	Mitchell	Geology	Total
	*Prostanthera cryptandroides**	V	V	0	8	10	15
	Prostanthera stricta	V	V	0	8	8	8
	*Philotheca ericifolia**	V	V	0	0	0	1
	Commersonia rosea	E1	-	0	5	5	5
	Lasiopetalum longistamineum	V	V	0	13	13	13
	Rulingia procumbens	V	V	0	2	2	2
Austral Toadflax	*Thesium australe**	V	V	0	0	co3	3
Wollemi Pine	*Wollemia nobilis**	E1	E	n/a	n/a	n/a	n/a

* Identified by EPBC Act Protected Matters Search

** Known to occur locally

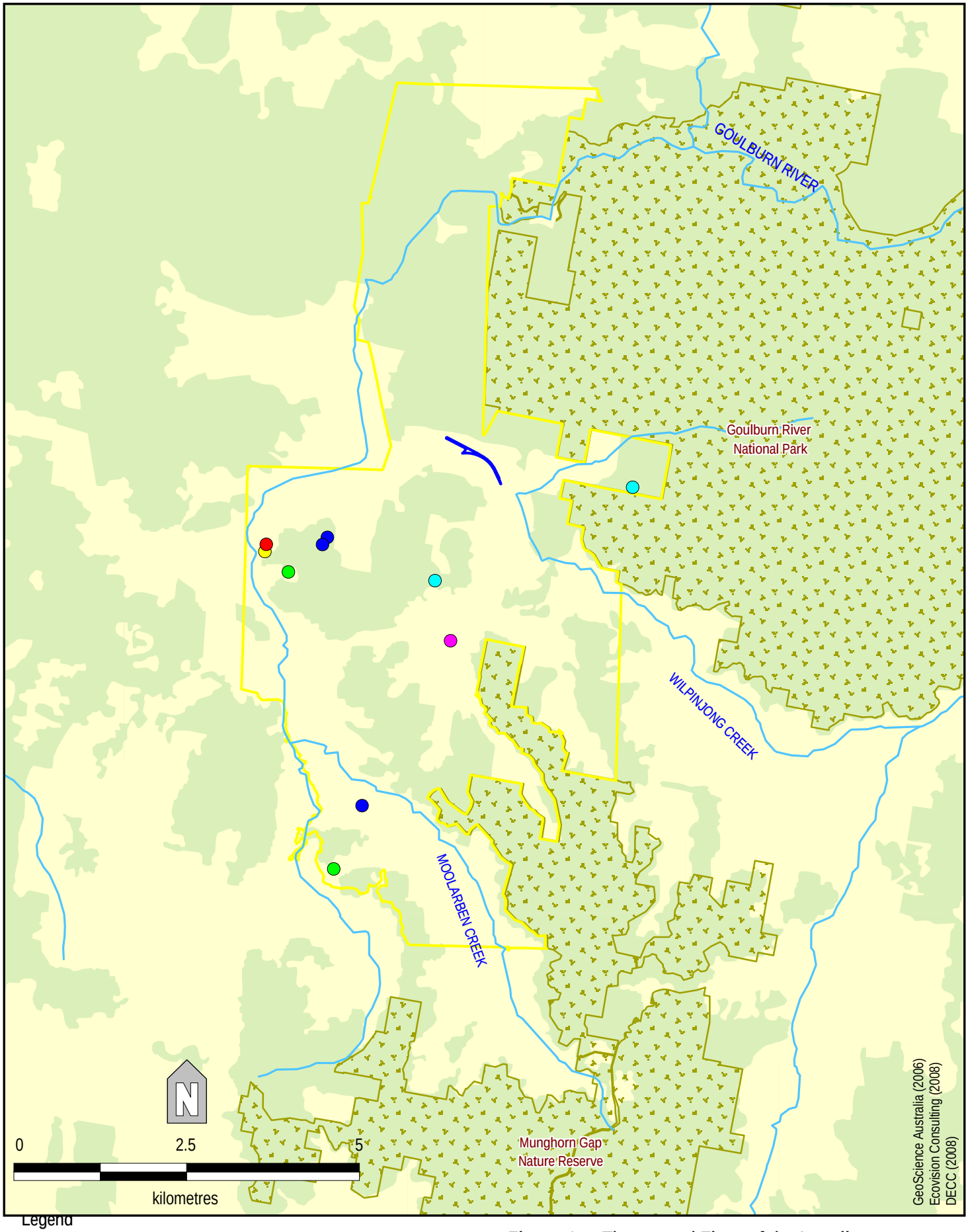
† DECC (2008)

4.3.2 Fauna

Database searches identified 36 threatened fauna species within the locality (DECC, 2008; DEWHA, 2008, Ecovision Consulting, 2008). **Table 10** lists the species the total number of database records within the HCR CMA, relevant Mitchell Landscapes and geological formations. Threatened species with occurrences of the locality are shown in **Figure 7**.

Table 10: Potential Subject Species - Fauna

Common Name	Scientific Name	TSC Act	EPBC Act	Database Records†			
				30 km	Mitchell	Geology	Total
Booroolong Frog*	*Litoria booroolongensis*	E1	E	0	0	0	6
Giant Barred Frog	*Mixophyes iteratus*	E1	E	1	0	15	24
Worm Skink	*Aprasia parapulchella*	V	V	1	0	1	1
Collared Whip Snake	*Suta flagellum*	V	-	1	0	0	1
Sydney Broad-headed Snake*	*Hoplocephalus bungarioides*	E1	V	0	0	0	0
Mallee Fowl*	*Leipoa ocellata*	E1	E	1	1	0	1
Square-tailed Kite	*Lophoictinia isura*	V	-	10	2	2	15
Bush Stone-curlew	*Burhinus grallarius*	E1	-	1	1	13	141
Australian Painted Snipe*	*Rostratula australis*	V	V	0	0	0	2
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-	19	10	113	178
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	60	104	255	609
Swift Parrot*	*Lathamus discolor*	E1	E	2	0	8	50
Superb Parrot*	*Polytelis swainsonii*	V	V	0	0	0	0
Turquoise Parrot	*Neophema pulchella*	V	-	55	16	47	102
Barking Owl	*Ninox connivens*	V	-	1	2	18	63
Powerful Owl	*Ninox strenua*	V	-	32	9	132	414
Masked Owl	*Tyto novaehollandiae*	V	-	1	0	0	0
Gilberts Whistler	*Pachycephala inornata*	V	-	1	0	0	0
Brown Treecreeper	*Climacteris picumnus*	V	-	147	164	60	323
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-	79	86	86	240
Painted Honeyeater	*Grantiella picta*	V	-	15	9	4	17
Black-chinned Honeyeater	*Melithreptus gularis gularis*	V	-	37	13	39	120
Regent Honeyeater*	*Anthochaera phrygia*	E1	E	86	20	23	77
Hooded Robin	*Melanodryas cucullata*	V	-	33	39	13	45
Grey-crowned Babbler	*Pomatostomus temporalis*	V	-	9	34	25	319
Diamond Firetail	*Stagonopleura guttata*	V	-	54	59	23	91
Spotted-tailed Quoll*	*Dasyurus maculata*	E1	E	0	2	35	992
Koala	*Phascolarctos cinereus*	V	-	8	6	43	693



Legend

- Waterways
- The Site
- Boundary of EL6288
- Conservation Reserves
- Native Vegetation
- "Treeless" Landcover
- *Acacia ausfeldii*
- *Diuris tricolor*
- *Eucalyptus cannonii*
- *Eucalyptus scoparia*
- *Leucochrysum albicans var. tricolor*
- *Pomaderris queenslandica*

Figure 4 Threatened Flora of the Locality

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Common Name	Scientific Name	TSC Act	EPBC Act	Database Records†			
				30 km	Mitchell	Geology	Total
Squirrel Glider	*Petaurus norfolkensis*	V	-	1	6	150	460
Brush-tailed Rock-wallaby*	*Petrogale penicillata*	E1	V	1	12	80	139
Large-eared Pied Bat*	*Chalinolobus dwyeri*	V	V	8	18	66	109
Little Pied Bat	*Chalinolobus picatus*	V	-	1	4	4	4
Eastern Bentwing Bat	*Miniopterus schreibersii*	V	-	2	9	103	359
Eastern Long-eared Bat*	*Nyctophilus timoriensis*	V	-	6	8	25	30
Large-footed Myotis	*Myotis adversus*	V	V	1	0	0	0
Yellow-bellied Sheath-tailed Bat**	*Saccolaimus flaviventris*	V	-	0	2	4	26

* Identified by EPBC Act Protected Matters Search

** Known to occur locally from local studies (i.e. no databased records).

† Birds Australia (2008) and DECC (2008) for the HCR CMA west of Cessnock (i.e. eastern extent of Narrabeen geology)

4.3.3 Ecological Communities

Vegetation communities listed as endangered that have known occurrences within the locality include White Box Yellow Box Blakely's Redgum Woodland EEC (i.e. TSC Act) or White Box Yellow Box Blakely's Redgum Woodland and Derived Grasslands CEEC (i.e. EPBC Act). A description of this community is provided as follows.

White Box Yellow Box Blakely's Redgum Woodland

White Box Yellow Box Blakely's Red Gum Woodland is found on relatively fertile soils on the tablelands and western slopes of NSW and generally occurs between the 400 and 800 mm isohyets extending from the western slopes, at an altitude of c. 170m to c. 1200 m, on the northern tablelands. The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions (NSW Scientific Committee, 2002).

White Box Yellow Box Blakely's Red Gum Woodland includes those woodlands where the characteristic tree species include one or more of the following species in varying proportions and combinations - White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) or Blakely's Red Gum (*Eucalyptus blakelyi*). Grass and herbaceous species generally characterise the ground layer. In some locations, the tree overstorey may be absent as a result of past clearing or thinning and at these locations only an understorey may be present. Shrubs are generally sparse or absent, though they may be locally common (NSW Scientific Committee, 2002).

Woodlands with *Eucalyptus albens* are most common on the undulating country of the slopes region while *Eucalyptus blakelyi* and *Eucalyptus melliodora* predominate in grassy woodlands on the tablelands. Drier woodland areas dominated by *Eucalyptus albens* often form mosaics with areas dominated by *Eucalyptus blakelyi* and *Eucalyptus melliodora* occurring in more moist situations, while areas subject to waterlogging may be treeless. Western Grey Box (*Eucalyptus macrocarpa*) is often found in association with *Eucalyptus melliodora* and *Eucalyptus albens* on the south western slopes. Woodlands including *Eucalyptus crebra, Eucalyptus dawsonii* and *Eucalyptus moluccana* (and intergrades with *Eucalyptus albens*), for example in the Merriwa plateau, Goulburn River National Park and western Wollemi National Park, are also included. Intergrades between *Eucalyptus blakelyi* and *Eucalyptus tereticornis* may also occur here (NSW Scientific Committee, 2002).

