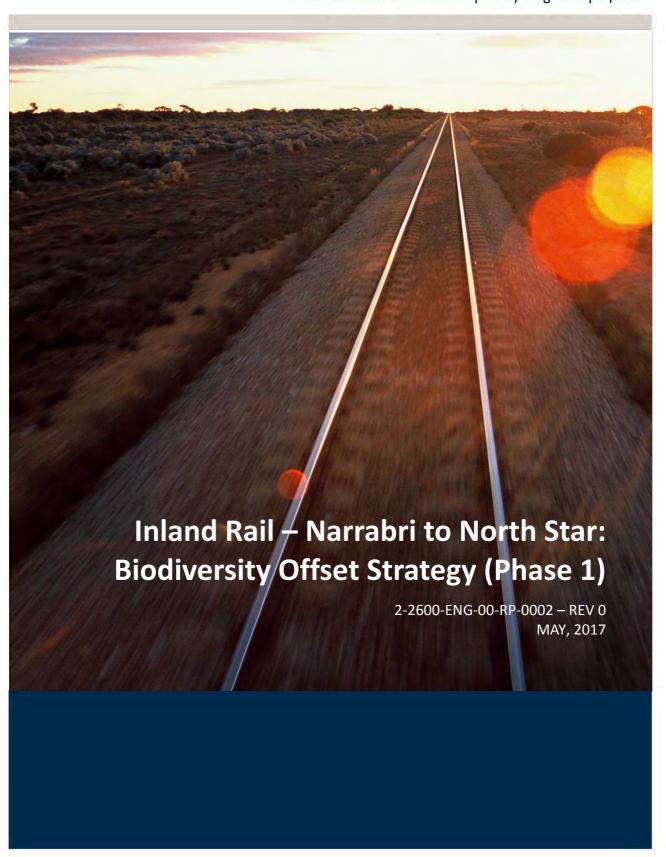
## **APPENDIX**

# Narrabri to North Star Biodiversity Offset Strategy (Phase 1)

NARRABRI TO NORTH STAR SUBMISSIONS PREFERRED INFRASTRUCTURE REPORT



The Australian Government's priority freight rail project





#### **Document Control**

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#### **EXECUTIVE SUMMARY**

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane. The Inland Rail programme (Inland Rail) involves the design and construction of a new inland rail connection, about 1,700 kilometres long, between Melbourne and Brisbane.

Inland Rail has been divided into 13 projects, seven of which are located in New South Wales (NSW). One of these is the **Narrabri to North Star** (proposal), consisting of approximately 183 kilometres of upgraded track, replacement of culverts and bridges, five new passing loops and other associated infrastructure and facilities.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') is seeking approval to construct and operate the proposal. The proposal requires approval from the NSW Minister for Planning under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). ARTC are required to prepare an environmental impact statement (EIS) for the proposal that meets the Secretary's Environmental Assessment Requirements (SEARs). The EIS will be assessed by the NSW Department of Planning & Environment (DPE) under the Bilateral agreement made between the Commonwealth and NSW governments.

ARTC have completed the preparation of a Biodiversity Assessment Report (BAR) (Umwelt, 2017a) as part of the EIS, and this biodiversity offsets strategy has been prepared to support the BAR. The BAR describes the ecological values that occur within the *proposal site and additional assessment area*<sup>1</sup> including threatened flora and fauna species and ecological communities that have the potential to be impacted, assesses the potential for significant impacts, and calculates the offset requirements in accordance with the *NSW Biodiversity Offsets Policy for Major Projects* (Major Projects Offsets Policy). The BAR identifies nine Plant Community Types (PCTs), three flora species (finger panic grass (*Digitaria porrecta*), creeping tick-trefoil (*Desmodium campylocaulon*), Belson's panic (*Homopholis belsonii*)) and one fauna species (koala (*Phascolarctos cinereus*)) as requiring biodiversity offsets under Major Projects Offsets Policy. A total of 18,826 ecosystem credits and 6,501 species credits need to be retired. Further details are provided in Table 4-2.

Based on the offset credits required, a desktop assessment was undertaken to identify the potential for suitable land based offset sites to be located and secured. The principles established under the Framework for Biodiversity Assessment (FBA) which underpins the Major Projects Offsets Policy was used to guide which PCTs and areas could be used for the proposal. A range of sources were investigated including the NSW Office of Environment and Heritage (OEH) biodiversity credits register, expressions of interest (EOI) register and desktop spatial analysis using available PCT mapping.

The assessment identified there are no existing registered suitable ecosystem credits or flora species credits occurring in the impact subregions of Northern Basalts, Northern Outwash or Castlereagh-Barwon, or the adjacent subregions. Two EOIs are located in impact subregions that may contain areas of impact PCT71 and PCT78. For koala species credits there are three existing credit registered offset areas, and 14 EOIs within NSW.

<sup>&</sup>lt;sup>1</sup> Defined as the construction footprint, including provision for ancillary facilities, for the total 183 kilometres of the rail line; resulting in a total proposal site area of approximately 1,563 hectares the (Umwelt, 2017a). NOTE: *The proposal site and additional assessment area* referenced within this report refers to the "Proposal Site" and the "Additional Assessment Area" terminology used within the EIS, and the "Development Site" terminology used in the BAR assessment.



The majority of the registered offset areas are located in eastern and coastal areas of NSW and it is likely there would be adequate koala credits available to meet the proposal's requirements. Under the FBA proponents are permitted to offset for a threatened species within other subregions that are within the known geographic distribution of the threatened species impacted.

Desktop analysis found that for the majority of impact PCTs there are adequate areas mapped within the impact subregions and adjoining subregions to meet the proposal's offset requirements. For impact PCT52 - Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains and PCT135 - Coobah - Western Rosewood low open tall shrubland or woodland mainly on outwash areas in the Brigalow Belt South Bioregion it is likely offset areas may be limited within the impact and adjoining subregions. Therefore, offsets for these PCTs may require the use of alternate PCTs. The extent of area available for each PCT is summarised in Table 5-7 and 5-8. Figures illustrating the distribution for each impact and alternate PCT are provided in Appendix A.

Due to a lack of suitable registered offsets for ecosystem and flora species credits ARTC will need to investigate sourcing their own offset sites and register BioBanking agreements with landowners. A preference will be for land-based offsets that are strategically located in the impact or adjacent subregions, where a number of PCTs and suitable habitat for those species required to be offset can be co-located, and 'like for like' conservation outcomes are achieved.



#### **GLOSSARY OF TERMS AND ABBREVIATIONS**

Abbreviation	Description
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority
DPE	NSW Department of Planning and Environment
DoEE	Commonwealth Department of the Environment and Energy
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
FBA	Framework for Biodiversity Assessment
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEARS	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
TSC Act	Threatened Species Conservation Act 1995 (NSW)



Abbreviation	Description
VIS	Vegetation Information System



#### 1. INTRODUCTION

#### 1.1. Background

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane. The Inland Rail programme (Inland Rail) involves the design and construction of a new inland rail connection, about 1,700 kilometres long, between Melbourne and Brisbane. Inland Rail is a transformational rail infrastructure initiative that will enhance Australia's existing national rail network and serve the interstate freight market.

Inland Rail has been divided into 13 projects, seven of which are located in New South Wales (NSW). One of these is the **Narrabri to North Star** (proposal), consisting of about 183 kilometres of new and upgraded track and associated infrastructure and facilities.

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') has sought approval to construct and operate the proposal. The proposal requires approval from the NSW Minister for Planning under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The proposal was referred to the Commonwealth Department of Environment and Energy (DoEE) in June 2016. A notice was issued on 20 September 2016 by DoEE the proposal will be a controlled action for listed species and communities, and the assessment approach is through the bilateral agreement with New South Wales.

ARTC is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the proposal under the *NSW Biodiversity Offsets Policy for Major Projects* (Major Projects Offsets Policy).

#### 1.2. Purpose

The Narrabri to North Star Biodiversity Offset Strategy (BOS) (Phase 1) has been developed in accordance with the Narrabri to North Star Biodiversity Assessment Report (BAR) and supports the overall Environmental Impact Statement (EIS) process. The purpose of this report is to:

- Summarise the proposal's biodiversity offset requirements (both State and Commonwealth) which have been determined through environmental impact assessments as part of finalising the BAR and EPBC Act referral
- Identify requirements for delivering a suitable offset under the Major Projects Offsets Policy and delivery options available for the proposal
- Assess the availability of suitable offset sites
- Outline a preferred offset delivery approach
- Identify future steps to secure the biodiversity offset requirements and associated timeframes.

This report forms the first of three phases of the BOS.

Phase 2 of this BOS will be prepared post detailed design and prior to the commencement of construction activities for the proposal. The BOS Phase 2 report will provide confirmation of offset values and credits required, identification of proposed offset site options, summary of preliminary field inspections, confirmation of initial landholder interest and assessment of existing condition, key threats and likely management actions on the offset site.



Phase 3 of this BOS will be prepared and submitted for approval within 12 months post commencement. Phase 3 of the BOS report will provide in detail the final offset sites proposed, ground-truthed confirmation of PCTs and species credits generated at the offset site/s, completed biodiversity credit calculator output and report and a detailed offset site management plan. It is then proposed the endorsed offset site/s are legally secured within 2 years post commencement.



#### 2. NARRABRI TO NORTH STAR PROJECT DESCRIPTION

#### 2.1.1. Location and Area

The proposal is generally located in the existing rail corridor between the towns of Narrabri to North Star in north-western NSW, and will involve upgrading the existing line (approximately 183 kilometres) (Figure 2-1). The proposal is located within three predominantly rural local government areas (LGAs) including Narrabri LGA for the southern section of the proposal, Moree Plains LGA for the middle section of the proposal, and Gwydir LGA for the northern section of the proposal.

The rail corridor is generally defined by fences located approximately 20 metres either side of the rail line, however in some sections where fences are not present the rail corridor may be wider, extending out to about 30 to 40 metres from the rail line or wider where site compounds are proposed. The proposal site varies along the length of the proposal depending on the construction activities that are to take place in any given area (Umwelt, 2017a).

The proposal site and additional assessment area includes the construction footprint and provision for ancillary facilities, for the total 183 kilometres of the rail line; resulting in a total proposal site area of approximately 1,563 hectares (Umwelt, 2017a). Offset requirements have been calculated based on the proposal site and additional assessment area.

