YANCOAL
兖煤澳大利亚有限公司

WARKWORTH MINE

Biodiversity Management Plan

Yancoal Warkworth Mine, New South Wales | September 2018

The Biodiversity Management Plan is a requirement of Warkworth Mining Limited NSW Project Approval (SSD-6464) to operate the Warkworth Coal Mine. It details the implementation of the Biodiversity Offset Strategy and biodiversity management actions on the mine's operational land and Biodiversity Areas.

Cover photo
Goulburn River - Goulburn River Biodiversity Area, 2015

Document Title	Version	Date Effective	Comment
Biodiversity Management Plan	1	3/12/2015	Consultation with OEH and DPE
Biodiversity Management Plan	2	29/01/2016	Final submitted for approval
Biodiversity Management Plan	3	15/02/2017	Revisions for approval by DPE
Biodiversity Management Plan	4	30/11/2017	Revision for Yancoal Ownership
Biodiversity Management Plan	5	30/07/2018	Revision following AER 2017
Biodiversity Management Plan	6	19/09/2018	Revision for approval by DPE

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Abbreviations and Definitions

BA	Biodiversity Area includes the Offset Area, infrastructure and other land.
BCAM	BioBanking Certification Assessment Methodology
BMP	Biodiversity Management Plan
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
CHGBIW	Central Hunter Grey Box – Ironbark Woodland
Coal & Allied	Coal & Allied Operations Limited
DoEE	Australian Government Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
E	Endangered
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act* 1979
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FBA	Framework for Biodiversity Assessment
GDP	Ground Disturbance Permit
ha	Hectare
km	Kilometre
MNES	Matter of National Environmental Significance
MP	Management Plan
MTO	Mount Thorley Operations
MTW	Mount Thorley Warkworth
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
Offset Area	Area of vegetation and habitat secure by legally binding mechanism.
PC	Performance Criteria
PCT	Plant Community Type
TARP	Trigger Response Action Plan
TSC Act	NSW *Threatened Species Conservation Act 1995*
V	Vulnerable
WBACH	Wollombi Brook Aboriginal Cultural Heritage
WML	Warkworth Mining Limited
WS Grassland	Warkworth Sands Grassland
WSW	Warkworth Sands Woodland
Yancoal	Yancoal Australia Limited

1 Introduction

Warkworth Mine is owned by Warkworth Mining Limited (WML). In 2004 the Warkworth Mine and the adjoining Mount Thorley Operations (MTO) were integrated and operate as Mount Thorley Warkworth (MTW) for mining purposes. The MTW coal mine is operated and managed by Yancoal Australia Limited (Yancoal).

Warkworth Mine has been granted environmental approvals under Commonwealth and NSW legislation to construct and operate an open cut coal mine located approximately 15 kilometres (km) southwest from Singleton, NSW.

The Commonwealth Minister for the Environment granted WML two approvals under provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the first in February 2004 (EPBC2002/629) and the second in August 2012 (EPBC2009/5081).

The NSW government granted Project Approval (DA 300_09_0202i) in 2003 under the NSW *Environmental Planning and Assessment Act 1979* (EPA Act) to account for the impact of a mine extension. The Warkworth Continuation Project Project Approval (SSD-6464) was granted to account for impacts of the second mine extension in 2015.

The Commonwealth and State determinations provide approval to impact the same disturbance area; therefore some offset areas are used to offset the impact upon Matters of National and State Environmental Significance.

1.1 Purpose

The Biodiversity Management Plan (BMP) is a requirement of Condition 36 of the Project Approval (SSD-6464). The BMP aims to ensure that the mine operates in compliance with all avoidance, minimisation and rehabilitation measures detailed it the Warkworth Continuation Project Environmental Impact Statement and implements the Biodiversity Offset Strategy to mitigate the mines impact on biodiversity values.