The condition of remnants ranges from relatively good to highly degraded, such as paddock remnants with weedy understoreys and only a few hardy natives left. A number of less degraded remnants have survived in Travelling Stock Routes, cemeteries and reserves, although because of past and present management practices understorey species composition may differ between the two land uses. Some remnants of the community may consist of only an intact overstorey or an intact understorey, but may still have high conservation value due to the flora and fauna they support. Other sites may be important faunal habitat, have significant occurrences of particular species, form part of corridors or have the potential for recovery.

The conservation value of remnants may be independent of remnant size (NSW Scientific Committee, 2002).

The community is poorly represented in conservation reserves. There are small occurrences of White Box Yellow Box Blakely's Red Gum Woodland in Border Ranges National Park, Goobang National Park, Goulburn River National Park, Manobalai Nature Reserve, Mt Kaputar National Park, Oxley Wild Rivers National Park, Queanbeyan Nature Reserve, Towarri National Park, Warrumbungle National Park, Wingen Maid Nature Reserve and Wollemi National Park. The community also occurs in the following State Conservation Areas, Copeton State Conservation Area, Lake Glenbawn State Conservation Area and Lake Keepit State Conservation Area (NSW Scientific Committee, 2002).

4.4 Current Impacts Affecting the Site

The site has experienced impacts from human activity, with existing impacts affecting the ecological character of the site discussed in **Table 11**.

Table 11: Current Site Impacts

Impact	Area of Impact (%)	Notes
Clearing	30	Approximately a third of the site is cleared of intact native vegetation cover. Areas subjected to clearing are predominantly covered by a mix of cosmopolitan native and exotic species, with shrub/ tree regrowth restricted to areas of marginal agricultural suitability. Much of the remaining vegetation has been cleared or thinned in the past and is now classified as regrowth.
Vegetation modification	70	Approximately two thirds of native vegetation cover has been modified by past land uses (i.e. agriculture and thinning), as evidenced by structural changes in vegetation cover away from natural conditions (e.g. shrublands and open woodlands). A high degree of floristic variability occurs throughout this area in response to complex interactions between natural and anthropogenic environmental gradients (e.g. natural/ altered soil fertility; exotic plant density; grazing vs time/ climate fluctuations; altered soil moisture), with pioneer native such as Sifton Bush often characteristic of these areas.
Fire	70	There is evidence of past fire activity presumably during the past clearing/ thinning event. Fire within the site appears to be associated with non-natural regimes.
Agriculture	100	Livestock grazing is a widespread activity across the valley floor of the locality, with livestock generally regulated in low densities particularly in recent years (i.e. drought). Evidence of grazing activity within the site is scant due to the low agricultural suitability of this area..
Roads, Rail, Power	0	Infrastructure including road, rail and power transmission occurs within the locality. Rail passes along the southern edge of the site, with its impact largely being the point source for exotic plants and environmental gradients supportive their lifecycles (i.e. water and soil fertility).
Exotic flora and fauna	30	Elevated densities of exotic flora occur primarily throughout the treeless environs, with areas of intact native vegetation having few exotics.

5.0 IMPACT ANALYSIS

The impact of development on the sites ecological values was initially considered at a biological level for species, populations and communities relevant to this assessment (i.e. threatened biodiversity: "Subject Species"). The key considerations, as listed in the "Assessment of Significance" (i.e. Section 5A of the EP&A Act), which apply in this assessment are as follows:

- The likelihood for a local extinction of a listed species or population;
- The change in local extent and composition for a listed community including the likelihood of a local extinction;
- The change in local habitat extent and composition for a listed species or population;
- The affects of habitat fragmentation;
- Any impact on mapped critical habitat;
- The relevance of any recovery plans; and
- The relationship between the proposed development and listed key threatening processes.

In this respect, the following impacts have been considered relative to the proposed rail line loop

- Loss of core/ secondary habitat for local threatened biodiversity (i.e. 'impact likelihood');
- The duration of habitat modification and its extent relative to the local area (i.e. 'impact consequence'); and
- Reduction of wildlife connectivity.

Impacts on threatened biodiversity will initially arise during constructions works (i.e. direct impact), with site occupation resulting in a permanent impact.

5.1 Quantification of Impacts

Compared to the existing consent for Stage 1 of the MCP, the new proposed rail loop alignment requires a revised impact assessment for an area totalling 6 ha. No part of the approved rail loop made redundant by the proposed new alignment is covered by intact native vegetation, rather secondary grasslands. Thus any vegetation clearing arising from this new alignment represents permanent clearing works in addition to the Stage 1 approval.

The impact footprint arising from the proposed development includes the area directly impacted by the proposed rail loop construction works (i.e. clearing, fill and side roads). The alteration of soil conditions and availability of macro nutrients from these changed conditions, combined with a disturbed edge, could result in the introduction of weeds in adjoining uncleared native vegetation (i.e. indirect impact). Altered surface water movements arising from the modification are likely to have indirect impacts downslope of the infrastructure emplacement (i.e. increased water interception and/or channelled water flows).

The proposed development will result in the removal of 1.7 ha intact native vegetation, this initially determined from aerial photography interpretation and later verified by field survey. This area contains higher potential habitat values for threatened biodiversity when compared with the remaining 4.3 ha, this represented by treeless lands that are likely to be classified as Secondary Grassland and Shrublands.

5.2 Preliminary Ecological Risk Analysis

An ecological risk analysis was completed to determine the likely level of threat posed by the proposed development against matters of ecological significance as defined in this EIA report. The results of this analysis were used to identify 'Subject Species' thus defining the scope for impact management. The preliminary ecological risk analysis is provided in **Table 12** and Table 13.

Table 12: Preliminary Ecological Risk Analysis - Flora

Common Name	Scientific Name	Site Occurrence (Level of Certainty)	Site Habitat Value	Likelihood	Consequence	Ecological Risk Analysis	Subject Species
	*Cynanchum elegans**	None (high)	Absent	E	3	Low	No
Hoary Sunray	*Leucochrysum albicans var tricolor***	None (high)	Absent	E	3	Low	No
	*Ozothamnus tessellatus**	None (high)	Absent	E	2	Low	No
Ausfield's Wattle	*Acacia ausfieldii*	None (high)	Absent	E	2	Low	No
Flockton Wattle	*Acacia flocktoniae*	None (high)	Absent	E	3	Low	No
Weeping Myall of the Hunter Catchment	*Acacia pendula*	None (high)	Absent	E	3	Low	No
	*Kennedia retrorsa**	None (high)	Absent	E	2	Low	No
	*Swainsona recta**	None (high)	Absent	E	3	Low	No
Cannons Stringybark	*Eucalyptus cannonii**	None (high)	Moderate	E	2	Low	No
River Redgum of the Hunter Catchment	*Eucalyptus camaldulensis*	None (high)	Absent	E	3	Low	No
	Eucalyptus pumila	None (high)	Absent	E	2	Low	No
	Eucalyptus scoparia	None (high)	Absent	E	3	Low	No
	*Homoranthus darwinioides**	None (high)	Absent	E	2	Low	No
Tiger Orchid of the Hunter Catchment	*Cymbidium canaliculatum*	None (high)	Low	D	3	High	Yes
Painted Diuris	*Diuris tricolor (syn D. sheiffiana)**	None (moderate)	Moderate	C	2	Medium	Yes
	*Diuris pedunculata**	None (high)	Absent	E	3	Low	No
	*Digitaria porrecta**	None (high)	Absent	E	3	Low	No
Silky Pomaderris	*Pomaderris sericea**	None (high)	Absent	E	3	Low	No
	Pomaderris queenslandica	None (high)	Absent	E	3	Low	No
Denman Pomaderris	*Pomaderris reperta**	None (high)	Absent	E	4	Low	No
	*Prostanthera discolor**	None (high)	Absent	E	2	Low	No
	*Prostanthera cineolifera**	None (high)	Absent	E	2	Low	No
	*Prostanthera cryptandroides**	None (high)	Absent	E	2	Low	No
	*Prostanthera stricta**	None (high)	Absent	E	2	Low	No
	*Philotheca ericifolia**	None (high)	Absent	E	2	Low	No
	*Commersonia rosea**	None (high)	Absent	E	3	Low	No
	*Lasiopetalum longistamineum**	None (high)	Absent	E	2	Low	No
	*Rulingia procumbens**	None (high)	Absent	E	3	Low	No
Austral Toadflax	*Thesium australe**	None (high)	Absent	E	2	Low	No
Wollemi Pine	*Wollemia nobilis**	None (high)	Absent	E	4	Low	No

* Dual listed on the State and Commonwealth Acts ** Listed solely on the Commonwealth Act

Table 13: Preliminary Ecological Risk Analysis - Fauna

Common Name	Scientific Name	Site Occurrence (Level of Certainty)	Site Habitat Value	Likelihood	Consequence	Risk Analysis	Subject Species
Booroolong Frog	*Litoria booroolongensis**	Absent (High)	Absent	E	3	Low	No
Giant Barred Frog	*Mixophyes iteratus**	Absent (High)	Absent	E	3	Low	No
Worm Skink	*Aprasia parapulchella**	Absent (High)	Absent	E	3	Low	No
Sydney Broad-headed Snake	*Hoplocephalus bungarioides**	Absent (High)	Absent	E	3	Low	No
Collared Whip Snake	*Suta flagellum*	Absent (High)	Absent	E	3	Low	No
Mallee Fowl	*Leipoa ocellata**	Absent (High)	Absent	E	3	Low	No
Square-tailed Kite	*Lophoictinia isura*	Absent (Low)	High	C	2	Medium	Yes
Bush Stone-curlew	*Burhinus grallarius*	Absent (Moderate)	Moderate	C	3	High	Yes
Australian Painted Snipe	*Rostratula australis**	Absent (High)	Absent	E	3	Low	No
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Absent (High)	Absent	E	2	Low	No
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Known	Low	D	2	Medium	Yes
Swift Parrot	*Lathamus discolor**	Absent (Moderate)	Low	D	3	Medium	Yes
Superb Parrot	*Polytelis swainsonii**	Absent (High)	Low	E	2	Low	No
Turquoise Parrot	*Neophema pulchella*	Absent (Moderate)	Medium	C	2	Medium	Yes
Barking Owl	*Ninox connivens*	Absent (Moderate)	High	C	2	Medium	Yes
Powerful Owl	*Ninox strenua*	Absent (Low)	Low	D	2	Low	No
Masked Owl	*Tyto novaehollandiae*	Absent (High)	Low	D	2	Low	No
Brown Treecreeper	*Climacteris picumnus*	Absent (Moderate)	Medium	C	2	Medium	Yes
Speckled Warbler	*Pyrrholaemus sagittatus*	Absent (Low)	High	C	2	Medium	Yes
Painted Honeyeater	*Grantiella picta*	Absent (Low)	High	C	2	Medium	Yes
Black-chinned Honeyeater	*Melithreptus gularis gularis*	Absent (Low)	Medium	C	2	Medium	Yes
Regent Honeyeater	*Anthochaera phrygia**	Absent (Moderate)	Medium	C	3	High	Yes
Gilbert's Whislter	*Pachycephala inornata*	Absent (Low)	Medium	C	2	Medium	Yes
Hooded Robin	*Melanodryas cucullata*	Absent (Low)	High	C	2	Medium	Yes
Grey-crowned Babbler	*Pomatostomus temporalis*	Absent (Low)	Low - Medium	C	2	Medium	Yes
Diamond Firetail	*Stagonopleura guttata*	Known	High	A	2	Extreme	Yes
Spotted-tailed Quoll*	*Dasyurus maculata**	Absent (Moderate)	Medium	D	3	Medium	Yes
Koala	*Phascolarctos cinereus*	Absent (High)	Absent	E	2	Low	No
Squirrel Glider	*Petaurus norfolcensis*	Absent (Moderate)	Medium	C	2	Medium	Yes
Brush-tailed Rock-wallaby	*Petrogale penicillata**	Absent (High)	Low	E	4	Low	No
Large-eared Pied Bat	*Chalinolobus dwyeri**	Absent (Low)	High	D	2	Low	No
Little Pied Bat	*Chalinolobus picatus*	Absent (Low)	High	D	2	Low	No