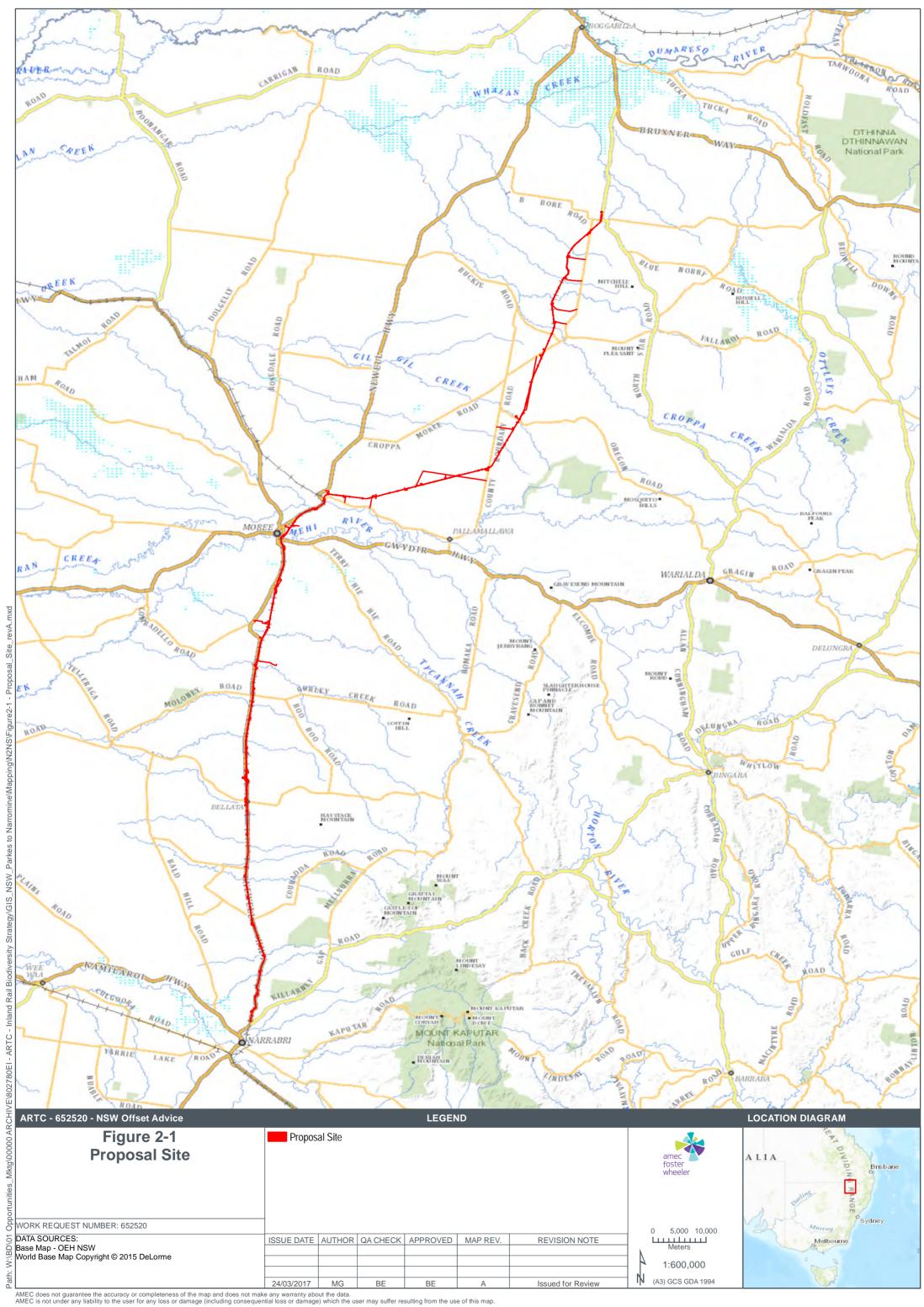
#### 2.1.2. Key Features

Key features of the proposal involve:

- Upgrading the track, track formation, culverts and bridges within the existing rail corridor for a distance of 183 kilometres between Narrabri to North Star
- Realigning the track where required within the existing rail corridor to minimise/ease tight curves, including
  construction of a deviation at Camurra to eliminate the existing hairpin curve
- Providing five new passing loops within the existing rail corridor, at Bobbiwaa, Penny's Road, Moree, Coolleearllee and Croppa Creek.

Ancillary work would include works to level crossings, flood immunity works, stormwater drainage works, upgrading signalling and communications, establishing or upgrading existing fencing of the rail corridor and relocation of some services and utilities within the proposal site.

Inland Rail (through-connection) would be operational in 2025.





#### 3. NARRABRI TO NORTH STAR OFFSET LEGISLATIVE REQUIREMENTS

The proposal will be assessed and approved under both State and Commonwealth legislation including:

- Sections 130(1) and 133 of the Commonwealth EPBC Act
- Part 5.1 of NSW EP&A Act as State Significant Infrastructure (SSI) with assessment via an EIS.

Based on the approval and legislative requirements the following sections provide an overview of the State and Commonwealth biodiversity offset frameworks that will apply to the proposal, and requirements for the provision of biodiversity offsets.

#### 3.1. Commonwealth

The proposal was referred to the Commonwealth DoEE in June 2016. A notice was issued on 20 September 2016 that the proposal will be a controlled action for listed species and communities, and the assessment approach is through the bilateral agreement with New South Wales.

ARTC is required to assess potential for the proposal to have significant impacts on matters of national environmental significance (MNES) in accordance with the issued Secretary's Environmental Assessment Requirements (SEARs). Where a significant impact has been identified, a biodiversity offset is required to compensate for this loss. An offset framework is established under the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012) that provides guidance on what constitutes an acceptable offset. However, the EPBC Act Environmental Offsets Policy is not applicable to the proposal as the NSW Major Projects Offsets Policy is accredited under the NSW Bilateral Agreement. As the proposal has been declared a major project, offsets for impacts on MNES can be delivered in accordance with the NSW Major Projects Offsets Policy (as set out in Chapter 3.2 below).

An Assessment of Significance has been undertaken in accordance with the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (DoEE, 2013) for those MNES identified in the referral as known or likely to occur in the proposal site. Results of this assessment are outlined in the BAR (Umwelt, 2017a) and the Assessment of Commonwealth Matters Report (Umwelt, 2017b) which will be appended to the BAR. The MNES assessed and findings are summarised in Chapter 4.4.

#### 3.2. New South Wales

#### 3.2.1. New South Wales Biodiversity Offset Strategy for Major Projects

The NSW *Biodiversity Offsets Policy for Major Projects 2014* (OEH, 2014a) (Offsets Policy for Major Projects) establishes a set of offsetting principles for major projects, outlines an assessment methodology to quantify and describes the offsets required as well as detailing a range of options that can be used to provide offsets. The policy provides a standard method for assessing impacts and the quantum of biodiversity credits (species credits and ecosystem credits) required for projects declared as State Significant Development (SSD) or SSI under the EP&A Act. This includes impacts on:

Species credit species – threatened species listed under the NSW Threatened Species Conservation Act 1995 (TSC Act) and/or EPBC Act that are identified by the OEH Threatened Species Profile Database as not being able to reliably be predicted to occur on a development site based on Plant Community Types (PCT), distribution and habitat criteria



- Ecosystem credit species threatened species listed under the TSC Act and/or EPBC Act that are identified by the OEH Threatened Species Profile Database as being able to be predicted to occur on a development site based on the presence of habitat surrogates, including the confirmed presence of PCT
- Critically endangered ecological communities (CEECs) and endangered ecological communities (EECs) listed under the TSC Act
- Migratory species and Threatened Ecological Communities (TECs) listed under the EPBC Act.

Under the policy offset credit requirements can be satisfied through one or a combination of options which include:

- Land based offsets through the purchase and retirement of biodiversity credits from the biodiversity credit register
- Making payments into an offset fund (this option is not currently available)
- Supplementary measures (these are measures other than protection and management of land, and can include funding of actions identified in species recovery plans, threat abatement programs or research), or
- A combination of the above.

Supplementary measures may only be considered if appropriate offset sites cannot be found. Proponents need to demonstrate reasonable steps have been undertaken to locate appropriate like-for-like offset sites before supplementary measures can be proposed. Reasonable steps are defined in Appendix A of the Major Projects Offsets Policy.

Where there are insufficient credits available from the register to acquit a project's offset requirements, proponents can seek to identify and establish a biobank site by entering into a BioBanking agreement with an interested landholder.

Proponents are generally required to secure offsets before development commences. If they wish to secure the offset after development commences, they must enter into a voluntary planning agreement prior to the granting of project approval, requiring the offset requirement to be carried out.

#### 3.2.2. Framework for Biodiversity Assessment

As a requirement under the EP&A Act the proposal has been provided with SEARs that require ARTC to prepare a Biodiversity Assessment Report (BAR) and apply the Framework for Biodiversity Assessment (FBA) to assess impacts on biodiversity. The FBA underpins the Major Projects Offsets Policy.

The FBA sets out the process for assessing impacts on threatened species, CEECs, EECs and TECs and determining the biodiversity offset requirements for those impacts. It provides a method for calculating an offset quantum in the form of biodiversity credits (species credits and ecosystem credits) based on landscape analysis and detailed field assessments including ground truthing of mapped vegetation communities and threatened species surveys.

The results of the application of the FBA are documented by accredited assessors in a BAR. ARTC have completed the preparation of a BAR for the proposal which identifies the potential impacts to species and ecological communities and biodiversity offset credits required (Umwelt, 2017a). The findings of the BAR in terms of offset credit requirements are summarised in Chapter 4.1 - 4.3.



#### 3.2.3. BioBanking

BioBanking was established by the former NSW Department of Environment, Climate Change and Water (DECCW) (now the OEH) as a method to address the loss of biodiversity and threatened species. The scheme attempts to create a market framework for the conservation of biodiversity values and the offsetting of development impacts.

BioBanking is established under Part 7A of the TSC Act. The *Threatened Species Conservation (Biodiversity Banking)*Regulation 2008 provides additional rules for specific aspects of the scheme that are important for its operation. The BioBanking Assessment Methodology 2014 (BBAM) sets out how biodiversity values will be assessed, establishes rules for calculating the number and class of biodiversity credits, and determines the trading rules that will apply (OEH, 2014a).