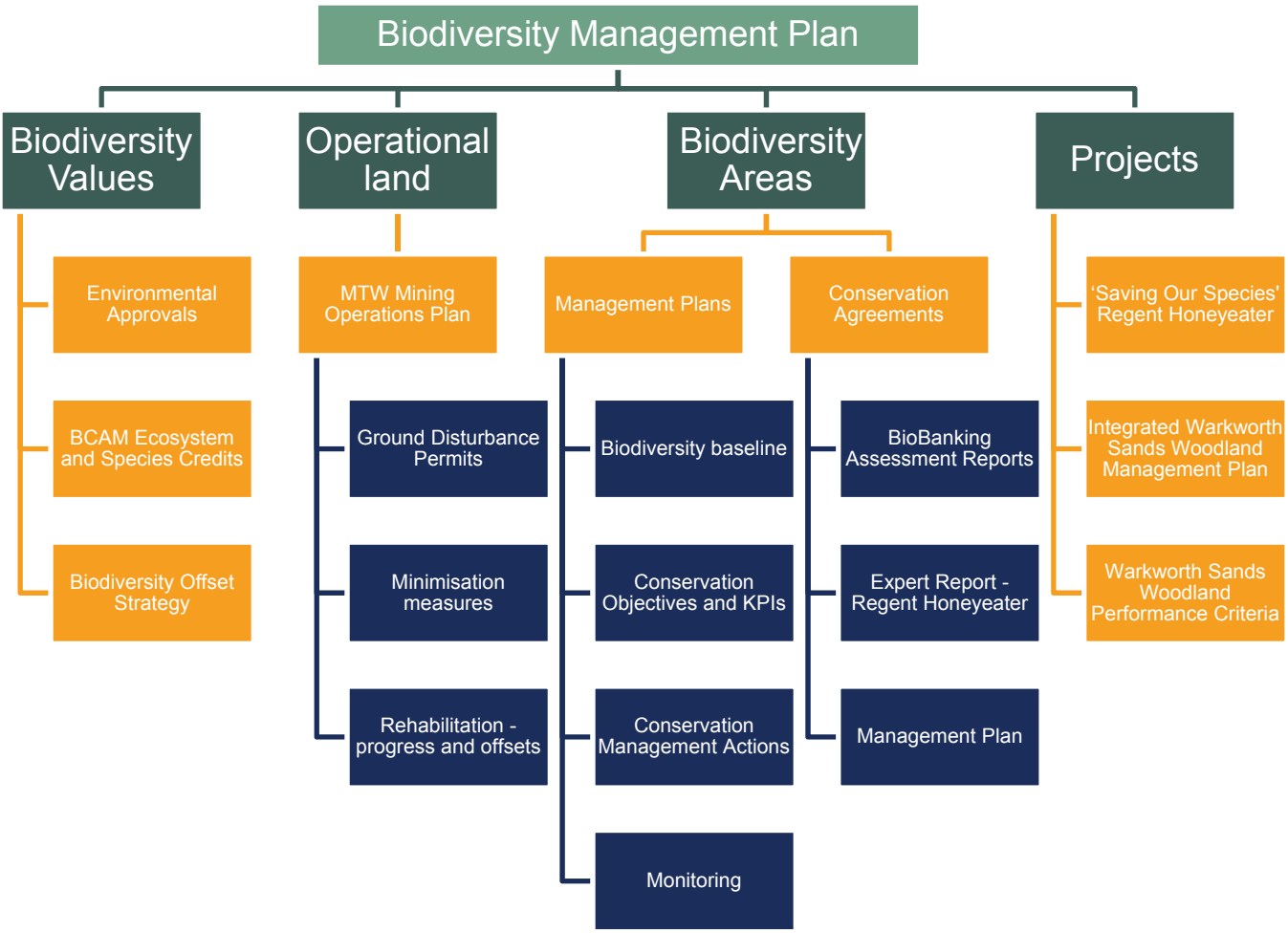
1.2 Structure

Condition 36 covers activities across operational land, Biodiversity Areas (BAs) and projects to compensate for Warkworth Mines impacts on biodiversity values. The BMP is structured into the following sections:

- Biodiversity Values – Section 2 of the BMP describes the; biodiversity values impacted by the mine operations, approved Biodiversity Offset Strategy, and ecosystem and species credits calculated by the BioBanking Certification Assessment Methodology (BCAM);
- Operational land – Section 3 of the BMP describes the minimisation and rehabilitation measures undertaken on operational land that are contained within the MTW Mining Operations Plan;
- Biodiversity Areas – Section 4 of the BMP describes the non-operational land managed for biodiversity purposes to improve and increase the extent of biodiversity values. Biodiversity Areas contain designated offset areas that will be permanently protected under a legally binding conservation agreement and managed in accordance with Management Plans (MPs); and
- Projects – Section 5 of the BMP describes the indirect activities that deliver improved biodiversity outcomes through:
    - co-ordination of conservation effort from integrated and/or improved planning; and
    - contribution to strategic conservation programmes.