Common Name	Scientific Name	Site Occurrence (Level of Certainty)	Site Habitat Value	Likelihood	Consequence	Risk Analysis	Subject Species
Eastern Bentwing Bat	*Miniopterus schreibersii*	Absent (Low)	Moderate	D	2	Low	No
Eastern Long-eared Bat	*Nyctophilus timoriensis**	Absent (Low)	High	C	2	Medium	Yes
Large-footed Myotis	*Myotis adversus*	Absent (High)	Absent	E	2	Low	No
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	Absent (Low)	High	C	2	Medium	Yes

* Dual listed on the State and Commonwealth Acts ** Listed solely on the Commonwealth Act

This EIA report is based on extensive widespread systematic and targeted surveys over a number of seasons throughout EL6288, of which the site is contained within, with specific onsite survey activity limited to systematic flora surveys and opportunistic observations. As such a lower level of certainty is placed over most fauna species, thus commanding a greater weighting of 'site habitat value' in the risk analysis.

For most threatened flora, the high level of certainty is a consequence of targeted surveys conducted within the site (for most species) and is thus a reliable robust platform for evaluating risk. However, in the case of threatened fauna a landscape based assessment approach has been adopted, this representing a conservative appraisal of the site. Greater reliance on the baseline dataset for EL6288 is therefore implied.

5.2.1 Risk Minimisation Strategies

The proposed development, as depicted in **Figure 2**, would have a maximum direct impact footprint of approximately 6 ha. Furthermore, indirect impacts such as altered hydrological regimes may have indirect impacts on adjoining landscapes located downslope of the site. In the absence of specific impact management actions, the proposed rail line loop may adversely affect local native vegetation cover and habitat.

The preliminary ecological risk analysis assigned varying levels of risk to each 'Potential Subject Species'. General strategies aimed at minimising this risk include:

- Consider avoiding areas of high biodiversity; and/or
- Undertake weed management prior to and after the proposed construction works; and/or
- Avoidance of important biodiversity values such as trees with hollows or threatened species habitats; and/or
- Development of plans of management to moderate onsite development impacts; and/or
- Initiate/ support regional initiatives and/or DECCs priority actions for threatened biodiversity; and/or
- Offset site impacts through compensatory habitat initiatives and/or biobanking scheme.

5.2.2 Summary of Ecological Risk Analysis

The main conclusion of the preliminary ecological risk analysis (Section 5.2) is a focus on the use of mitigation actions to increase the certainty of expected impact intensity. It is assumed that baseline and site species field surveys are supportive of this focus.

Impact management actions considered for this development include:

- Avoidance of hollow bearing trees, where practicable;
- Avoidance of construction works coinciding with breeding events;
- Management of hollow bearing trees that are to be removed by the proposed development through the use of fauna clearance, relocation and compensatory habitat initiatives; and
- Provision of biodiversity offsets for vegetation cover loss, particularly areas classified as WBYBBRW EEC/ CEEC

It is considered that the assumptions generated from the preliminary ecological risk analysis are sufficiently robust to support the recommended field survey approach and development of appropriate and sustainable mitigation actions. In this respect there is sufficient confidence in the base assumptions to support an impact assessment (i.e. "Assessment of Significance") for the nominated 'Subject Species'.

6.0 FIELD SURVEY RESULTS

The site was investigated on 6 February 2009 by Mark Aitkens (NPWS Licence Number S10015), this being in addition to the completion of 211 quadrats for EL6288 (i.e. baseline studies), to validate the predicted ecological values identified from these baseline studies. The site investigations primarily focused on defining the vegetation cover, which in turn was used to evaluate the likely presence of threatened biodiversity and their habitats (i.e. nominated 'Subject Species'). Recent and past surveys (i.e. baseline studies) were conducted in accordance with relevant industry guidelines.

6.1 Flora

6.1.1 Survey Extent

Detailed systematic flora surveys were restricted to the lands enclosed within the sites boundaries. Flora surveys were completed using 3 quadrat sample sites, with each quadrat sampling 400 m^2 (20 m X 20 m). Biodiversity searches of ecotones and disturbed boundaries were also completed throughout the remaining parts of the site to compliment the quadrat sampling methods. Survey locations were randomly selected within representative vegetation types defined through an analysis of recent imagery of the site. **Figure 6** identifies the flora survey locations.

6.1.2 Vegetation of the Site

The flora survey identified 60 species, consisting of 51 natives and 9 exotics. A summary description of site vegetation is provided in **Section 6.1.3**, with a flora species list provided in **Appendix 2**.

6.1.3 General Observations

The following are general descriptions of the sites vegetation cover based on the visual dominance of tree canopy species. The spatial distribution of these vegetation formations is illustrated in **Figure 7**.

Narrow-leaved Ironbark Woodland/ Forest Regrowth

The prominent vegetation formation of the elevated parts of the site was found to be Narrow-leaved Ironbark woodland typified by a grass/ herb understorey and a moderate shrub understory. The total area covered by this vegetation type is 1.7 ha for the site. Tree cover also included Rough-barked Apple (*Angophora floribunda*) on the drier rises and Yellow Box (*E. melliodora*)/ Blakley's Redgum (*E. blakelyi*) restricted to drainage swales and closed depressions. Areas containing Yellow Box (*E. melliodora*)/ Blakley's Redgum (*E. blakelyi*) where limited to an area of 0.2 ha.

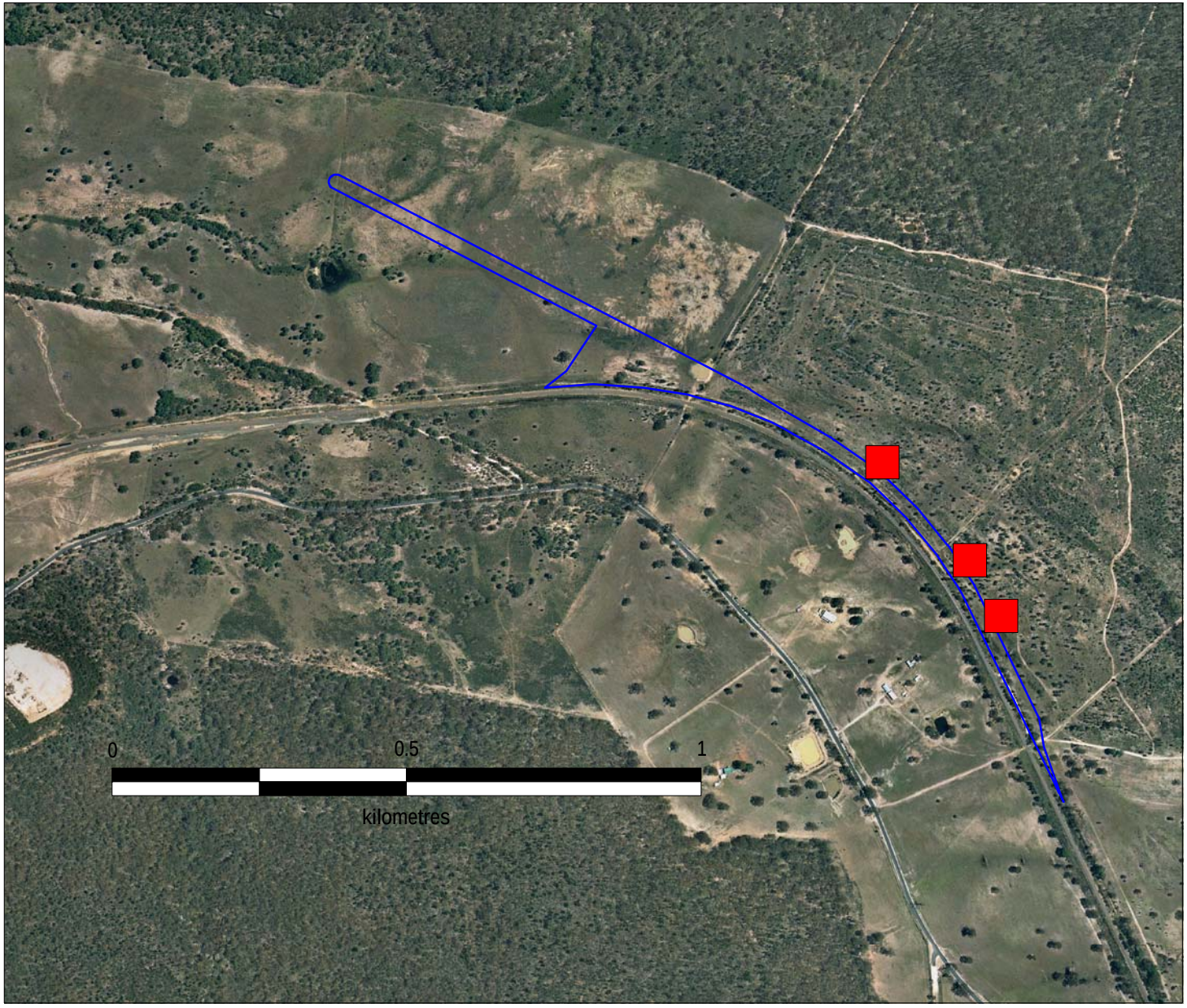
Groundcovers are dominated by Wiregrass (*Aristida ramosa*), Barb-wire grass (*Cymbopogon refratus*), Wallaby Grass (*Austrodanthonia* spp.), Love Grass (*Eragrostis* spp.) and Matrushes (*Lomandra filliformis*). Shrub species included *Cassinia arcuata*, *Styphelia triflora*, *Acacia gladiiformis*, *Astroloma humisifolia*.