To support proponents and offset providers OEH have established the BioBanking Public Registers. They consist of:

- BioBanking agreements register identifies locations of approved biobank sites, number and type of credits generated and a copy of BioBanking agreement
- BioBanking statements register provides the location of where BioBanking statements apply, the number and type of credits required, a copy of the BioBanking statement and credits retired to satisfy conditions of statement requirements
- Biodiversity credits register provides ownership information in relation to each credit, including its status. The credit register can be used to find buyers and sellers
- Biodiversity credit transactions and sales register information on credit transactions including the price and date of transactions
- Expressions of Interest (EOI) register landowners who are interested in establishing biobank sites, but have not entered into a formal agreement
- Credits wanted register proponents who are seeking biodiversity credits.

A search of the above public registers has been undertaken to identify offset credit availability in this strategy.



#### 4. NARRABRI TO NORTH STAR OFFSET REQUIREMENTS

The BAR (Umwelt, 2017a) has assessed the biodiversity values that are known and likely to occur in the proposal site and additional assessment area. An assessment has been undertaken to determine the residual impacts requiring an offset through the application of the FBA. The number of biodiversity offset credits (both ecosystem and species credits) has been estimated and further supporting information is provided in the BAR (Umwelt, 2017a).

All information presented in this chapter has been summarised from the BAR (Umwelt, 2017a).

#### 4.1. Threatened Species Requiring Offset

A total of 32 ecosystem-credit fauna species have been identified as required to be assessed to calculate the total ecosystem credits required for the proposal. These are summarised in Table 5.1 of the BAR. The species with the highest multiplier was used to determine credit requirements for the vegetation zones they are predicted to occur in. Five ecosystem-credit fauna species were recorded during targeted field surveys. These fauna species and their applicable species multipliers are listed in Table 4-1. Offset sites will incorporate habitat for these fauna species through associated PCTs.

Table 4-1 Ecosystem-credit species requiring offset as a result of the proposal

Common Name	Species Name	Threatened Species Offset Multiplier
grey-crowned babbler	Pomatostomus temporalis subsp. temporalis	1.3
varied sittella	Daphoenositta chrysoptera	1.3
eastern bentwing-bat	Miniopterus schreibersii oceanensis	Not predicted in the BioBanking Credit Calculator
little pied bat	Chalinolobus picatus	2.1
yellow-bellied sheathtail-bat	Saccolaimus flaviventris	2.2

The BAR identified five species-credit species as being recorded in the proposal site being; finger panic grass (*Digitaria porrecta*), creeping tick-trefoil (*Desmodium campylocaulon*), Belson's panic (*Homopholis belsonii*), koala (*Phascolarctos cinereus*)) and grey-headed flying fox (*Pteropus poliocephalus*). The grey-headed flying fox only generates species-credits for impacts on breeding habitat. No camp sites were recorded within the proposal site therefore no species credits are generated. Details are summarised in Table 4-2.

#### 4.2. Biodiversity Offset Credit Summary

There are nine PCTs within ten condition classes, three flora species and one fauna species requiring biodiversity offsets. A summary of ecosystem and species credits that require offsetting under the FBA is provided in Table 4-2 below. A total of 18,826 ecosystem credits and 6,501 species credits are required to offset the direct impacts of the proposal. Maps of these PCTs within the proposal site and the full Credit Calculator reports are provided as Appendices to the BAR.



Table 4-2 Ecosystem and species credits generated by the proposal

Name	Credits Required
Ecosystem Credits	
PCT27 (BR233, NA219) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	254
PCT35 (BR120, NA117) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion	250
PCT39 (BR130, NA129) Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion	63
PCT52 (BR191, NA187) Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion	11,046
PCT56 (BR186, NA182) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW Moderate to Good	3,386
PCT56 (BR186; NA182) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW  Moderate to Good – Derived Native Grasslands	2,917
PCT71 (BR127, NA126) Carbeen - White Cypress Pine - River Red Gum - bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern Brigalow Belt South Bioregion and Darling Riverine Plains Bioregion	2
PCT78 (BR196, NA193) River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	675
PCT135 (BR284, NA271) Coobah - Western Rosewood low open tall shrubland or woodland mainly on outwash areas in the Brigalow Belt South Bioregion	133
PCT413 (BR346, NA348) Silver-leaved Ironbark - White Cypress Pine - box dry shrub grass woodland of the Pilliga Scrub - Warialda region, Brigalow Belt South Bioregion	100
Total Ecosystem Credits	18,826
Species Credits	
finger panic grass ( <i>Digitaria porrecta</i> )	364
creeping tick-trefoil ( <i>Desmodium campylocaulon</i> )	2,607



Name	Credits Required
Belson's panic (Homopholis belsonii)	1,898
koala ( <i>Phascolarctos cinereus</i> )	1,632
Total Species Credits	6,501

#### 4.3. Matters of National Environmental Significance

ARTC have completed assessments of significance for MNES applying the *Significant Impact Guidelines 1.1* (DoEE, 2013). Assessments of significance concluded the proposal was likely to result in a significant impact on the CEEC Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland. No other MNES was identified to be significantly impacted by the proposal (Umwelt, 2017b). Further detail on the MNES assessed are summarised below and provided in the BAR.

#### 4.3.1. Threatened Ecological Communities

Assessments of Significance following Significant Impact Criteria in the Significant Impact Guidelines (DoEE, 2013) for EPBC Act TECs have been undertaken as part of the BAR. The TECs include:

- Brigalow (Acacia harpophylla dominant and co-dominant) (EEC under EPBC Act)
- Coolibah Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (EEC under the EPBC Act)
- Natural Grassland on Basalt and Fine-textured Alluvial Plains of Northern NSW and Southern QLD (CEEC under the EPBC Act)
- Weeping Myall Woodlands (EEC under the EPBC Act).

Assessments of Significance concluded that only one TEC (Natural Grassland on Basalt and Fine-textured Alluvial Plains of Northern NSW and Southern QLD CEEC) is likely to be significantly impacted by the proposed action with impacts on up to 268 ha of the CEEC and as such, offsets are required for this TEC.

Each of the above TECs is equivalent to a NSW PCT impacted by the proposal and requires offsetting as detailed in Table 4-3 below. As such, offsets for the ecosystem credits calculated from project impacts to these PCTs will also offset impacts to all four TECs under the NSW Bilateral Agreement. Table 4-3 also identifies the extent of clearing for each TEC and the corresponding PCT.



Table 4-3 NSW Plant Community Types impacted by the proposal and equivalent Commonwealth Threatened Ecological Communities impacted

NSW PCT	Equivalent TEC	PCT area to be Impacted (ha)	TEC area to be impacted (ha)
PCT27 (BR233, NA219) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion Moderate to Good	Weeping Myall Woodland	5.05	1.99 meets the Listing Advice for Weeping Myall Woodland TEC
PCT35 (BR120, NA117) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion Moderate to Good	Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions	3.54	3.54
PCT39 (BR130, NA129) Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion Moderate to Good	Coolibah - Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregions	1.19	1.19
PCT52 (BR191, NA187) Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion  Moderate to Good Natural Grassland	Natural Grassland on Basalt and Fine- textured Alluvial Plains of Northern NSW and Southern QLD	237.41	237.41
PCT56 (BR186, NA182) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW Moderate to Good	Nil	55.07	N/A
PCT56 (BR186, NA182) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW Moderate to Good – Derived Native Grassland	Nil	87.87	N/A



NSW PCT	Equivalent TEC	PCT area to be Impacted (ha)	TEC area to be impacted (ha)
PCT71 (BR127, NA126) Carbeen - White Cypress Pine - River Red Gum - bloodwood tall woodland on sandy loam alluvial and aeolian soils in the northern Brigalow Belt South Bioregion and Darling Riverine Plains Bioregion Moderate to Good	Nil	0.04	N/A
PCT78 (BR196, NA193) River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion Moderate to Good	Nil	14.59	N/A
PCT135 (BR284, NA271) Coobah - Western Rosewood low open tall shrubland or woodland mainly on outwash areas in the Brigalow Belt South Bioregion  Moderate to Good	Nil	3.57	N/A
PCT413 (BR346, NA348) Silver-leaved Ironbark - White Cypress Pine - box dry shrub grass woodland of the Pilliga Scrub - Warialda region, Brigalow Belt South Bioregion Moderate to Good	N/A	2.29	N/A
Total clearing (ha)	,	410.62	244.13



#### 4.3.2. Threatened Species

Assessments of Significance following Significant Impact Criteria in the Significant Impact Guidelines (DoEE, 2013) were completed for a number of EPBC Act threatened fauna species as part of the BAR. These species were listed in the controlled action notification and included:

- Regent honeyeater (Anthochaera phrygia) critically endangered under the EPBC Act
- Swift parrot (Lathamus discolor) critically endangered under the EPBC Act
- Bluegrass (Dichanthium setosum) vulnerable under the EPBC Act
- Belson's panic (Homopholis belsonii) vulnerable under the EPBC Act
- Tylophora linearis endangered under the EPBC Act
- Murray cod (Maccullochella peelii) vulnerable under the EPBC Act
- Five-clawed worm skink (Anomalopus mackayi) vulnerable under the EPBC Act
- Pink-tailed worm-lizard (Aprasia parapulchella) vulnerable under the EPBC Act
- Border thick-tailed gecko (Uvidicolus sphyrurus) vulnerable under the EPBC Act
- Squatter pigeon (Geophaps scripta scripta) vulnerable under the EPBC Act
- Painted honeyeater (Grantiella picta) vulnerable under the EPBC Act
- Large-eared pied bat (Chalinolobus dwyeri) vulnerable under the EPBC Act
- Pilliga mouse (Pseudomys pilligaensis) vulnerable under the EPBC Act
- Koala (*Phascolarctos cinereus*) combined populations of Qld, NSW and the ACT vulnerable under the EPBC Act
- Grey-headed flying-fox (Pteropus poliocephalus) vulnerable under the EPBC Act
- South-eastern long-eared bat (Nyctophilus corbeni) vulnerable under the EPBC Act.

Assessments of Significance concluded that all of these species are unlikely to be significantly impacted by the proposed action. The assessment of significance for the koala concluded that the proposal is unlikely to result in a significant impact on an important population of the koala, however the DoEE has determined that the proposal is likely to result in a significant impact on the koala, and residual impacts will be offset (Umwelt, 2017b).



#### 5. OFFSET INVESTIGATIONS

#### 5.1. Requirements under the Major Projects Offsets Policy and Framework for Biodiversity Assessment

As identified in Chapter 3.2 the FBA provides guidance and criteria to assist proponents in determining offset sites that will satisfy the Major Projects Offsets Policy requirements. The objective is to ensure that the biodiversity values, such as PCTs and threatened species, being lost at an impact site are offset by improvements on land with the same or similar biodiversity values (i.e. like for like offsets). A summary of the FBA offset criteria that have supported the assessment of offset availability for the proposal are summarised in Table 5-1.