Figure 1 shows the structure of the BMP and identifies the key activities and plans that support its implementation.

Figure 1 Biodiversity Management Plan structure



1.3 Compliance

Table 1 provides an overview of relevant biodiversity activities in the Project Approval (SSD-6464), with the associated timeframes and delivery mechanism.

Table 1 NSW Project Approval biodiversity environmental performance activities

Actions	Timeframe	Delivery mechanism
Retirement of credits		
Schedule 3 Condition 28 - Retirement of ecosystem and species credits	Within 3years from the date of commencement of the development, before **January 2019**.	BioBanking Agreement or equivalent
Rehabilitation Offsets		
Schedule 3 Condition 29 - Retirement of mine rehabilitation credits	Within 10 years of completion of mining operations.	BioBanking Agreement
Direct land based offsets		
Schedule 3 Condition 30 - Secure offset area	Within 3years from the date of commencement of the development, before end of **January 2019**.	BioBanking Agreement or equivalent
Schedule 3 Condition 30 - Improve ecological condition	**Within 10 to 15 years**	Management Plan for each BA
Additional Warkworth Sands Woodland (WSW) Measures		
Schedule 3 Condition 32 (a) - Submit suitable performance criteria for WSW to the satisfaction of OEH	Within 6 months from the date of commencement of the development, before end of **July 2016**.	Warkworth Sands Woodland Performance Criteria
Schedule 3 Condition 32 (b) - Lodge $1 million WSW bond with NSW Office of Environment and Heritage (OEH)	Within 6 months from the date of commencement of the development, before end of **July 2016**.	Bank guarantee
Schedule 3 Condition 34 - Prepare WSW Integrated Management Plan	Within 12 months from the date of commencement of the development, before end of **January 2017**.	Warkworth Sands Woodland Integrated Management Plan
Schedule 3 Condition 35 - Contribute $1 million to OEH 'Saving Our Species – Regent Honeyeater' conservation program	Within 6 months from the date of commencement of the development, before end of **July 2016**.	Donation made to OEH.
Biodiversity Management Plan		
Schedule 3 Condition 36 - Approved Biodiversity Management Plan	Prior to commencement of the development	Biodiversity Management Plan
Conservation Bond		
Schedule 3 Condition 37 - Lodge Conservation Bond with the NSW DPE	Within 3 months of approval of the Biodiversity Management Plan, end of **April 2016**.	Bank guarantee
Reporting and auditing		
Schedule 5 Condition 4 - Annual Review	By end of March each year	Annual Environment Report
Schedule 5 Condition 9 - Independent Audit	Before June 2017, and every 3 years thereafter.	Audit Report

To demonstrate compliance of the BMP, Table 2 provides a reference to the relevant section within the BMP.