Secondary Grassland

The open grassland vegetation formation is dominated by grassy and herbaceous species such as Wiregrass (*Aristida ramosa*), Matrushes (*Lomandra spp.*), Rats Tail (*Sporobolus creber*) and Lemon Beautyheads (*Calocephalus citreus*). Scattered juvenile Rough-barked Apple (*A. floribunda*) and/or Narrow-leaved Ironbark (*E. crebra*) may occur as regrowth together with various pioneer shrub species such as Sifton Bush (*Cassinia arcuata*) and Mudgee Wattle (*Acacia spectablis*). The area occupied by this vegetation type is 4.3 ha.

Exotic Species

Exotic species were infrequently observed throughout the site, with the majority of observations restricted to the ephemeral open drainage lines and chronically disturbed areas (i.e. secondary grasslands). Exotic species of significance that were observed within the site include Black Berry (*Rubrus discolor**), Fireweed (*Senecio madagascariensis*[+]), Arons Rod (*Verbascum thapsus**) and Fleabane (*Conyza sumatrensis**).



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Legend

Flora Quadrat (20X20m)

FIGURE 6

Flora Survey Locations

Sources
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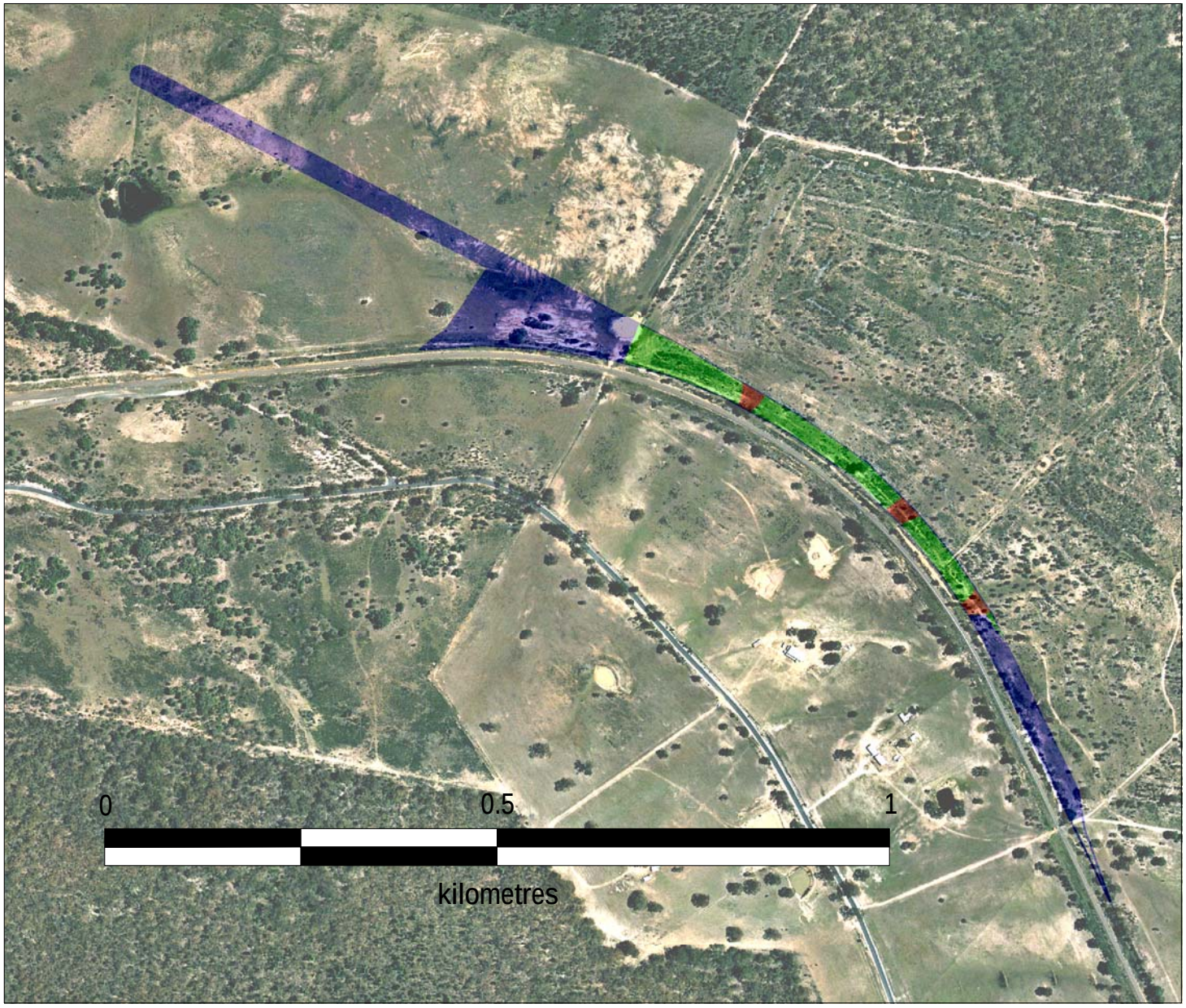

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Legend

- 'Transition' Lowland Ironbark Forest
- Lowland Ironbark Forest
- Secondary Grasslands and Shrublands

FIGURE 7

Site Vegetation

N

Sources
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6.2 Fauna

6.2.1 Survey Extent

Systematic targeted sampling techniques were employed during the diurnal survey period such as visual/audible observations (timed quadrats), scat/physical searches and habitat evaluation. Nocturnal and seasonal surveys involved spotlighting, call playback, Elliott trapping and microchiropteran bat recordings have also been completed throughout the locality in vegetation representative of the site via extensive baselines studies (Ecovision Consulting, 2008).

6.2.2 Fauna Observations

The impact of land clearing and agriculture on native vegetation cover and fauna habitats throughout the valley floor landscape has led to a predominance of generalist coastal and western fauna species such as the Red-browned Treecreeper, Bar-shouldered Dove, Nankeen Kestrel, Red-rumped Parrot, Dusky Woodswallow, Striped Honeyeater, White-plumed Honeyeater, White-winged Triller, Singing Bushlark, Emu, Spiny-checked Honeyeater, White-browed Babbler, Galah, Eastern Rosella, Pied Currawong, Australian Magpie, Australian Raven, Richards Pipit, Willie Wagtail and various Thornbills (Birds Australia, 2008).

Species observed during the recent site survey are characteristic of both forest and woodland environments. Species regularly observed within both these vegetation structures throughout the locality include the Crested Pigeon (*Geophaps lopotes*) and Black-faced Cuckoo-shrike (*Coracina novaehollandiae*). Ecological generalists such as the Eastern Rosella (*Platycerus eximius*) were observed flying throughout the vegetated margins of the site where it adjoins forested areas. Smaller honeyeaters such as the White-plumed Honeyeater (*L. pencilliatus*) were also observed. Other commonly observed generalists that frequent the site include the Pied Butcherbird (*Cracticus nigrogularis*) and Magpie (*Gymnorhyna tibicen*). The threatened Diamond Firetail was observed foraging within the site, with the potential for site vegetation to act as breeding habitat also evident due to its proximity to favoured riparian environments.

Isolated patches of relatively diverse fauna communities are mostly restricted to the larger less disturbed vegetation remnants and vegetated edges of the adjoining midslopes. These areas consist of species common to the disturbed landscapes, as previously described, in addition to various sensitive woodland species such as Diamond Firetail, Restless Flycatcher, Speckled Warbler, Southern Whiteface, White-winged Triller, Crested Shrike-tit, Jacky Winter and Rufous Songlark (Ecovision Consulting, 2008). Locally, the Permian geological formation appears to represent source habitat for species such as Barn Owl, Black-chinned Honeyeater, Fuscous Honeyeater, Stubble Quail and Southern Whiteface (Birds Australia, 2008).

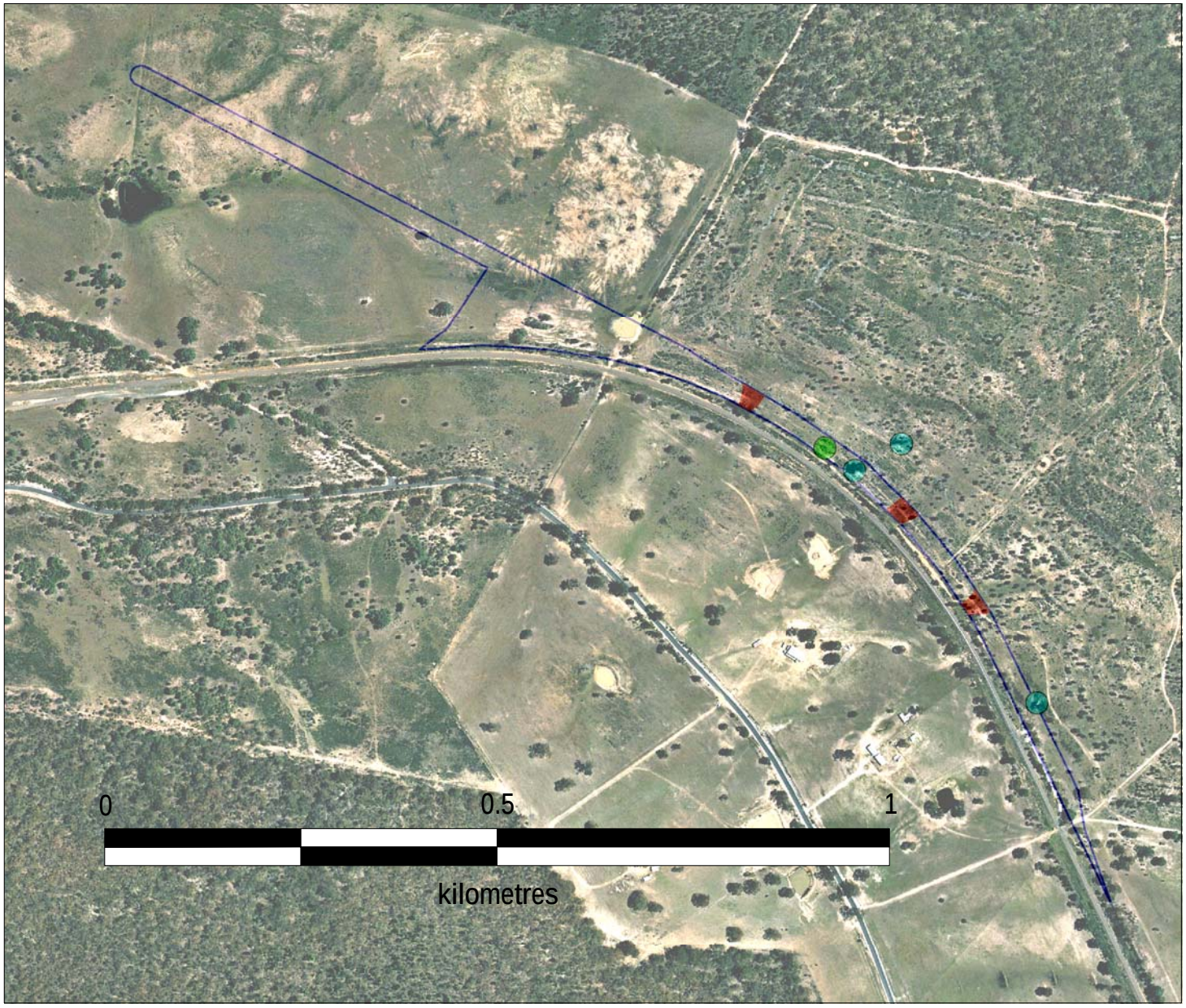
Reptiles other than common wide ranging species such as Lace Monitor, Red-bellied Black Snake, Brown Snake and Bearded Dragon were generally absent from the cleared parts of the valley floor. Increased species richness occurred only in isolated patches were suitable shelter habitats was sufficiently high and/or complex such as isolated rock outcrops associated with the Marangaroo conglomerates. Reptiles were frequently encountered north of the Ulan – Wollar Road where ground habitat such as rock cover was relatively high (Ecovision Consulting, 2008).