Table 5-1 Criteria used to identify potential like for like offsets

Offset Attribute	Offset Criteria (OEH, 2014b)	
PCT	PCTs that meet the following criteria may be used for offsetting:  1. The same PCT for which the ecosystem credit is required (i.e. the impact PCT).  2. Any PCT of the same vegetation class as the impact PCT that has:  • A percent cleared value that is equal to, or greater than the percent cleared of the impact PCT  OR  • A percent cleared value up to 10% lower than the impact PCT if the percent cleared of the impact PCT is less than or equal to 70%.	
Interim Biogeographic Regionalisation for Australia (IBRA) Subregions	IBRA subregions that meet the following criteria can be used for offsetting purposes.  1. The IBRA subregion in which the impact will occur (i.e. the impact subregion)  2. The adjoining IBRA subregions within the same IBRA bioregion as the impact PCT  3. Any other IBRA subregions that immediately adjoin the impact subregion  4. Any other IBRA subregions that have the same geographic distribution of the threatened species assessed for ecosystem credits or species credits.	
Species Credits	A required species credit must be offset with a species credit created for the same species, determined in accordance with the BBAM.	

The offset criteria outlined in Table 5-1 have been used to assess offset availability for the proposal, and results are outlined in Chapter 5.3.

An analysis of the IBRA subregions that satisfy the FBA (being the impact IBRA subregions and adjacent subregions) has been undertaken and results are presented in Table 5-2. The proposal occurs within three IBRA subregions, namely Northern Basalts, Northern Outwash and Castlereagh-Barwon. These will be given priority for locating potential offset sites. There are a total of nine adjoining IBRA subregions that can also be considered when assessing potential offset availability (Table 5-2). The location of the proposal in relation to the location of impact and adjacent subregions is illustrated in Figure 5-1.



Table 5-2 IBRA subregions that satisfy the FBA offset rules

IBRA Bioregion	Impact IBRA Subregion/s	Adjoining IBRA Subregion/s
Brigalow Belt South	Northern Basalts	Nandewar Northern Complex Inverell Basalts Peel Kaputar Liverpool Plains
Brigalow Belt South	Northern Outwash	Liverpool Plains
Darling Riverine Plains	Castlereagh-Barwon	Pilliga Outwash Pilliga Bogan-Macquarie Moonie-Barwon Interfluve

A range of alternative PCTs to the impact PCTs that may also be considered for offsets are presented in Table 5-3. These PCTs meet the FBA offset rules presented in Table 5-1 in that:

- They are of the same vegetation class as the impact PCT
- They occur in the impact subregions or adjoining subregions identified in Table 5-2
- They have a percent clearing value that is equal to, or greater than the percent clearing for the impact PCT in the major catchment area (consistent with criteria outlined in Appendix A of the NSW Biodiversity Offsets Policy for Major Projects for achieving 'like for like' offset outcomes).

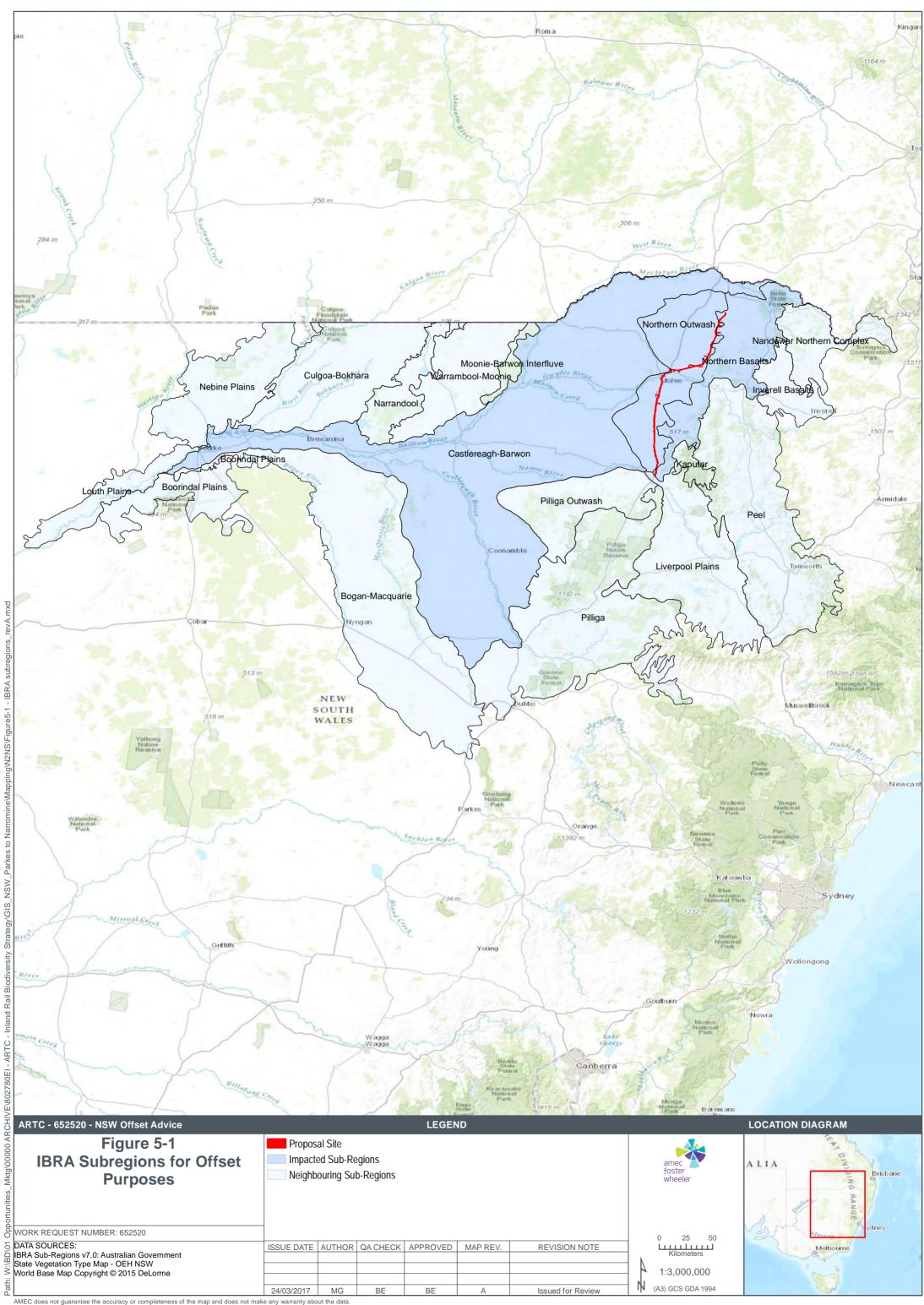




Table 5-3 Impact and Alternative PCTs that may be considered for offsets

Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
	Riverine Plain Woodlands	PCT27 (BR233, NA219) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	PCT26 (BR233, CW204, NA219, WE97) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
	Brigalow Clay Plain Woodlands	PCT35 (BR120, NA117) Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion	PCT101 (BR189, NA185) Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
	North-west Floodplain Woodlands	PCT39 (BR130, NA129) Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion	PCT37 (BR105, CW106, NA105, WE73) Black Box woodland wetland on NSW central and northern floodplains including the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
Semi-arid woodland (Grassy sub-formation)			PCT40 (BR131, CW126, NA130, WE76) Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains
			PCT55 (BR102, CW104, NA102, WE66) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.
			PCT87 (BR187, CW168, NA183, WE78) Poplar Box - Coolabah floodplain woodland on light clay soil mainly in the Darling Riverine Plains Bioregion
	North-west Alluvial Sand Woodlands	PCT71 (BR127, NA126, WE128) Carbeen - White Cypress Pine - River Red Gum - bloodwood tall woodland on sandy loam alluvial and eolian	PCT206 (BR138, CW132, NA136) Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion



Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
		soils in the northern Brigalow Belt South Bioregion and Darling Riverine Plains Bioregion	PCT227 (BR208, CW189, NA203) Silver-leaved Ironbark - White Cypress Pine - Rough-barked Apple woodland on alluvial terraces in central-north NSW
			PCT428 (BR281, NA267) Carbeen - White Cypress Pine - Curracabah - White Box tall woodland on sand in the Narrabri - Warialda region of the Brigalow Belt South Bioregion
			PCT72 (LA221, WE95) White Cypress Pine - Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion
		PCT135 (BR284, CW246, NA271) Coobah - Western Rosewood low open tall shrubland or woodland mainly on outwash areas in the Brigalow Belt South Bioregion.	PCT98 (BR188, CW170, LA250, NA184, WE137) Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
	Western Peneplain Woodlands		PCT103 (CW169, LA176, MR675, WE91) Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion
			PCT105 (CW171, LA177, WE92) Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion
			PCT109 (CW173, WE93) Poplar Box - Mulga - Ironwood woodland on red loam soils on plains in the Cobar Peneplain Bioregion and north-eastern Mulga Lands Bioregion



Vegetation Formation	etation Formation Vegetation Class Impact PCT		Alternative PCT Option
			PCT145 (BR249, CW222, NA235, WE150) Western Rosewood - Wilga - Wild Orange - Belah low woodland of the Brigalow Belt South Bioregion and eastern Darling Riverine Plains Bioregion
	Semi-arid Floodplain Grasslands  Floodplain Transition Woodlands		PCT43 (BR157, CW151, NA155, WE6) Mitchell Grass grassland - chenopod low open shrubland on floodplains in the semi-arid (hot) and arid zones
		PCT52 (BR191, NA187, WE7) Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains mainly the northern-eastern Darling Riverine Plains Bioregion	PCT49 (BR251, CW223, NA236) Partly derived Windmill Grass - copperburr alluvial plains shrubby grassland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
Grasslands			PCT50 (BR133, CW128, LA134, LM119, MR545, MU537, NA132, WE130) Couch Grass grassland wetland on river banks and floodplains of inland river systems
			PCT242 (BR192, CW174, LA179, LM141, MR590, MU565, NA188, WE139) Rats Tail Couch sod grassland wetland of inland floodplains
			PCT214 (BR167; CW161; NA168; WE134) Native Millet - Cup Grass grassland of the Darling Riverine Plains Bioregion
Grassy Woodlands		PCT56 (BR186, CW167, LA175, NA182, WE136) Poplar Box - Belah woodland on clay-loam soils	PCT70 (BR247, CW220, LA223, NA233, WE148) White Cypress Pine woodland on sandy loams in central NSW wheatbelt
		on alluvial plains of north-central NSW	PCT76 (CW145, LA154, MR566, MU555) Western Grey Box tall grassy woodland on alluvial loam and clay soils



Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
			in the NSW South Western Slopes and Riverina Bioregions
			PCT80 (LA153, MR565, MU554) Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
			PCT82 (CW144, LA152, MR564, WE96) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion
			PCT244 (BR190, CW172, LA178, NA186, WE138) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)
			PCT248 (CW152, LA162) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW
			PCT628 (BR282; NA268) Carbeen +/- Coolabah grassy woodland on floodplain clay loam soil on northwestern NSW floodplains, mainly Darling Riverine Plain Bioregion
Forested Wetlands	Inland Riverine Forests	PCT78 (BR196, CW184, NA193) River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	PCT36 (BR195, CW183, LA193, NA192, WE100) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion



Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
			PCT112 (BR119, CW237, NA253) Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in the Brigalow Belt South Bioregion
	North-west Slopes Dry Sclerophyll Woodlands	PCT413 (BR346, NA348) Silver-leaved Ironbark - White Cypress Pine - box dry shrub grass woodland of the Pilliga Scrub - Warialda region, Brigalow Belt South Bioregion	PCT228 (BR257; CW232; NA242) Semi-mesic woodland on basalt hills of the dry subtropical climate zone, north western slopes of NSW
			PCT318 (LA249; MR579; MU559) Mugga Ironbark - Tumbledown Red Gum - Red Box - Black Cypress Pine open forest on shallow stony soils on hills in the NSW South Western Slopes Bioregion
Dry Sclerophyll Forests (Shrub/grass sub- formation)			PCT385 (CW314; NA382) Warrumbungle trachyte hillcrest Tumbledown Red Gum - Black Cypress Pine - White Bloodwood shrubby woodland
			PCT412 (CW319; NA392) White Box - Black Cypress Pine shrubby hill woodland in the east Pilliga - Mendooran - Gulgong regions, mainly Brigalow Belt South Bioregion
			PCT413 (BR346; NA348) Silver-leaved Ironbark - White Cypress Pine - box dry shrub grass woodland of the Pilliga Scrub - Warialda region, Brigalow Belt South Bioregion



Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
			PCT429 (BR393; NA407) White Cypress Pine - Poplar Box - Silver-leaved Ironbark viney shrub woodland of the Brigalow Belt South Bioregion
			PCT435 (BR239; CW321; NA397) White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion
			PCT453 (BR373) Granite gorge Tumbledown Red Gum - White Cypress Pine - Oleander Wattle low open woodland in the Warialda region
			PCT527 (BR310) Mugga Ironbark - Black Cypress Pine shrubby open forest mainly in the Nandewar Bioregion and northern Brigalow Belt South Bioregion
			PCT549 (BR343) Silver-leaved Ironbark - Black Cypress Pine +/- White Box shrubby open forest mainly in the northern Nandewar Bioregion
			PCT564 (BR394, NA408) White Cypress Pine - Silver- leaved Ironbark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tableland Bioregion
			PCT591 (BR392, NA401) White Box shrubby open forest on hills mainly in the Nandewar Bioregion



Vegetation Formation	Vegetation Class	Impact PCT	Alternative PCT Option
			PCT594 (BR349, NA349) Silver-leaved Ironbark – White Cypress Pine shrubby open forest of Brigalow Belt South Bioregion and Nandewar Bioregion
			PCT595 (BR347) Silver-leaved Ironbark - White Cypress Pine - tea tree shrubby woodland mainly in the northern Nandewar Bioregion
			PCT596 (BR374) Tumbledown Red Gum - White Cypress Pine - Silver-leaved Ironbark shrubby woodland mainly in the northern Nandewar Bioregion
			PCT597 (BR385, NA396) White Box - cypress pine - Silver-leaved Ironbark shrub grass open forest / woodland of the northern Brigalow Belt South Bioregion and Nandewar Bioregion
			PCT598 (BR345, NA347) Silver-leaved Ironbark - White Box - White Cypress Pine viney scrub woodland in the Nandewar Bioregion and Brigalow Belt South Bioregio



#### 5.2. Methodology Used to Identify Suitable Offset Sites

In accordance with the Major Projects Offsets Policy, the options presently available for the proposal to fulfil its offset requirements are:

- Retiring biodiversity credits like for like offsets are secured and credits retired
- Contributing to supplementary measures, or
- Combination of the above.

Biodiversity credits are generated when a landholder agrees to enter a BioBanking agreement. BioBanking agreements provide security and certainty for offsets, as adequate funding for offset site management forms part of the agreements as well as stringent monitoring and reporting requirements to OEH.

The following steps were undertaken in order to find biodiversity credits for the PCTs and species requiring offsets for the proposal (refer Chapter 4).

Table 5-4 Process used to identify offset credits and like for like offsets for the proposal

	Step	Actions
1.	Check for available credits	The OEH biodiversity credits register was checked on 21 March 2017 to determine if ecosystem credits matching the proposal offset requirements have been issued and are available.
2.	Check for expressions of interest	The OEH Biobank site expression of interest (EOI) register was checked on 21 March 2017 to determine if a landholder may have credits matching the proposal offset requirements, but have not yet issued those credits.
3.	Identify potential like for like offset sites	A desktop analysis has been completed using the offset rules specified in Table 5-1 to identify potential like for like offset sites. Desktop analysis occurred during January 2017.
4.	Put a request on the credits wanted list	A 'credits wanted' request will be prepared and submitted on the OEH credits wanted register for the approximate number and type of credits required for the proposal once these are confirmed with assessing agencies.
5.	Test landholder interest	Post approval of the proposal contact will be made with shortlisted landholders to determine interest in entering into a BioBanking agreement and selling credits to ARTC.
6.	Validate offset credits	Based on landholder interest ground-truth the potential offset site to validate the presence of ecosystem and/or species credit requirements and assess overall suitability as an offset. Shortlist preferred offset properties that will then be taken to the next level of assessment.



 Investigate options for supplementary measures and estimate costs The indicative cost of supplementary measures is estimated with similar credits already sold as part of the BioBanking scheme acting as a guide to pricing. Estimated offset delivery costs for the proposal are summarised in Chapter 5.3.4.

#### 5.3. Biodiversity Offset Availability

The availability of ecosystem credits and potential like for like offset sites as identified by undertaking the actions described in Table 5-2 is discussed in the following sections.

#### 5.3.1. Offset Register Availability

The BioBanking public register is established under section 127ZZ of the TSC Act. The public register covers:

- BioBanking agreements register
- Biobank site expressions of interest (EOI) register
- BioBanking statements register
- Biodiversity credits register
- Biodiversity credit transactions and sales register.

The biodiversity credits register was searched on 21 March 2017 for credits available for purchase that satisfy the proposal offset requirements. At present, there are no suitable ecosystem credits in the impact subregions or adjoining subregions (Table 5-2) available on the BioBanking credit register (Table 5-5). There are three registered koala credits that could meet most of the proposal's species credit requirements, but an additional area would need to be found.

Table 5-5 Results of Biobank credit register searches

Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions
Ecosystem Credits – Pri	ority PCTs		
PCT27	BR233, NA219	No available credits in impact subregions.	No available credits state- wide.
PCT35	BR120, NA117	No available credits in impact subregions.	No available credits state- wide.
РСТ39	BR130, NA129	No available credits in impact subregions.	No available credits state- wide.
PCT52	BR191, NA187	No available credits in impact subregions.	No available credits state- wide.



Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions
PCT56	BR186, NA182	No available credits in impact subregions.	No available credits state- wide.
PCT71	BR127, NA126	No available credits in impact subregions.	No available credits statewide.
PCT78	BR196, NA193	No available credits in impact subregions.	No available credits state- wide.
PCT135	BR284, NA271	No available credits in impact subregions.	No available credits statewide.
PCT413	BR346, NA348	No available credits in impact subregions.	No available credits state- wide.
Ecosystem credits – Alt	ernative PCTs [Correspondi	ng Impact PCT]	
PCT26 [PCT27]	BR233, CW204, NA219, WE97	No available credits in alternative subregions.	No available credits state- wide.
PCT101 [PCT35]	BR189, NA185	No available credits in alternative subregions.	No available credits statewide.
PCT37 [PCT39]	BR105, CW106, NA105, WE73	No available credits in alternative subregions.	No available credits state- wide.
PCT40 [PCT39]	BR131, CW126, NA130, WE76	No available credits in alternative subregions.	No available credits state- wide.
PCT55 [PCT39]	BR102, CW104, NA102, WE66	No available credits in alternative subregions.	No available credits state- wide.
PCT87 [PCT39]	BR187, CW168, NA183, WE78	No available credits in alternative subregions.	No available credits state- wide.
PCT43 [PCT52]	BR157, CW151, NA155, WE6	No available credits in alternative subregions.	No available credits state- wide.
PCT49 [PCT52]	BR251, CW223, NA236	No available credits in alternative subregions.	No available credits statewide.
PCT50 [PCT52]	BR133, CW128, LA134, LM119, MR545, MU537, NA132, WE130	No available credits in alternative subregions.	No available credits state- wide.



Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions			
PCT242 [PCT52]	BR192, CW174, LA179, LM141, MR590, MU565, NA188, WE139	No available credits in alternative subregions.	No available credits state- wide.			
PCT70 [PCT56]	BR247, CW220, LA223, NA233, WE148	No available credits in alternative subregions.	No available credits state- wide.			
PCT76 [PCT56]	CW145, LA154, MR566, MU555	No available credits in alternative subregions.	No available credits state- wide.			
PCT80 [PCT56]	LA153, MR565, MU554	No available credits in alternative subregions.	No available credits statewide.			
PCT82 [PCT56]	CW144, LA152, MR564, WE96	No available credits in alternative subregions.	No available credits statewide.			
PCT244 [PCT56]	BR190, CW172, LA178, NA186, WE138	No available credits in alternative subregions.	No available credits statewide.			
PCT248 [PCT56]	CW152, LA162	No available credits in alternative subregions.	No available credits statewide.			
PCT628 [PCT56]	BR282; NA268	No available credits in alternative subregions.	No available credits statewide.			
PCT206 [PCT71]	BR138, CW132, NA136	No available credits in alternative subregions.	No available credits statewide.			
PCT227 [PCT71]	BR208, CW189, NA203	No available credits in alternative subregions.	No available credits statewide.			
PCT428 [PCT71]	BR281, NA267	No available credits in alternative subregions.	No available credits statewide.			
PCT36 [PCT78]	BR195, CW183, LA193, NA192, WE100	No available credits in alternative subregions.	No available credits statewide.			
PCT112 [PCT78]	BR119, CW237, NA253	No available credits in alternative subregions.	No available credits statewide.			
PCT72 [PCT135]	LA221, WE95	No available credits in alternative subregions.	No available credits statewide.			
PCT98 [PCT135]	BR188, CW170, LA250, NA184, WE137	No available credits in alternative subregions.	No available credits statewide.			



Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions			
PCT103 [PCT135]	CW169, LA176, MR675, WE91	No available credits in alternative subregions.	No available credits statewide.			
PCT105 [PCT135]	CW171, LA177, WE92	No available credits in alternative subregions.	No available credits statewide.			
PCT109 [PCT135]	CW173, WE93	No available credits in alternative subregions.	No available credits state- wide.			
PCT145 [PCT135]	BR249, CW222, NA235, WE150	No available credits in alternative subregions.	No available credits state- wide.			
PCT429 [PCT413]	BR393, NA407	No available credits in alternative subregions.	No available credits state- wide.			
PCT435 [PCT413]	BR239, CW321, NA397	No available credits in alternative subregions.	No available credits state- wide.			
PCT453 [PCT413]	BR373	No available credits in alternative subregions.	No available credits state- wide.			
PCT527 [PCT413]	BR310	No available credits in alternative subregions.	No available credits state- wide.			
PCT549 [PCT413]	BR343	No available credits in alternative subregions.	No available credits state- wide.			
PCT564 [PCT413]	BR394, NA408	No available credits in alternative subregions.	No available credits state- wide.			
PCT591 [PCT413]	BR392, NA401	No available credits in alternative subregions.	No available credits state- wide.			
PCT594 [PCT413]	BR349, NA349	No available credits in alternative subregions.	No available credits state- wide.			
PCT595 [PCT413]	BR347	No available credits in alternative subregions.	No available credits state- wide.			
PCT596 [PCT413]	BR374	No available credits in alternative subregions.	No available credits state- wide.			
PCT597 [PCT413]	BR385, NA396	No available credits in alternative subregions.	No available credits state- wide.			



Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions			
PCT598 [PCT413]	BR345, NA347	No available credits in alternative subregions.	No available credits state- wide.			
Species Credits						
koala (Phascolarctos cinereus)	N/A	There are no species credits for the koala available in the impact subregions  There are three credit registered areas for koalas state-wide available for use. All are classified with a credit status of "Issued" and have a combined credit number of 1,391. One is located within the Macleay Hastings - Northern Rivers subregio of Kempsey Shire LGA with 965 credits available for use.  The second is located in the Cumberland – Hawke Karuah Manning subregion of Great Lakes LGA with 109 credits available. The third is located in Cumberland - Hawkesbury/Nepean subregion of Wollondilly Shire LGA with 317 credit available.  1,632 koala credits are needed for the proposal. Therefore, there would still be a deficit of 241				
finger panic grass (Digitaria porrecta)	N/A	There are no species credits for finger panic grass available in the impact subregions.	There are no species credits for finger panic grass available statewide.			



Impact PCT Biodiversity credit required	BioBanking Plant Community Codes	Availability in impact subregions	Availability in adjoining subregions		
creeping tick-trefoil (Desmodium campylocaulon)	N/A	There are no species credits for creeping tick-trefoil available in the impact subregions.	There are no species credits for creeping tick-trefoil available statewide.		
Belson's panic (Homopholis belsonii)	N/A	There are no species credits for Belson's panic available in the impact subregions.	There are no species credits for Belson's panic available statewide.		

# 5.3.2. Expressions of Interest

The Biobank EOI register provides details of potential Biobank sites that could generate biodiversity credits in the future. The EOI register was searched on 22 March 2017 for potential sites with ecosystem credits that would satisfy the proposal offset requirements (Table 5-6). Two EOI's have the potential to be located in an impact subregion which may contain areas of PCT71 and PCT78.

**Table 5-6** Results of Biobank Credit Expressions of Interest Searches

Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions					
Ecosystem credits – Impact/priority PCTs								
PCT27	BR233, NA219	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions					
PCT35	BR120, NA117	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions					
РСТ39	BR130, NA129	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions					
PCT52	BR191, NA187	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions					
PCT56	BR186, NA182	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions					
PCT71	BR127, NA126	There is currently one EOI for BR127* (Carbeen - White Cypress Pine - River Red Gum - bloodwood tall woodland on sandy loam alluvial and eolian soils in the northern Brigalow Belt	There are currently no EOIs in adjoining subregions					



Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions		
		South Bioregion and Darling Riverine Plains Bioregion) within the Inverell Shire Council, Northeast Basalts IBRA sub- region. The total patch size comprises 25-100ha of potential ecosystem credits. Further information on the EOI site will need to be sought.			
РСТ78	BR196, NA193	There is currently one EOI for NA193* (River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion) within the Narrabri Shire Council, Pilliga Outwash IBRA sub-region. The total site area comprises 2570 ha of potential ecosystem credits. Further information on the EOI site will need to be sought.	There are currently no EOIs in adjoining subregions		
PCT135	BR284, NA271	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions		
PCT413	BR346, NA348	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions		
Ecosystem credits –	Alternative PCTs [Corre	sponding Impact PCT]			
PCT26 [PCT27]	BR233, CW204, NA219, WE97	There are currently no EOIs for the impact subregions.	There are currently no EOIs in adjoining subregions		
PCT101 [PCT35]	BR189, NA185	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT37 [PCT39]	BR105, CW106, NA105, WE73	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT40 [PCT39]	BR131, CW126, NA130, WE76	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		



Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions			
PCT55 [PCT39]	BR102, CW104, NA102, WE66	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT87 [PCT39]	BR187, CW168, NA183, WE78	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT43 [PCT52]	BR157, CW151, NA155, WE6	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT49 [PCT52]	BR251, CW223, NA236	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT50 [PCT52]	BR133, CW128, LA134, LM119, MR545, MU537, NA132, WE130	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT242 [PCT52]	BR192, CW174, LA179, LM141, MR590, MU565, NA188, WE139	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT70 [PCT56]	BR247, CW220, LA223, NA233, WE148	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT76 [PCT56]	CW145, LA154, MR566, MU555	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT80 [PCT56]	LA153, MR565, MU554	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT82 [PCT56]	CW144, LA152, MR564, WE96	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT244 [PCT56]	BR190, CW172, LA178, NA186, WE138	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			
PCT248 [PCT56]	CW152, LA162	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions			



Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions
PCT628 [PCT56]	BR282, NA268	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT206 [PCT71]	BR138, CW132, NA136	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT227 [PCT71]	BR208, CW189, NA203	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT428 [PCT71]	BR281, NA267	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT36 [PCT78]	BR195, CW183, LA193, NA192, WE100	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT112 [PCT78]	BR119, CW237, NA253	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT72 [PCT135]	LA221, WE95	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT98 [PCT135]	BR188, CW170, LA250, NA184, WE137	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT103 [PCT135]	CW169, LA176, MR675, WE91	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT105 [PCT135]	CW171, LA177, WE92	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT109 [PCT135]	CW173, WE93	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT145 [PCT135]	BR249, CW222, NA235, WE150	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT429 [PCT413]	BR393, NA407	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions
PCT435 [PCT413]	BR239, CW321, NA397	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions



Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions		
PCT453 [PCT413]	BR373	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT527 [PCT413]	BR310	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT549 [PCT413]	BR343	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT564 [PCT413]	BR394, NA408	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT591 [PCT413]	BR392, NA401	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT594 [PCT413]	BR349, NA349	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT595 [PCT413]	BR347	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT596 [PCT413]	BR374	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT597 [PCT413]	BR385, NA396	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
PCT598 [PCT413]	BR345, NA347	There are currently no EOIs for the alternative subregions.	There are currently no EOIs in adjoining subregions		
Species credits					
koala	N/A	There are currently no EOIs for the impact subregions.	There are currently no EOIs for the adjoining subregions. However, under FBA an offset site can be used in a different subregion if it occurs in the species known distribution.  There are currently 14 EOIs for the koala statewide located within Burragorang (Part A), Coffs Coast & Escarpment, Cumberland – Hawkesbury/Nepean,		



Ecosystem credit required	BioBanking Plant Community Codes	EOIs in impact subregions	EOIs in adjoining subregions
			Illawarra, Karuah Manning, Macleay Hastings – Northern Rivers, Peel – Namoi, Richmond-Tweed (Part B), Sydney Cataract – Sydney Metro and Upper Hunter IBRA sub-regions, providing 4,116.2 ha of potential ecosystem credits.
finger panic grass	N/A	There are currently no EOIs for the impact subregions.	There are currently no EOIs statewide.
creeping tick- trefoil	N/A	There are currently no EOIs for the impact subregions.	There are currently no EOIs statewide.
Belson's panic	N/A	There are currently no EOIs for the impact subregions.	There are currently no EOIs statewide.

### 5.3.3. Desktop Analysis

To assess availability of potential offset sites (other than those registered through OEH databases) a spatial analysis of OEH's Vegetation Information System (VIS) database and mapping was undertaken. Based on the latest PCT mapping available for the impact and adjacent subregions, spatial analysis identified the extent of each impact PCT or suitable alternative PCT. It should be noted there are some limitations with the spatial analysis; PCT mapping was unavailable for a number of adjacent subregions in the north-west, there may also be a level of inaccuracy in the PCT mapping therefore future steps will include field validation and an evaluation of landholder interest.

The spatial extent of each impact PCT and alternative PCTs is presented in figures in Appendix A.

The results of the spatial analysis using NSW State Type Vegetation Mapping (STVM) indicate that there are mapped areas of each impact PCT (except for PCT52) within at least one of the impact subregions (Table 5-7; Appendix A). Based on the results of desktop analysis there are sufficient areas of impact or alternative PCTs that could be used for offsets within impact and/or adjoining subregions. PCT135 was found to be restricted in its availability, with only 1ha mapped in the impact subregion of Northern Basalts and 36ha mapped in adjoining subregions. PCT52 did not have any mapped areas occurring in any impact or adjoining subregions. Throughout most of NSW native grasslands have been extensively cleared or modified, and now mainly occur as small remnants, thereby making them difficult to map. In 2010 a study was commissioned to map areas of native grassland in the Namoi Catchment that are likely to be remnants of the EPBC-listed grassland (associated with PCT52) using a combination of extensive field validation, existing vegetation mapping, historic information from Parish and Portion plans, and various spatial layers. It was found that about 8,900 hectares remain out of a probable pre-European extent of about 183,000 hectares in the Namoi Catchment. This mapping will be used to support offset identification in the next phase.