Table 2 Compliance tracking for NSW Project Approval Condition 36

Condition 36 Biodiversity Management Plan	Operational land	Biodiversity Areas	Project
36. The Applicant shall prepare a Biodiversity Management Plan for the development to the satisfaction of the Secretary, and carry out the development in accordance with this plan. The plan must:			
(a) be prepared in consultation with OEH and submitted to the Secretary for approval prior to the commencement of any development under this consent;	BMP Section 1.3.1	BMP Section 1.3.1	BMP Section 1.3.1
(b) describe the short, medium, and long term measures that would be implemented to:			
• manage the remnant vegetation and fauna habitat on the site;	BMP Section 3.2		
• implement the biodiversity offset strategy described in the EIS	BMP Section 3.3.2 – Rehabilitation Offset	BMP Section 4	BMP Section 5
• regenerate and conserve Warkworth Sands Woodland EEC in the biodiversity areas;	N/A	BMP Section 4	BMP Section 5
• integrate the implementation of the biodiversity offset strategy to the greatest extent practicable with the rehabilitation of the site;	BMP Section 3		
(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy, and triggering remedial action (if necessary);	BMP Section 3.3.2 – Rehabilitation Offset	BMP Section 4	
(d) include a detailed description of the measures that would be implemented over the next 3 years for: • protecting vegetation and fauna habitat outside the approved disturbance area on-site;	BMP Section 3		
• enhancing the quality of existing vegetation and fauna habitat on the site and in the biodiversity offset areas;	BMP Section 3	BMP Section 4	
• minimising clearing and avoid unnecessary disturbance;	BMP Section 3.1 and 3.2		
• maximising the salvage of resources within the approved disturbance area - including vegetative and soil resources – for beneficial reuse in the enhancement of any land-based offsets or the rehabilitation of the site;	BMP Section 3.2.3	BMP Section 4	
• collecting and propagate seed;	BMP Section 3.2.3	BMP Section 4	
• minimising the impacts on fauna on site, including undertaking pre-clearance surveys;	BMP Section 3.2.2	BMP Section 4	
• managing salinity using best practice dryland salinity management revegetation measures;	N/A	N/A	
• controlling weeds and feral pests;	BMP Section 3.2.4	BMP Section 4	
• controlling erosion;	BMP Section 3.2.6	BMP Section 4	
• managing grazing and agriculture on site;	BMP Section 3.2.7	BMP Section 4	
• controlling access; and	BMP Section 1.3.4	BMP Section 4	
• bushfire management;	BMP Section 3.2.5	BMP Section 4	
(e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;	BMP Section 3.3.2	BMP Section 4	
(f) identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks;	BMP Section 3.3.2	BMP Section 4 .	
(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.	BMP Section 1.3.3	BMP Section 1.3.3	

1.3.1 Consultation

Consultation commenced with OEH on 3 December 2015, they provided comments on 29 January 2016 (refer to Attachment B – OEH Consultation Response) , and were incorporated where appropriate.

1.3.2 Review

The BMP is to be revised in 3 years to:

- incorporate new knowledge;
- support adaptive management to account for environmental factors or other uncontrollable circumstances;
- update the performance and completion criteria for the conservation management strategies; and
- adjust monitoring programmes where appropriate.

1.3.3 Key BMP Stakeholders and Roles

The key stakeholder and roles of the entities involved in the implementation of the BMP are listed in Table 3.

Table 3 Key roles and stakeholders

Roles	Responsible Entity	Details
NSW Regulator: Administers approvals granted under the EP & A Act. Approves the BMP, MP and receives Annual Environmental Reports.	Department of Planning & Environment (DPE)	Singleton Office Compliance (Mining) Mining & Industry Projects Department of Planning & Environment http://www.planning.nsw.gov.au
NSW Environmental Operations Consultation and review BMP and MPs	Office of the Environment and Heritage (OEH)	Regional Operations Hunter Central Coast Region Newcastle rog.hcc@environment.nsw.gov.au
Administers the TSC Act and BioBanking Agreements or equivalent	Office of the Environment and Heritage (OEH)	BioBanking team OEH, Sydney Phone: 131 555 Email: biobanking@environment.nsw.gov.au
Commonwealth Regulator: Administers approvals granted under the EPBC Act.	Australian Government Department of the Environment and Energy(DoEE)	EPBCMonitoring@environment.gov.au
Project Proponent and land owner/manager: Prepare and implement the MP and complete reporting.	Warkworth Mining Limited, whose operations are managed by Yancoal Australia Ltd	Manager, Environmental Services NSW

1.3.4 Access

The access to MTW operational sites is restricted by locked gates and visitation is monitored through site induction processes. Access to Biodiversity Areas is restricted by locked gates, where appropriate, and visitation is monitored through a site induction process.

2 Biodiversity values

The Environmental Impact Assessment prepared for the Warkworth Continuation Project described the biodiversity values within the disturbance area and assessed the potential impact of the Warkworth Mine on native flora and fauna. The assessment focused particularly, but not exclusively, on endangered ecological communities (EECs) as well as flora and fauna species protected under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth EPBC Act.

2.1 Threatened Ecological Communities

The vegetation within the disturbance area primarily consists of dry sclerophyll woodland, regrowth woodland and grassland. The threatened ecological communities recorded and their conservation status has been listed in Table 4.