6.2.3 Habitat Values

The field survey identified the following fauna habitats within the site, these generally opportunity for a range of fauna activity common to the local area such as foraging and movement.

- Grasses and herbs;
- Fallen timber;
- Trees with hollows (see Figure 8 for locations); and
- A nectar producing tree canopy dominated by the Narrow-leaved Ironbark, with lesser contributions from Grey Box, Yellow Box and Blakely's Redgum.

The eastern hollow bearing tree, as shown in **Figure 8**, is capable of being retained with the western hollow bearing tree to be removed by the proposed development.



Drafted by: MA Date: 31 Mar 09 File: 2009_2003_Fig8.WOR

Legend

- Hollow Bearing Trees
- Diamond Firetail
- 'Transition' Lowland Ironbark Forest
- Site Boundary

FIGURE 8

Threatend Biodiversity

Sources

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7.0 DATA INTERPRETATION

7.1 Vegetation Formations

A statistical analysis comparing field survey results collected from the site with baseline data of EL6288 indicates the sites vegetation formations are transitional between the Western Slopes Grassy Woodlands and Western Slopes Dry Sclerophyll Forest vegetation classes (Keith, 2004). More specifically, the vegetation of the site was identified as "Lowland Ironbark Forest", with the presence of isolated Yellow Box and Blakely's Redgum within and downslope of the site indicative of the nearby presence of "Blakely's Redgum – Rough-barked Apple Forest" (Ecovision Consulting, 2008).

The statistical analysis identifies the sites native treed vegetation cover as Lowland Ironbark Forest with sufficient transitional qualities with the downslope vegetation formation (i.e. Blakely's Redgum – Rough-barked Apple Forests on course sands) to warrant an analysis of relevant EECs/CEECs (WBYBBRW and Derived Grasslands). In this respect further discussion is provided in the following section.

7.2 Is an EEC/ CEEC present onsite?

Vegetation of the site was examined relative to the identification framework provided by the NSW Scientific Committee, DECC and DEWHA for determining the occurrence WBYBBRW EEC/ CEEC.

A comparative analysis between site data and baseline data for EL6288 (Ecovision Consulting, 2008), which consists of 214 quadrats, identified site vegetation as 'Lowland Ironbark Forest' (Ecovision Consulting, 2008). Whilst this vegetation association is not classified as an EEC/ CEEC, the potential occurrence of WBYBBRW EEC/ CEEC was considered due to proximal occurrences of Blakely's Redgum – Rough-barked Apple Forests on course sands (i.e. transitional values). The isolated presence of Blakely's Redgum and Yellow Box within the site is indicative of these considerations.

In this respect it was recognised that there is the potential for transitional values between site vegetation (i.e. non-EEC) and adjoining vegetation formations (i.e. EEC). The following sections discuss this in terms of WBYBBRW and Derived Grasslands EECs/ CEECs.

7.2.1 Point 1 – Consideration of Yellow Box Occurrences within the site

According to Ecovision Consulting (2008), vegetation of the localities lowland or valley floor landscapes, is generally described as follows:

> *"…. vegetation formations characterised by the canopy dominants Yellow Box (E. melliodora) - Blakely's Redgum (E. blakelyi) – Rough-barked Apple (A. floribunda) (i.e. group 8) and Rough-barked Apple (A. floribunda) – Banksia (Banksia marginata) (i.e. group 12). These groups represent the majority of vegetation cover throughout the lower Murragamba valley, with Yellow Box (E. melliodora) - Blakely's Redgum (E. blakelyi) vegetation generally restricted to basalt enriched clays along drainage lines and Rough-barked Apple (A. floribunda) – Banksia (Banksia marginata) vegetation restricted to the adjoining dry deep tertiary sand deposit*.
>
> *The distantly similar group 1 is dominated by Rough-barked Apple (A. floribunda) and Blakely's Redgum (E. blakelyi), which principally occurs on sandy drainage lines and low rises immediately downlsope of Triassic geological formations (i.e. no basalt). This vegetation is shrubbier than group 8 and contains Blakely's Redgum (E. blakelyi), this being absent from group 12.*
>
> *Groups 3, 4, 5 and 10* [which includes Lowland Ironbark Forest] *are distantly similar to groups 1, 8 and 12 with the vegetation generally formed on midslope sandy clay to clay soils with no direct/ indirect interaction with basalt occurrences. Various Ironbarks and Grey Box (E. moluccana) typify these vegetation formations, with restricted isolated occurrences of Blakely's Redgum (E. blakelyi), Yellow Box (E. melliodora) and White Box (E. albens) associated with ecotones between groups 3, 4, 5, 10 and groups 1 and 8."*

This general description provides a relevant baseline interpretation for native vegetation cover of the site. Recognised in this analysis is the dominance of Narrow-leaved Ironbark (*E. crebra*) woodlands on sandy clay to clay soils, with these occurrences largely restricted to elevated positions above the floodplain on rises and hills. However, implied by the analysis is the potential occurrence of Yellow Box and Blakely's Redgum within transitional zones near lower footslopes, streams and creeks and not throughout the

Lowland Ironbark Forest vegetation formation. Thus contact zones between Lowland Ironbark Forest and adjoining vegetation formations described as belonging to the WBYBBRW and Derived Grasslands EEC/ CEEC could result in ecotones where 'transition' forests/ woodland are likely.

7.2.2 Point 2 – Consideration of WBYBBRW and Derived Grasslands EEC/ CEEC

WBYBBRW and Derived Grasslands CEEC are known to occur locally and throughout the Hunter Valley (NSW Scientific Committee, 2001). The NSW Scientific Committee (2001) indentifies variants of the state listed WBYBBRW EEC, with the Hunter region subject to the following:

> *"Woodlands including Eucalyptus crebra, Eucalyptus dawsonii and Eucalyptus moluccana (and intergrades with Eucalyptus albens), for example in the Merriwa plateau, Goulburn River National Park and western Wollemi National Park, are also included. Intergrades between Eucalyptus blakelyi and Eucalyptus tereticornis may also occur here."*

It should be noted that the context for the above statement is derived from '*woodlands including*', which fundamentally implies a minimum requirement of one or more characteristic canopy species (i.e. White Box, Yellow Box or Blakely's Redgum) being present.

Baseline vegetation mapping for EL6288 identifies the adjoining 'Blakely's Redgum – Rough-barked Apple Forests on course sands' as part of the EEC/ CEEC listing. This adjoining vegetation is situated within a broad open depression to the northeast of the site, this being an unnamed tributary of the Wilpingjoing Creek, with short shallow feeder open depressions contributing to this unnamed tributary transcending the site. It is within this landscape (i.e. open depressions) where site occurrences of Blakely's Redgum and Yellow Box are restricted.

Relative to the context provided above, it is considered that site occurrences of WBYBBRW EEC/ CEEC are restricted to areas where the characteristic canopy species also occur (i.e. open drainage swales). These areas are defined as transitional areas. Site data indentified the presence of Yellow Box and Blakely's Redgum, these being restricted to depressions, with their absence from the adjoining rises and slopes being consistent with the less suitable environmental conditions of these lands (i.e. drier less fertile soils).

7.2.3 Conclusion

In conclusion the site consists of Lowland Ironbark Forest with distinct mappable areas exhibiting transitional qualities with adjoining downslope vegetation types (i.e. Blakely's Redgum – Rough-barked Apple Forests on course sands). In this respect, areas containing either Yellow Box and/or Blakely's Redgum within the site are consequently considered to form part of the WBYBBRW EEC/ CEEC, with drier less fertile upslope positions dominated by Narrow-leaved Ironbark and Grey Box never having the WBYBBRW EEC/ CEEC characteristic canopy species. Mapping in accordance with this interpretation identifies 0.2 ha of WBYBBRW EEC/ CEEC from the 1.7 ha of Lowland Ironbark Forest identified within the site. No areas of 'derived grasslands' have been identified.

8.0 MATTERS OF ECOLOGICAL SIGNIFICANCE

8.1 Subject Species

8.1.1 Threatened Species

Database searches (DECC, 2008; DEWHA, 2008), spatial analysis of relevant Mitchell Landscapes/ vegetation types, site habitat features and the preliminary risk analysis collectively identified 21 "Subject Species" and one EEC/ CEEC requiring consideration in this assessment. Targeted site surveys identified moderate to high value threatened species habitat (i.e. Diamond Firetail, Hooded Robin, Grey-crowned babbler and Speckled Warbler), the presence of WBYBBRW EEC/ CEEC and confirmed potential core/ secondary habitat for many of the remaining 'Subject Species'. Threatened biodiversity with known occurrences within the site are illustrated in **Figure 8**. Discussion of these species is provided in the following sections.

Potential Habitat

Threatened owls, such as the Powerful Owl (*N. strenua*) may potentially use Lowland Ironbark Forest for foraging and/or breeding purposes, particularly where proximal large intact native vegetation remnants occur with suitable roost habitat and presence of ground and arboreal fauna (i.e. foraging resources). Similarly, the Glossy Black Cockatoo (*Calyptorhynchus lathami*) is also likely to utilise forests adjoining the site, particularly due to the presence of Sheoak foraging resources within these proximal vegetation remnants.