As a priority offsets should be located within the impact subregions as far as practical. Should this not be possible, the adjoining subregions with the greatest mapped areas and ability to co-locate PCTs should be considered as a priority, given their proximity to the proposal site and associated impacts.



Table 5-7 Area (ha) of Impact PCTs in each impact subregion and adjoining subregion.

Impact PCT	Area (	ha) – Impact Su	bregions	Area (ha) – Adjoining Subregions								
	Northern Basalts	Northern Outwash	Castlereagh- Barwon	Bogan- Macqua rie	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex
PCT27	5,038	8,631	43,623	36,991	166	16	1,833	99	938	108	-	-
PCT35	5,735	4,521	564	-	-	-	25	-	16	10,770	-	-
РСТ39	63	7,395	169,884	9,294	-	-	73	-	-	650	-	-
PCT52	-	-	-	-	-	-	-	-	-	-	-	-
PCT56	1,988	8,677	80,704	16,508	-	-	7	3	520	2,066	-	-
PCT71	1	1	1,862	-	-	-	-	-	-	-	-	-
PCT78	2,772	252	719	32	5	334	6,651	3,83 8	4,261	1,404	-	2,368
PCT135	1	-	-	34	-	-	-	-	2	-	-	-
PCT413	3,310	8	-	-	-	-	-	336	-	-	-	-



Table 5-8 Area (ha) of Alternative PCTs in each impact subregion and adjoining subregion

Alternative PCT	Area (	(ha) – Impact S	ubregions	Area (ha) – Adjoining Subregions								
[Associated Impact PCT]	Norther n Basalts	Northern Outwash	Castlereagh- Barwon	Bogan- Macquarie	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex
PCT26 [PCT27]	-	-	-	17	-	-	-	-	-	-	-	-
PCT101 [PCT35]	5	-	1	-	-	-	16,372	723	7	2,472	-	-
PCT37 [PCT39]	-	-	167,808	114,494	-	-	-	-	-	1,080	-	-
PCT40 [PCT39]	-	484	216,325	32,854	-	-	-	-	-	48	-	-
PCT55 [PCT39]	4,650	29,123	40,507	5,645	-	13	313	5	1,330	3,755	-	-
PCT87 [PCT39]	-	112	5,953	76	-	-	-	-	-	17	-	-
PCT43 [PCT52]	-	9	4,862	2,941	-	-	7	-	-	-	-	-
PCT49 [PCT52]	-	-	287,854	266,569	-	-	-	-	17,123	69	-	-



PCT242 [PCT52]	-	-	6,667	7,017	-	-	-	-	-	-	-	-
PCT70 [PCT56]	-	-	18,643	11,621	-	-	-	-	2,305	20	-	-
PCT76 [PCT56]	-	-	253	3,168	-	-	-	-	513	-	-	-
PCT80 [PCT56]	-	-	-	286	-	-	-	-	97	-	-	-
PCT82 [PCT56]	-	-	-	9,059	-	-	-	-	1,379	-	-	-
PCT244 [PCT56]	3,430	166	54,775	86,905	3	-	-	304	3,432	1,403	-	583
PCT248 [PCT56]	-	-	2,960	4,972	-	-	-	-	549	-	-	-
PCT628 [PCT56]	-	-	287	-	-	-	-	-	-	-	-	-
PCT206 [PCT71]	-	-	10,790	30	-	-	-	-	373	3,611	-	-
PCT227 [PCT71]	1	-	8	-	-	-	-	-	46	-	-	-
PCT428 [PCT71]	250	-	-	-	-	-	12	-	-	-	-	-



PCT36 [PCT78]	3,021	5,452	41,187	40,349	-	-	-	5	2,746	392	1	125
PCT112 [PCT78]	708	3	-	-	121	487	1,309	3,334	-	-	-	165
PCT72 [PCT135]	-	-	-	213	-	-	-	-	-	-	-	-
PCT98 [PCT135]	80	33	42,522	36,511	-	-	-	-	417	7	-	-
PCT103 [PCT135]	-	-	-	0.35	-	-	-	-	-	-	-	-
PCT105 [PCT135]	-	-	-	41	-	-	-	-	-	-	-	-
PCT109 [PCT135]	-	-	-	34	-	-	-	-	-	-	-	-
PCT145 [PCT135]	669	589	66,310	53,223	4	1	236	87	287	1,166	-	19
PCT429 [PCT413]	740	-	-	-	-	-	-	302	-	-	-	-
PCT435 [PCT413]	13	-		-	-	-	10,570	3,412	8,055	7	-	-
PCT453 [PCT413]	360	-	-	-	469	-	-	-	-	-	-	-



PCT527 [PCT413]	187	-	-	-	260	-	-	-	-	-	-	73
PCT549 [PCT413]	382	-	-	-	998	-	-	-	-	-	-	934
PCT564 [PCT413]	178	-	-	-	358	-	-	3,638	-	-	-	57
PCT591 [PCT413]	144	-	-	-	-	17,589	1,557	63,635	-	-	-	-
PCT594 [PCT413]	6,821	-	-	-	349	2,280	2,929	54,055	-	-	-	21,896
PCT595 [PCT413]	1,784	-	-	-	32							31,259
PCT596 [PCT413]	574	-	-	-	1,252							55,667
PCT597 [PCT413]	27,79 7	13	-	-	9,728	2,061	1,293	23,354	2	-	-	279
PCT598 [PCT413]	3,210	-	-	-	289	72	149	25,777				977



Table 5-9 Koala habitat impact PCT area (ha) in each impact subregion and adjoining subregion.

Koala Habitat	Area (h	a) – Impact Sub	regions	Area (ha) – Adjoining Subregions									
(Associate d PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquarie	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex	
PCT39	63	7,395	169,884	9,294	-	-	73	-	-	650	-	-	
PCT78	2,772	252	719	32	5	334	6,651	3,838	4,261	1,404	-	2,368	
PCT56	1,988	8,677	80,704	16,508	-	-	7	3	520	2,066	-	-	
TOTAL	4,823	16,324	251,307	25,834	5	334	6,731	3,841	4,781	4,120	-	2,368	
Grand Total												320,468	

Table 5-10 Finger panic grass habitat in impact and alternative PCT area (ha) in each impact subregion and adjoining subregion.

Finger panic grass	Area (h	a) – Impact Sub	regions		Area (ha) – Adjoining Subregions								
(Associate d PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex	
PCT27	5,038	8,631	43,623	36,991	166	16	1,833	99	938	108	-	-	
PCT35	5,735	4,521	564	-	-	-	25	-	16	10,770	-	-	



Finger panic grass	Area (ha) – Impact Subregions			Area (ha) – Adjoining Subregions									
(Associate d PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex	
РСТ39	63	7,395	169,884	9,294	-	-	73	-	-	650	-	-	
PCT52	-	-	-	-	-	-	-	-	-	-	-	-	
PCT56	1,988	8,677	80,704	16,508	-	-	7	3	520	2,066	-	-	
PCT135	1	-	-	34	-	-	-	-	2	-	-	-	
TOTAL	12,825	29,224	294,775	62,827	166	16	1,938	102	1,476	13,594	-	-	
Grand Total												416,943	

Table 5-11 Creeping tick-trefoil habitat impact PCT area (ha) in each impact subregion and adjoining subregion.

Creeping tick-trefoil					Area (ha) — Adjoining Subregions									
(Associated PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex		
PCT27	5,038	8,631	43,623	36,991	166	16	1,833	99	938	108	-	-		
PCT35	5,735	4,521	564	-	-	-	25	-	16	10,770	-	-		



Creeping tick-trefoil	Area (h	Area (ha) – Impact Subregions			Area (ha) – Adjoining Subregions									
(Associated PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex		
РСТ39	63	7,395	169,884	9,294	-	-	73	-	-	650	-	-		
PCT52	-	-	-	-	-	-	-	-	-	-	-	-		
TOTAL	10,836	20,547	214,071	46,285	166	16	1,931	99	954	11,528	-	-		
Grand Total												306,433		

Table 5-12 Belson's panic habitat impact PCT area (ha) in each impact subregion and adjoining subregion.

Belson's panic	Area (h	Area (ha) – Impact Subregions			Area (ha) – Adjoining Subregions									
(Associated PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex		
PCT27	5,038	8,631	43,623	36,991	166	16	1,833	99	938	108	-	-		
PCT35	5,735	4,521	564	-	-	-	25	-	16	10,770	-	-		
PCT52	-	-	-	-	-	-	-	-	-	-	-	-		
PCT56	1,988	8,677	80,704	16,508	-	-	7	3	520	2,066	-	-		



Belson's panic	Area (h	Area (ha) – Impact Subregions			Area (ha) – Adjoining Subregions									
(Associated PCT)	Northern Basalts	Northern Outwash	Castlereag h-Barwon	Bogan- Macquari e	Inverell Basalts	Kaputar	Liverpool Plains	Peel	Pilliga	Pilliga Outwash	Moonie- Barwon Interfluve	Nandewar Northern Complex		
PCT71	1	1	1,862	-	-	-	-	-	-	-	-	-		
PCT135	1	-	-	34	-	-	-	-	2	-	-	-		
TOTAL	12,763	21,830	126,753	53,533	166	16	1,865	102	1,474	12,944	-	-		
Grand Total												231,446		



### 5.3.4. Supplementary Measures

Under the Major Projects Offsets Policy, a proponent may use supplementary measures which are defined as: another measure undertaken as part of the BOS that is likely to lead to improvements in biodiversity or other environmental values that are not on an offset site. The policy states that proponents can provide funds for supplementary measures when offsets are not available and requires that supplementary measures be of an equivalent cost to the provision of offsets.

A search of the OEH biodiversity credits register for the impacted PCTs (performed in March 2017) indicated there were no suitable credits available for purchase. Subsequently, an evaluation of all available offset transactions listed in the OEH biodiversity credits register for 2015 and 2016 has been completed to support determination of the cost to provide ecosystem and species credits.

The estimated cost has been calculated using the average range of price per credit of all available transactions per year and averaged between years to determine the current market for estimated costs of providing offsets for unavoidable impacts.