Table 4 Threatened Ecological Communities impacted by Warkworth Mine

Ecological Communities	Hectares within disturbance area	TSC Act	EPBC Act
Warkworth Sands Woodlands	72	E	CE
Central Hunter Grey Box–Ironbark Woodlands	365.5	E	CE
Central Hunter Ironbark–Spotted Gum–Grey Box Forest	15	E	CE
V= Vulnerable; E = Endangered, CE = Critically Endangered			

Descriptions of the ecological communities that are to be re-established within the offset areas are provided in the following subsections.

2.2 Threatened fauna species

The Environmental Impact Assessment identified a number of threatened fauna species that have been recorded or could potentially occur within the disturbance area, (Table 5).

Table 5 Threatened fauna species impact

Threatened fauna species	Recorded in disturbance area	TSC Act	EPBC Act
Birds			
Barking Owl (*Ninox connivens*)	No	V	
Black Bittern(Ixobrychus flavicollis)	No	V	
Black-breasted Buzzard (*Hamirostra melanosternon*)	Yes	V	
Black-chinned Honeyeater (*Melithreptus gularis*)	No	V	
Brown Treecreeper (*Climacteris picumnus*)	Yes	V	-
Diamond Firetail (*Stagonopleura guttata*)	Yes	V	
Gang Gang Cockatoo (*Callocephalon fimbriatum*)	No	V	
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	Yes	V	
Grey-crowned Babbler (*Pomatostomus temporalis*)	Yes	V	
Hooded Robin (*Melanodryas cucullata*)	Yes	V	
Little Eagle (*Hieraaetus morphnoides*)	Yes	V	
Little Lorikeet (*Glossopsitta pusilla*)	Yes	V	
Masked Owl (*Tyto novaehollandiae*)	No	V	
Powerful Owl (*Ninox strenua*)	No	V	
Regent Honeyeater (*Anthochaera phrygia*)	Yes	CE	CE
Scarlet Robin (*Petroica boodang*)	Yes	V	
Speckled Warbler (*Chthonicola sagittata*)	Yes	V	
Spotted Harrier (*Circus assimilis*)	Yes	V	
Square-tailed Kite (*Lophoictinia isura*)	No	V	
Swift Parrot (*Lathamus discolour*)	Yes	E	CE
The Painted Honeyeater (*Grantiella picta*)	No	V	
Turquoise Parrot (*Neophema pulchella*)	No	V	
Varied Sittella (*Daphoenositta chrysoptera*)	Yes	V	

Threatened fauna species	Recorded in disturbance area	TSC Act	EPBC Act
Mammals			
Brush-tailed Phascogale (*Phascogale tapoatafa*)	No	V	
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	Yes	V	
Eastern Free-tail Bat (*Mormopterus norfolkensis*)	Yes	V	
Eastern Pygmy-possum (*Cercartetus nanus*)	No	V	
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Yes	V	
Koala (*Phascolarctos cinerreus*)	No	V	V
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Yes	V	V
Southern Myotis (*Myotis macropus*)	Yes	V	
Little Bent-wing Bat (*Miniopterus australis*)	Yes	V	
Spotted-tail Quoll (*Dasyurus maculatus*)	No	E	E
Squirrel Glider (*Petaurus norfolcensis*)	Yes	V	
V= Vulnerable; E = Endangered, CE = Critically Endangered			

Descriptions of the fauna species to be offset are provided in the following subsections.

2.2.1 Warkworth Sands Woodland

Warkworth Sands Woodland (WSW) is listed as an EEC under the TSC Act; and Critically Endangered Ecological Community (CEEC) under the EPBC Act. The community is confined to Aeolian sand deposits in the vicinity of Warkworth, south-east of Singleton in the mid Hunter Valley (NSW Scientific Committee 2011).

WSW is a unique vegetation community due to the presence of a sand substrate. The sand substrate is believed to have formed during the Pleistocene epoch, some 18,000-15,000 years ago, from the sandy alluvium of the Wollombi Brook, possibly from erosion in Wollemi and Yengo National Parks (Galloway 1963).

The presence of a relatively deep sand substrate has allowed for the development of a plant community that is characterised by species that usually occur on coastal, Aeolian (windblown) dunes. These include the Coast Banksia (*Banksia integrifolia*), Wedding Bush (*Pimelea linifolia*) and Rough Barked Apple (*Angophora floribunda*).