However, the site does not contain sufficient resources (i.e. trees with large hollows; plentiful Sheoak and arboreal fauna habitat) to support core foraging/ breeding for these species. In this context, the site represents low value habitat for these species with the sites greatest attribute being it's connection between large vegetation remnants with known populations. Given the scale of the development and the propensity for movement by these species over developed landscapes it is considered that the proposed development is unlikely to have an adverse impact resulting in a significant impact. As such there is no further consideration of the Powerful Owl, Glossy-black Cockatoo and Barking Owl in this assessment.

Conversely, sedentary/ home range dependant threatened woodland bird species such as the Grey-crowned Babbler, Hooded Robin and Speckled Warbler are more sensitive to localised impacts, particularly where known/ potential core habitat values are involved. Whilst none of the above species were observed within the site, baseline studies (Ecovision Consulting, 2008) imply the site as having moderate to high habitat value. As the proposed development would have a permanent impact on existing vegetation cover and associated habitat, it is considered that there is increased risk of a significant impact on these species. Further assessment of these species is warranted.

Habitat values for nectar seeking species such as the Swift Parrot (*L. discolor*) and Regent Honeyeater (*X. phrygia*) occur throughout the locality (e.g. winter flowering eucalypts), with these habitat attributes largely absent from the site. However, the presence of the occasional spring-summer flowering Yellow Box and Blakely's Redgum indicates a potential for foraging activity within the site during this period. The presence of Mistletoe also raises the potential for the Painted Honeyeater, this being a species known to occur within close proximity to the site. Whilst breeding habitat values are largely absent from the site (except Painted Honeyeater), the presence of potential foraging habitat indicates the potential for an impact on these species. As such, these species will be further considered in this assessment.

Species utilising large areas of undisturbed vegetation as part of their natural home ranges may also potentially use the site (e.g. Spotted-tailed Quoll, Square-tailed Kite, Bush-stone Curlew). The Spotted-tailed Quoll would primarily use the site as a movement corridor between nearby large native vegetation remnants and intermittently as an opportunistic foraging area. The Square-tailed Kite and Bush-stone Curlew would also use the site in a similar manner, however, may also use the site for nesting purposes.

Microchiropteran bats identified as 'subject species' include cave and non-cave roosting species. In relation to cave dwelling species, it is considered that the site represents important foraging habitat due to the increased insect resources of the nearby riparian corridor. Tree roosting species are likely to be similarly attracted to the site and proximal areas, with the presence of tree hollows indicating the potential for roost

and breeding activity. In this respect, the Eastern Bent-wing Bat, Little Pied Bat, Large-eared Pied Bat, Eastern Long-eared Bat and Yellow-bellied Sheath-tail Bat may potential experience an impact as a consequence of the proposed development. However, the extent of this impact is greatest on tree dwelling species, with the loss of potential foraging habitat for the cave dwelling species being limited within the context of the locality. As such the Eastern Long-eared Bat and Yellow-bellied Sheath-tail Bat will further considered within this assessment.

Known Habitat

The site contains known habitat values for the Diamond Firetail and Glossy-black Cockatoo. The Diamond Firetail was observed foraging onsite, with typical nest structures also observed nearby the site implying the potential for breeding habitat. As such this species will be considered further in this EIA report.

The Glossy-black Cockatoo was observed flying over the site between large tract of intact native vegetation located to the north and south of the site. As no roost habitat and very limited foraging habitat occurs within the site, it is considered that the proposed development would have any measurable deleterious impact on north-south movements as observed. In this context, no further assessment is warranted.

8.1.2 EPs

Three EPs may potentially occur within the locality and site, these being Hunter Catchment populations of the Tiger Orchid (*Cymbidium canaliculatum*), Weeping Myall (*Acacia pendula*) and River Redgum (*Eucalyptus camaldulensis*). Targeted biodiversity surveys confirmed the absence of these three listed populations from the site and locality. Whilst potential habitat occurs for at least the Tiger Orchid (*Cymbidium canaliculatum*), Weeping Myall (*Acacia pendula*), their absence from the site indicates a low likelihood for there being a deleterious impact on these species. No further assessment is warranted for these species.

8.1.3 EECs

There are known occurrences of White Box Yellow Box Blakely's Redgum Woodland and Derived Grasslands EEC/ CEEC within the locality (Ecovision Consulting, 2008), this being the only EEC/ CEEC within the area. Targeted surveys confirmed the presence of this EEC/ CEEC within the site, thereby warranting further consideration of this matter in this report.

8.1.4 Matters of NES (EPBC Act 1999)

The site is not located in a:

- Declared world heritage property;
- Ramsar wetland;
- Commonwealth marine area; or
- Represent a nuclear action.

Threatened Species, EPs and EECs

The Protected Matters Report (DEWHA, 2008) identified 8 threatened species and 1 critically endangered ecological community (CEEC) and/or their habitats listed on the EPBC Act within the locality. Several of these listed threatened species are considered to potentially occur within the habitats described for the site these being the Painted Diuris (*Diuris tricolor*), Large-eared Pied Bat (*C. dwyeri*) and Spotted-tailed Quoll (*D. maculatus*). Commonwealth listed species relevant to this assessment have already been identified (i.e. Subject Species") and will be considered in this report. White Box Yellow Box Blakely's Redgum Woodland and Derived Grasslands CEEC are also located within the site and will consequently be considered within this assessment.

Migratory Species

Migratory species listed within the schedules of the EPBC Act are unlikely to occur in the site. No migratory species were observed within the site, however, baseline studies for similar landscapes within the locality have identified a number of migratory species including. Notwithstanding the presence of potential habitat

for migratory species, it is considered that the extent of the proposed development would have marginal impacts on locally occurring habitat values.

8.1.5 Critical Habitat

No mapped critical habitat occurs as defined by listing on the TSC Act and/or EPBC Act occur within or adjacent to the site.

8.2 SEPP 44 – Koala Habitat Protection

Surveys for Koala trees and activity was undertaken to determine the likelihood of potential or core Koala habitat occurring within the site. No preferred Koala foraging tree species occur within the site, thus eliminating the presence of potential habitat.

A management plan would be required if a koala was detected onsite. However no such evidence was noted. Accordingly, the site is not considered to constitute 'Potential Koala Habitat' nor 'Core Koala Habitat'.

9.0 IMPACT MANAGEMENT

The proposed development would have an adverse impact on known core habitat (WBYBBRW and Derived Grasslands EEC/ CEEC and Diamond Firetail) and potential habitat (foraging/ breeding) for threatened/ declining woodlands birds and microchiropteran bats.

Avoiding a significant impact on threatened biodiversity requires the consideration of impact management actions, particularly those that achieve a 'maintain and improve' outcome. The following global management actions, in order of preference, may form part of any considerations focused on impact minimisation:

- Avoidance (e.g. exclusion of development from areas that contribute to the threatened biodiversity lifecycles or time construction works after the completion of breeding lifecycle event); and/or
- Onsite mitigation (e.g. retention of representative habitats within site together with management regimes); and/or
- Offsite direct/ indirect offsets (e.g. compensatory habitat, regional recovery management).

In the case of this development, it is considered that the first two listed impact management actions are applicable to minimising the developments impact on trees with hollows, loss of vegetation along creeklines and the known threatened biodiversity habitat. The following discusses these two issues in greater detail.

Loss of Tree Hollows

The NSW Scientific Committee has recently listed this as a key threatening process due to the importance of this habitat type for many threatened and declining native species (i.e. at least 46 mammals, 81 birds, 31 reptiles and 16 frogs). Eucalypts containing large hollows are rarely less than 220 years old, with tree age for tree hollow development starting at 140 years, with the presence, abundance and species richness of hollow-using fauna correlated with the density of hollow-bearing trees.

Baseline and site specific biodiversity surveys have identified at least two tree hollow dependant species within the locality such as threatened microchiropteran bat species (e.g. Eastern Long-eared Bat) and woodland birds (e.g. Brown Treecreeper). Whilst tree hollows located onsite may not be solely responsible for the presence of tree hollow dependant fauna, it is considered that these habitat attributes would play a significant role in regulation of local populations reliant on this habitat feature over time. As there are trees with hollows located within the development area, it is reasonable to conclude that the removal of these habitat features may result in a higher order impact on threatened biodiversity lifecycles that may ultimately threaten population viability.

Impact management involving avoidance is the most preferable solution, followed by the use of onsite mitigation then finally by offsite offsets (e.g. compensatory habitat). Where impacts cannot be avoided or mitigated it is recommended that offsite offsets be considered to achieve a 'Maintain and Improve' outcome. In this case, offsets would involve the re-establishment of tree hollows (i.e. natural and/or artificial nesting boxes) within the nearby landscape to maintain the occurrence and density of this habitat feature within the locality. Natural hollows are preferred over nesting boxes as the lifespan of a natural hollow is likely to far exceed a manufactured structure. Other mitigation considered important is fauna clearing during construction works and relocation.

Indirect Impacts on Proximal Riparian Vegetation

From site and locality data (Ecovision Consulting, 2008) it is apparent that nearby riparian corridors offer important foraging grounds for many microchiropteran bat species, particularly threatened species such as the Large-eared Pied Bat, and movement corridors for threatened birds such as the Glossy Black Cockatoo. Hollows within this landscape are equally important as are hollows in dead or dying trees. The vegetation of proximal riparian environments is also classified as part of WBYBBRW and Derived Grasslands EEC/ CEEC.

Threatened Biodiversity Habitat

The Diamond Firetail was the only threatened species confirmed within the site. This species was observed foraging throughout the Lowland Ironbark Forest, with characteristic nests also observed within low

regrowth trees. This species is listed as vulnerable on the TSC Act and not listed on the EPBC Act. A small area of WBYBBRW and Derived Grasslands was also found to occur within the site (o.2 ha). This community is listed as an EEC on the TSC Act and CEEC on the EBPC Act.

Notwithstanding the apparent absence of other threatened woodland bird species from the site, as determined by the site survey, the habitat analysis clearly identified moderate to high habitat values for many locally occurring threatened woodland species. Thus, it is assumed that the lifecycles of these species have the potential to involve site habitats over time.

In this sense the preferred impact management approach is avoidance where practicable, (e.g. timing of construction works outside breeding periods and retention of hollow bearing trees). Other actions contributing to a lower impact, at a local level, would include offsets involving revegetation. At a more strategic level, offsets dedicated to the conservation reserve network on a like for like basis also represent an important contribution to the minimisation of impacts.