### 5.3.5. Ecosystem Supplementary Measures

To support a quantification of what the extent of funds may be required for supplementary measures, an evaluation of costs associated with approved biodiversity offsets was undertaken. There was a total of 102 available transactions for analysis. The costs for offsets in years 2015-2016 was calculated at an average of \$10,554 per ecosystem credit and ranged from \$1,451 - \$24,482 per ecosystem credit. Costs include landholder payments and ongoing management payments. The transactions were from a variety of subregions predominantly in urban areas such as Cumberland-Sydney Metro, coastal regions such as Jervis and Bateman or resource focused areas such as Upper Hunter. Due to the location of these transactions the calculated costs are likely to be inflated compared to the proposals impact and adjacent subregions. Results of the cost analysis for each impact PCT and required ecosystem credits are shown in Table 5-13.

Table 5-13 Estimated offset delivery costs for ecosystem credits

Impact PCT	Proposal Credits Required	Minimum Cost Range (\$)	Maximum Cost Range (\$)	Average Total Cost (\$)
PCT27	254	368,554	6,218,428	3,292,491
PCT35	250	362,750	6,120,500	3,241,625
PCT39	63	91,413	1,542,366	816,889.50
PCT52	11,046	16,027,746	270,428,172	143,227.96
PCT56	3,386	4,913,086	82,896,052	43,904,569
PCT56 (Derived Natural Grassland)	2,917	4,232,567	71,413,994	37,823,280.50
PCT71	2	2,902	48,964	25,933
PCT78	675	979,425	16,525,350	8,752,387.50



Impact PCT	Proposal Credits Required	Minimum Cost Range (\$)	Maximum Cost Range (\$)	Average Total Cost (\$)
PCT135	133	192,983	3,256,106	1,724,544.50
PCT413	100	145,100	2,448,200	1,296,650

# 5.3.6. Species Supplementary Measures

There was a total of nine available transactions for analysis. The average cost for years 2015-2016 was calculated at a rate of \$2,410.70 per species credit with a range of \$5.50 - \$7,750.00 per species credit. Due to the location of these transactions being in coastal regions of NSW the calculated costs are likely to be inflated compared to the proposals impact and adjacent subregions. The impacted PCTs and some alternate PCTs provide suitable habitat for the threatened species required to be offset. It is therefore proposed the species credits will be offset as a component of the PCT offset areas, therefore there should be no additional costs to delivering ecosystem offset areas.

Table 5-14 Estimated offset deliver costs for species credits

Impact Species	Credits Required	Minimum Range Cost (\$)	Maximum Range Cost (\$)	Average Total Cost (\$)
koala	1,632	8,976	12,648,000	6,328,488
finger panic grass	364	2,002	2,821,000	1,411,501
creeping tick- trefoil	2,607	14,338.50	20,204,250	10,109,294.25
Belson's panic	1,898	10,439	14,709,500	7,359,969.50



### 6. CONCLUSION

This report has assessed the proposal's ecosystem and species offset requirements and estimated the availability of offsets in accordance with the NSW Major Projects Offset Policy and FBA.

The BAR has identified nine PCTs (PCT27, PCT35, PCT39, PCT52, PCT56, PCT71, PCT78, PCT135, PCT413) across 10 condition classes, three listed flora species (finger panic grass, creeping tick-trefoil, Belson's panic) and one fauna species (koala) as requiring biodiversity offsets as a result of the proposal. Under the EPBC Act assessments it was identified there are two MNES required to be offset being; the Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland TEC and the koala. The TEC will be offset as part of offsetting PCT52 and habitat for the koala will be offset as part of offsetting PCT39, PCT78 and PCT56 and koala species credit requirements.

In total 18,826 ecosystem credits (across nine PCTs) and 6,501 species credits (koalas, finger panic grass, creeping tick-trefoil and Belson's panic) need to be retired for the proposal. It is proposed the retirement of ecosystem credits associated with the native vegetation communities occurring in the proposal site also incorporates the required species credits.

Analysis has been undertaken using desktop information to identify the availability of these offset requirements. A range of sources were investigated including the OEH biodiversity credits register, EOI register and desktop spatial analysis using available PCT mapping. The assessment identified that there are no existing registered suitable ecosystem credits or flora species credits occurring in the impact subregions or adjacent subregions. There are two EOI's located in an impact subregion that may contain areas of impact PCT71 and PCT78. These EOI will be explored further in the next stage for their suitability. For koala species credits there are three existing credit registered offset areas, and 14 EOI within NSW. It is likely there would be adequate koala credits available to meet the proposal's requirements. Under the FBA proponents are permitted to offset for a threatened species within other subregions that are within the known geographic distribution of the threatened species impacted.

In order to assess offset availability more broadly, a spatial analysis of OEH's VIS database and mapping was undertaken. Desktop analysis found that for the majority of impact PCTs there are adequate areas mapped within the impact subregions and adjoining subregions to meet the proposal's offset requirements. For impact PCT52 Queensland Bluegrass +/- Mitchell Grass grassland on cracking clay floodplains and alluvial plains various data sources will be used in the next phase to identify potential offset areas given the extent of clearing in the region. The community is over 75% cleared in the Border Rivers/Gwydir and Namoi catchment areas, due to historical clearing for agriculture, cropping and changes to hydrology in these regions. Due to finer scale ground-truthing for the proposal vegetation surveys have confirmed the presence of this ecological community within the disturbance footprint. PCT135 Coobah - Western Rosewood low open tall shrubland or woodland mainly on outwash areas in the Brigalow Belt South Bioregion has only 1ha mapped within an impact subregion and 36ha mapped in adjoining subregions. Therefore offsets for these PCTs may need to use alternate PCTs.

Due to a lack of suitable registered offsets for ecosystem and flora species credits ARTC will need to investigate sourcing their own offset sites and register BioBanking agreements with landowners. A preference will be for land-based offsets that are strategically located in the impact or adjacent subregions, where a number of PCTs and species habitats can be co-located, and 'like for like' conservation outcomes are achieved.

The analysis suggests there is ample opportunity to identify potential offsets for impact PCTs within either an impact subregion or adjoining subregion as summarised in Table 6-1. The two PCTs with more limited availability are PCT52 and PCT135. PCT 135 has smaller credit requirements, however PCT52 requires larger areas. Therefore, further investigation into the occurrence of PCT52 and alternative PCTs will be undertaken in the next stage.



Table 6-1 Summary of area (ha) of impact PCTs in each impact subregion and adjoining subregion

Offset Value	Development Impact Area (ha)	Offset Avail. Impact Subregions (ha)	Offset Avail. Adjoining Subregions (ha)	Comments			
Impact PCTs							
PCT27 (BR233, NA219)	5.05	57,292	40,151	Scattered patches of PCT27 are mapped in the impact and adjoining subregions. Very little alternative PCTs are mapped.			
PCT35 (BR120, NA117)	3.54	10,820	10,812	The most of PCT35 patches are in the northern areas of the proposal. Alternative PCTs are mapped to the south of the proposal in adjoining subregions.			
PCT39 (BR130, NA129)	1.19	177,342	10,017	There are substantial areas of PCT39 mapped to the west of the proposal in the impact subregions. There are also large areas of alternative PCTs mapped to the west and southwest.			
PCT52 (BR191, NA187)	237.41	tbd	tbd	There are no mapped areas of PCT52 in the impact or adjoining subregions using NSW vegetation mapping. Other data sources including native grassland mapping in the Namoi Catchment will be used to support identification of available offset areas. There are large areas of alternative PCTs mapped to the south-west of the proposal in impact and adjoining subregions north of Dubbo.			
PCT56 (BR186, NA182)	142.94	91,369	19,103	Areas of PCT56 are mapped in proximity to the proposal and north of proposal. Larger areas of alternative PCTs are mapped to the south-west of the proposal, west of Dubbo.			
PCT71 (BR127, NA126, WE128)	0.04	1,864	0	Only small areas of PCT71 are mapped to the west of the proposal. There is also limited alternative PCTs available south-west of the proposal around Coonamble.			
PCT78 (BR196, CW184, NA193)	14.59	3,743	18,893	Areas of PCT78 are mapped along rivers and drainage lines to the east of the proposal in impact and adjacent subregions. Alternative PCTs are also mapped to the west of the proposal restricted to rivers and drainage lines.			
PCT135	3.57	1	36	Very small areas of PCT135 occur in the impact or adjoining subregions. Larger areas of alternative			



Offset Value	Development Impact Area (ha)	Offset Avail. Impact Subregions (ha)	Offset Avail. Adjoining Subregions (ha)	Comments
(BR284, CW246, NA271)				PCTs are mapped to the west of the proposal north-east of Nyngan and around Coonamble.
PCT413 (BR346, NA348)	2.29	3,318	336	Only minor areas of PCT413 are mapped to the east of the proposal. However there is greater availability of alternative PCTs to the east in adjoining subregions west of Inverell and northeast of Tamworth.

## The next steps will be to:

- Confirm the ecosystem credits and species credits required to be offset with relevant agencies through finalisation of the approval process and detailed design.
- A 'credits wanted' request will be prepared and submitted on the OEH credits wanted register for the approximate number and type of credits required for the proposal.
- Develop a shortlist of preferred offset properties based on desktop analysis. Preference would be properties
  that contain a number of the required PCTs, suitable habitats for those species required to be offset and are
  located in the impact or adjacent subregions and are strategically located.
- Undertake landholder engagement and field surveys to validate the presence of the biodiversity offset values, management actions required and overall suitability of the site.
- Based on the results of preliminary field surveys and landholder discussions, final offset sites would be selected. These sites would then be assessed by an accredited BioBanker and the number and type of biodiversity credits that can be generated would be finalised.
- Within 12 months of commencement of construction, ARTC would prepare a Biodiversity Offset Strategy (BOS) Phase 3 for approval. This report would include:
  - i. Details of the final offset sites
  - ii. Ecosystem credits and species credits created at an offset site
  - iii. Credit profiles for ecosystem credits and species credits at the offset site
  - iv. Identification of any ecosystem and species credits that are proposed to be converted to a supplementary measure
  - v. A summary of biodiversity offset measures and how these match to credit requirements created by the development site
  - vi. A management plan detailing management actions and the vegetation zones to which they will apply in accordance with BBAM Section 12.9.



### 7. REFERENCES

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APPENDIX A - MAPPING OF PCT DISTRIBUTION IN THE IMPACT AND ADJOINING SUBREGIONS