9.1 Recommended Impact Management Actions

The following impact management strategies are recommended for the proposed development to reduce the development impacts on threatened biodiversity:

- Avoid one of the two hollow being trees contained within the proposed rail loop alignment. The eastern tree is to be retained whilst the western tree is to be removed;
- Avoid construction works during the breeding cycle of known and potential threatened woodland species that occur within the locality (i.e. construction during autumn – early winter months preferable);
- Implement a plan of management for the removal of the second hollow bearing tree. This is to include removal techniques, hollow salvage, compensatory measures and monitoring;
- Undertake local revegetation works to minimise the cumulative impact of vegetation loss from the locality, hence the maintenance of fauna habitats;
- Establish a 'like for like' offset for vegetation directly impacted by the proposed development. The extent of this offset is to be determined by the Consent Authority and government agencies, with the extent of this offset to have regard for other actions such as offsite revegetation works.

In relation to predicted indirect impacts on offsite WBYBBRW and Derived Grasslands EEC/ CEEC, matters such as weed control, water/ erosion management and exclusion of livestock represent important management themes for impact minimisation. The offsite impacts are to be managed within the framework of any approved management plans prepared in response to the conditions of consent for Stage 1 of the Moolarben Coal Project where they apply.

Impact Assessment Assumptions

The assessment and conclusions presented within this EIA report rely on the implementation of the above impact management actions. In this respect, the recommended impact management actions are of sufficient scope and extent to minimise the risk of a significant impact on threatened biodiversity examined in this report.

Conversely, a limited uptake of these measures would significantly weaken the assessment conclusions. In such circumstances, the impact assessment contained within this report would be unsupported with the potential for a significant impact on threatened biodiversity remaining untested.

10.0 IMPACT ASSESSMENT

The proposed development may potentially have an impact on the natural environment and as such an 'Assessment of Significance' was consequently prepared in accordance with Section 5A of the EP&A Act to consider whether there will be a significant impact on threatened biodiversity and their habitats.

10.1 EP&A Act

The "Assessment of Significance" presented below in **Table 14** considers all the nominated 'Subject Species' identified in **Table 13** within a landscape context. The landscape assessment approach considers all matters in a holistic manner and, where necessary, localised habitat features critical to threatened biodiversity lifecycles. Other considerations supporting this assessment are described **Section 5.0** (i.e. Impact Analysis) and **Section 9.0** (Impact Mitigation) where proposed mitigation actions and assessment assumptions are detailed.

Table 14: Assessment of Significance – Threatened Species, EPs and EECs

Assessment Criteria	Assessment
a) In the case of a threatened species …… is likely to be placed at risk of extinction.	The Diamond Firetail was confirmed as occurring within the site and is likely to be actively breeding within the site. The loss of vegetation from the site would impact this species and other threatened woodland species of the locality that are likely to occur within the site. However, the extent of proposed vegetation clearing in combination with the recommended mitigation actions would substantially offset these impacts. Timed construction works combined with revegetation and offsets would provide a 'maintain and improve' outcome that would not place any of the assessed threatened biodiversity at risk of extinction.
b) In the case of an endangered population, .. is likely to be placed at risk of extinction.	No. The site does not contain any member of a listed endangered population. The proposed development would not result in the significant loss of potential habitat or indirect impacts on potential/ known habitat.
c) 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	No. The direct permanent impacts of the proposed development would result in the loss of 0.2 ha of White Box Yellow Box Blakely's Redgum Woodland and derived grasslands EEC/ CEEC. This loss represents a localised decline of approximately 0.1% when compared to conserved occurrences of White Box Yellow Box Blakely's Redgum Woodland and derived grasslands EEC/ CEEC immediately to the east within the Goulburn River National Park. Further offsetting by the dedication of this EEC/ CEEC to the conservation reserve network would ensure this predicted outcome.
(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.	No. The extent of White Box Yellow Box Blakely's Redgum Woodland and derived grasslands EEC/ CEEC located downslope of the site could be impacted by changes in hydrology, this potentially acting as a catalyst for improvement of weed habitat (increased water and nutrients). However, through mitigation it is proposed to manage the potential offsite impacts through weed and sediment/ erosion management actions. There is no predicted impact on conserved patches of this EEC/ CEEC
(d)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 removal of a single hollow bearing tree has the potential to directly impact the roosting habitat of threatened woodland birds and microchiropteran bats known to occur within the locality (i.e. Brown Treecreeper; Eastern Long-eared Bat; Yellow-bellied Sheath-tail Bat). Mitigation is proposed to offset such losses involving hollow felling, fauna clearing and compensatory habitat management actions. The loss of foraging and potential breeding habitat for woodland birds such as the Diamond Firetail, which is known to occur

Assessment Criteria	Assessment
	onsite, is limited by the retention of native vegetation of similar character to the north and provision of offsets for native vegetation loss and EEC/ CEEC loss. The local abundance of important habitat resources would not be significantly compromised by this proposed development.
(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.	No. The loss of a 25m wide patch of native vegetation would not adversely affect wildlife corridors within the locality. No fragmentation of any consequence is expected as a consequence of the proposed development .
(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 the vegetation to be removed is considered high for the Diamond Firetail and other threatened woodland bird species. This vegetation appears to be acting as breeding habitat for the Diamond Firetail and is also likely to be important in this capacity for other threatened woodland species. This importance is recognised through the proposed mitigation where local actions centred on revegetation and provision of offsets are recommended to ensure that long term viability for threatened woodland species is conserved within the locality.
(e) Whether critical habitat will be directly or indirectly affected.	No critical habitat declared within or adjacent to the site. No further consideration warranted.
(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	There is a recovery plan for the Bush-stone Curlew which identified land clearing as a threat to its conservation. The proposed action, when combined with the mitigation works is consistent with the recovery plan through its recommendations for revegetation and offset.
(g) 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.	Yes. The proposed development of the site is likely to result in the loss of one hollow bearing tree and as such resulting in the operation of the “Loss of Tree Hollows” KTP. Land clearing is also a result of the proposed development, however, the extent of this clearing within the context of the locality is of limited consequence.

This impact assessment clearly identifies the potential for an impact on the threatened biodiversity (i.e. Subject Species), which has been averted through avoidance (i.e. tree hollows and construction timing), management provisions (i.e. tree hollow removal and weed management) and offsets (i.e. tree hollows; native vegetation offsets and EEC/ CEEC offsets). The impact is balanced by the mitigation measures, which provide opportunity to obtain a “maintain and improve” outcome. Within this context, it is considered that the proposed development would not have a significant impact on locally occurring threatened biodiversity, particularly those identified as ‘Subject Species’ within this EIA report.

10.2 EPBC Act

Listed Threatened Species

No known threatened species habitat listed on the EPBC Act occurs within the site. However, potential secondary habitat has been identified for species such as the Spotted-tailed Quoll (*D. maculatus*), Regent Honeyeater (*A. phrygia*), Swift Parrot (*L. discolor*) and Large-eared Pied Bat (*C. dwyeri*). Whilst these species and other EPBC Act 'Subject Species' have habitat preferences that are generally contained within large vegetation remnants they are known to use and/or occupy smaller vegetation remnants such as that associated with the site.

Listed Communities

White Box Yellow Box Blakely's Redgum Woodland and Derived Grasslands CEEC has known occurrences within the locality, with the site identified to contain approximately 0.2 ha of this community. Within the context of the locality, this represents an approximate 0.15% loss relative to nearby known occurrences within the Goulburn River National Park (at least 150 ha). Mitigation recommending the provision of an offset for this loss further consolidates this conclusion. No significant impact is expected to occur on this CEEC as a consequence of site development.

Listed Migratory Species

Nine migratory species (terrestrial and wetland) were identified in the EPBC Act Protected Matters Report as potentially occurring in the locality. However, none of the listed migratory species or their habitats is likely to occur within the site. Therefore, it is concluded that there will be no significant impact on this matter of NES.

Significance Analysis

The nature and magnitude of the development's impact has considered the following matters to determine whether a referral to the Department of Environment and Water Conservation is necessary.

Table 15: NES Matters

All on site and off site impacts	Permanent removal of native vegetation from the site will result in a permanent inconsequential biodiversity loss that will not significantly impact any important populations (i.e. mitigation including vegetation management and offsets). Sufficient habitat contained within the locality/ retained within the site.
All direct and indirect impacts	Direct impacts will be largely restricted to the site with the impact being the permanent loss of groundcover biodiversity and some fauna habitats. Direct impacts will result in the loss of 0.2ha of WBYBBRW and Derived Grasslands CEEC, with offsite offsets proposed to minimise this impact. Impacts on the Large-eared Pied Bat (C. dwyeri) will be restricted to foraging habitat, which is abundant throughout the locality and not currently at threat.
The frequency and duration of the action	The proposed development is planned to be a single event and will be permanent.
The total impact which can be attributed to that action over the entire geographic area affected	Low.
The sensitivity of the receiving environment	The sensitivity of the receiving environment is high (i.e. known threatened species habitat). Mitigation proposed to offset impacts.
The degree of confidence with which the impacts of the action are known and understood	A high degree of confidence is placed on this assessment.

In summary, it is concluded that there would be an impact on matters of NES that are within tolerance limits assuming the implementation of the recommended impact management actions (**Section 9.0**). Thus, it is considered that a referral is not required for the further analysis of this development to determine whether the proposed development is a controlled action under the EPBC Act.

10.3 SEPP 44 – Koala Habitat Protection

The site was assessed for Koala activity using the following methods:

- A search of the NPWS *Wildlife Atlas* Database (DEC, 2008);
- A survey on foot, with koala food trees being inspected for signs of koala use. Trees were inspected and identified for the presence of koalas, characteristic scratch and claw marks on the trunk and scats around the base of each tree. The proportion of trees showing signs of koala use was calculated. Additionally the location and density of droppings, if found, were documented; and
- Identification and an assessment of tree density (stems/ha) for preferred feed trees listed in SEPP No. 44 - Koala Habitat Protection, including an estimate of the tree density for each tree species across the site, determined by averaging the percentage of stems counted.

No preferred Koala feed tree species listed on Schedule 2 of SEPP 44 was found during the survey of the site. No Koalas or evidence of recent Koala activity was observed during the survey period indicating the site is not core habitat. Given the absence of Koala preferred feed tree species and activity; it is considered that no further consideration of this matter is required for this site.

11.0 CONCLUSIONS

The results of the field survey, impact review and assessment support the following findings and conclusions.

- One threatened fauna species listed on the TSC Act was observed within the site during the survey period (i.e. Diamond Firetail);
- Three threatened fauna species listed on the TSC Act have been recorded within similar vegetation found within the locality these including the Large-eared Pied Bat, Speckled Warbler and Hooded Robin. Roosting habitat will remain unaffected for the Large-eared Pied Bat (i.e. caves), with most potential nesting/ breeding sites for threatened woodland birds to be permanently displaced by the development;
- No EP's listed on the TSC Act occur within the site;
- One EEC/ CEEC is known to occur within the site and would be directly/ indirectly impact by the proposed rail loop;
- No Critical Habitat listed on the TSC Act and/or the EPBC Act occurs within the site;
- Through the implementation of the proposed mitigation actions the proposed development would have a 'maintain and improve' outcome for threatened biodiversity; and
- The impact on local and/or regional wildlife corridors would be low as the proposed development is restricted to areas of low ecological value that do not contribute to the function of important wildlife corridors.

Assuming implementation of the recommended impact management strategy it is considered that the proposed development would not result in a significant impact the threatened biodiversity known to/ or potentially occur within or adjacent the site.

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APPENDIX 1

EPBC Act Protected Matters Search

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

4 April 2009 15:40

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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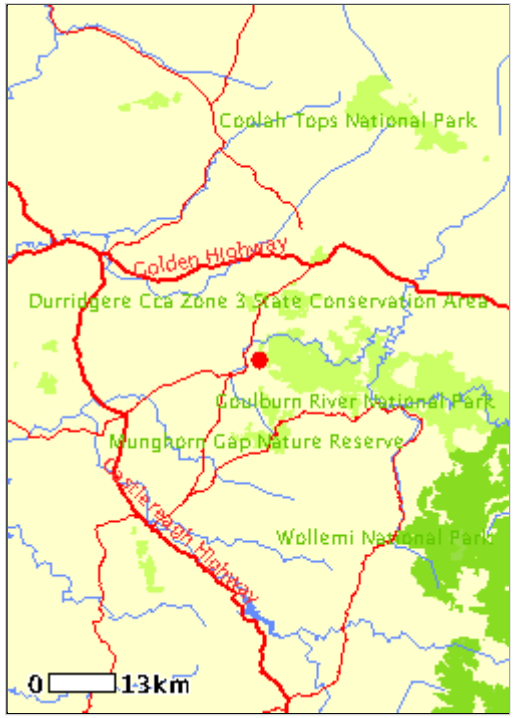
Search Type: Point

Buffer: 50 km

Coordinates: -32.25,149.8



This map may contain data which are
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Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	1
National Heritage Places:	1

Wetlands of International Significance: (Ramsar Sites)	2
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	3
Threatened Species:	25
Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	4
Commonwealth Heritage Places:	None
Places on the RNE:	29
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Other Commonwealth Reserves:	None
Regional Forest Agreements:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Dataset Information]		
The Greater Blue Mountains Area NSW		
National Heritage Places [Dataset Information]		
The Greater Blue Mountains Area NSW		
Wetlands of International Significance [Dataset Information] (Ramsar Sites)		
HUNTER ESTUARY WETLANDS		Within same catchment as Ramsar site
MACQUARIE MARSHES NATURE RESERVE		Within same catchment as Ramsar site
Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area
Threatened Species [Dataset Information]	Status	Type of Presence
Birds		

Anthochaera phrygia Regent Honeyeater	Endangered	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl	Vulnerable	Species or species habitat likely to occur within area
Polytelis swainsonii Superb Parrot	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis Booroolong Frog	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Nyctophilus timoriensis (South-eastern form) Eastern Long-eared Bat	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Ray-finned fishes		
Maccullochella peelii peelii Murray Cod, Cod, Goodoo	Vulnerable	Species or species habitat may occur within area
Reptiles		
Hoplocephalus bungaroides Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants		

Cynanchum elegans White-flowered Wax Plant	Endangered	Species or species habitat likely to occur within area
Digitaria porrecta Finger Panic Grass	Endangered	Species or species habitat likely to occur within area
Diuris sheaffiana Tricolour Diuris	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus macrorhyncha subsp. cannonii Cannon's Stringybark	Vulnerable	Species or species habitat likely to occur within area
Homoranthus darwinioides	Vulnerable	Species or species habitat likely to occur within area
Ozothamnus tesselatus	Vulnerable	Species or species habitat likely to occur within area
Philotheca ericifolia	Vulnerable	Species or species habitat likely to occur within area
Pomaderris sericea Bent Pomaderris	Vulnerable	Species or species habitat likely to occur within area
Prostanthera cryptandroides	Vulnerable	Species or species habitat likely to occur within area
Prostanthera discolor	Vulnerable	Species or species habitat likely to occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Wollemia nobilis Wollemi Pine	Endangered	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Leipoa ocellata Malleefowl	Migratory	Species or species habitat likely to occur within area

Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat known to occur within area

Migratory Wetland Species

Birds

Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area

Migratory Marine Birds

Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence

Birds

Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area

Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Commonwealth Trading Bank of Australia

Communications, Information Technology and the Arts - Australian Postal Corporation

Communications, Information Technology and the Arts - Telstra Corporation Limited

Defence

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Binnawee Homestead NSW

Burrundulla NSW

Coolah Courthouse and Police Station NSW

Eurunderee Public School Complex NSW

Gulgong Conservation Area NSW

Gulgong Opera House NSW

Guntawang Homestead, Garden and Stables NSW

Havilah Chapel NSW

Havilah Extensions NSW

Havilah Group NSW

Havilah NSW

Havilah Woolsheds NSW

Mudgee Courthouse NSW

Mudgee Post Office Group NSW

Mudgee Post Office NSW

Mudgee Railway Station NSW

Police Station Group NSW

Police Station Including Stables NSW

Police Station and Residence NSW

Public School NSW

Royal Hotel NSW

St Marys Catholic Church NSW

Village of Cassilis NSW

Indigenous

Bobadeen Area (Hands On the Rocks Shelter) NSW

Nagundie Archaeological Area NSW

Natural

Goulburn River National Park NSW

Munghorn Gap Nature Reserve (1978 boundary) NSW

Talbragar Reserve NSW

Wollemi National Park (1980 boundary) NSW

Extra Information

State and Territory Reserves [Dataset Information]

Avisford Nature Reserve, NSW

Goulburn River National Park, NSW

Munghorn Gap Nature Reserve, NSW

Wollemi National Park, NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection

- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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Last updated: Thursday, 20-Nov-2008 14:17:56 EST

APPENDIX 2

Flora and Fauna Species Lists

Table A2.1 Flora Species Recorded within the Site

Family	Scientific Name	Av Braun Blanquet Score
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	2
Anthericaceae	*Laxmannia gracilis*	1
Asteraceae	*Calotis cuneifolia*	1
Asteraceae	*Cassinia arcuata*	3.66667
Asteraceae	*Conyza bonariensis**	1
Asteraceae	*Hypochaeris glabrata**	1
Asteraceae	*Senecio madagascariensis**	1
Casuarinaceae	*Allocasuarina gymnanthera*	1
Casuarinaceae	*Allocasuarina luehmannii*	1
Clusiaceae	*Hypericum gramineum*	1
Cyperaceae	*Fimbristylis dichotoma*	2
Cyperaceae	*Gahnia aspera*	1
Dilleniaceae	*Hibbertia circumdans*	1
Epacridaceae	*Astroloma humifusum*	1.66667
Epacridaceae	*Leucopogon setiger*	1
Epacridaceae	*Melichrus urceolatus*	1
Epacridaceae	*Styphelia triflora*	1
Fabaceae_Faboideae	*Daviesia acicularis*	2
Fabaceae_Faboideae	*Trifolium repens**	1
Fabaceae_Mimosoideae	*Acacia gladiiformis*	2
Fabaceae_Mimosoideae	*Acacia hakeoides*	2
Fabaceae_Mimosoideae	*Acacia decora*	1
Fabaceae_Mimosoideae	*Acacia spectablis*	1.66667
Fabaceae_Mimosoideae	*Acacia verniciflua*	1
Haloragaceae	*Haloragis heterophylla*	2
Juncaceae	*Juncus articulatus*	1
Juncaceae	*Juncus planifolius*	2
Lomandraceae	*Lomandra multiflora subsp. multiflora*	1.5
Loranthaceae	*Amyema miquelii*	2
Myrtaceae	*Angophora floribunda*	2
Myrtaceae	*Babingtonia cunninghamii*	2
Myrtaceae	*Eucalyptus blakelyi*	3
Myrtaceae	*Eucalyptus crebra*	3.33333
Myrtaceae	*Eucalyptus melliodora*	1
Myrtaceae	*Eucalyptus moluccana*	1.5
Myrtaceae	*Leptospermum parvifolium*	2
Myrtaceae	*Melaleuca thymifolia*	2
Orchidaceae	*Microtis unifolia*	1
Plantaginaceae	*Plantago lanceolata**	1
Poaceae	*Aristida ramosa var. speciosa*	3.33333
Poaceae	*Arundinella nepalensis*	2
Poaceae	*Austrodanthonia racemosa*	2
Poaceae	*Cymbopogon refractus*	1
Poaceae	*Dichelacne micrantha*	2
Poaceae	*Digitaria breviglumis*	1.5
Poaceae	*Echinopogon caespitosus*	1
Poaceae	*Entolasia stricta*	1
Poaceae	*Eragrostis leptostachya*	2.33333
Poaceae	*Eulalia aurea*	1
Poaceae	*Microlaena stipoides*	1.66667
Poaceae	*Setaria gracilis**	1
Poaceae	*Sporobolus creber*	4
Proteaceae	*Grevillea sericea*	2
Proteaceae	*Persoonia linearis*	1
Rosaceae	*Rubrus discolor**	1
Rubiaceae	*Pomax umbellata*	1
Scrophulariaceae	*Veronica plebia*	1
Scrophulariaceae	*Verbascum thapsus**	1

Family	Scientific Name	Av Braun Blanquet Score
Verbenaceae	*Verbena bonariensis**	1
Zamiaceae	*Macrozamia secunda*	1.66667

Table A2.2: Fauna Species recorded within the Site

Class	Family	Scientific Name	Common Name	Exotic
Avifauna	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	
		Smicrornis brevirostris	Weebill	
	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	
		Grallina cyanoleuca	Magpie-lark	
		Gymnorhina tibicen	Australian Magpie	
	Cacatuidae	*Eolophus roseicapillus*	Galah	
	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
	Corvidae	*Corvus coronoides*	Australian Raven	
	Dicaeidae	*Rhipidura leucophrys*	Willy Wagtail	
	Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	
		Philemon corniculatus	Noisy Friarbird	
	Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	
		Pachycephala rufiventris	Rufous Whistler	
	Pardalotidae	*Pardalotus striatus*	Striated Pardalote	
	Passeridae	*Stagonopleura guttata*	Diamond Firetail	
	Psittacidae	*Platycercus eximius*	Eastern Rosella	
Mammalia	Macropodiae	*Macropus gigantea*	Eastern Grey Kangaroo	
Reptilia	Agamidae	*Morethia boulengeri*	Litter Skink	
Amphibia	Myobacteridae	*Pseudophryne bibronii*	Brown Toadlet	