It was estimated that the WSW community had a pre-European distribution of approximately 6,000 hectares (ha), however current estimates have varied since the community was gazetted under the TSC Act, with extant areas ranging from 800 hectares (ha) (NSW Scientific Committee 2002); 1,133.4 ha (Peake 2006); 464.8 ha (Umwelt 2011); and, 400 ha (Bell 2012). The WSW community has also been subjected to sand mining, through the removal of the surface (~1-2m) fine sand material, which is highly valued in the building industry.

While sandmass plant communities do occur elsewhere in New South Wales, only the Agnes Banks sandmass and subsequent vegetation communities from Western Sydney are of a similar age (Ryan *et al*. 1996). This makes the Warkworth Sands community unique. Another unique characteristic of the community is the occurrence of coastal plant species, such as the Coastal Banksia (*Banksia integrifolia*), which have their next closest occurrence at a distance of 100 km to the east in coastal communities.

Other sandmass plant communities that occur in the lower Hunter Valley include Kurri Sand Swamp Woodland (NSW NPWS 2008) and Quorrobolong Scribbly Gum Woodland (NSW NPWS 2002), however each of these communities occur on deeply weathered sandstone (Peake *et al*. 2002), rather than the river sediments that occur at Warkworth.

WSW sub communities have been observed and mapped by several ecologists and this delineation provides direction for the restoration program.

Keith (2004) includes WSW as part of the Sydney Sand Flats Dry Sclerophyll Forests, which are described as restricted and unique in the State to the Sydney and Newcastle regions.

DnA Environmental (2012) described three forms of WSW community. These forms are characterised by the following canopy species that occur within this community:

- Rough- barked Apple (*Angophora floribunda*) and Coastal Banksia (*Banksia integrifolia*);
- Blakely's Red Gum / Forest Red Gum (*Eucalyptus blakelyi / tereticornis)* and Coastal Banksia (*Banksia integrifolia*); and

- Black Cypress Pine (*Callitris endlicheri*) and White Cypress Pine (*Callitris glaucophylla*).

Cohen and Nanson (2009) describe the Warkworth Sands state that most likely falls into the Warkworth soils group. This soils group is characterised by two types of aeolian silicious sand deposits; sand dunes and thin sandsheets with gentle undulations, reflecting the underlying rock surface. The dunes are distributed on high river terraces of either Wollombi Brook or the Hunter River and range in height from 1 – 6 m and are generally aligned NW-SE.

Story *et al*. (1963) describe two land units associated within the Warkworth land system in the central lowlands of the Hunter Valley. Their description is useful because it agrees with the Cohen and Nanson (2009) description of the geomorphology of Warkworth soils group and, in addition, provides a description of the plant community associated with the two types of aeolian silicious sand deposits (Table 6).

Table 6 Description of two land units within the Warkworth Land system (Story *et al*. 1963)

Unit	Land Forms	Soil	Vegetation
1	Linear sand dunes 3-20 ft high [1 to 7 m], resting on high river terrace; aligned NWSE; generally stable but subject to blowouts; swamp seepage zones at margins	Sandy aeolian regosols (Warkworth) of single grain structure; very little organic matter in surface.	Anomalous woodland, trees usually scattered, 12-40 ft. high [4-13 meters], *Banksia integrifolia*, *Angophora floribunda*, *E. tereticornis*, *Callitris enlicheri*, much cleared and under grassland of *Aristida* and *Eragrostis* spp, with *Imperata cylindrica*, *Pteridium aqulinum* [now *P. esculentum*) and *Stenotaphrum secundatum* where damp: shrubs uncommon.
2	Low long linear dunes; less than 3ft. high [1 m], 100-200 yd apart and up to 0.5 mile long, aligned NW-SE; thin sand sheets with gentle undulations, reflecting the underlying rock surface.	Sandy aeolian regosols (Warkworth) over shallow clay at shallow to moderate depth.	Dense heath 5 ft. high [about 1.5 m], of many species; scanty grasses; trees scattered, up to 40 ft high [12.5 meters*], E. agglomerata*, *E. crebra*, *E. tereticornis.*

A key state-wide description of NSW plant community types (BioMetric), defines a single WSW community, however, it should be noted that the above two communities form sub-components of the main description (Table 7).

Table 7 WSW community described using the Biometric tool

Attribute type	Attribute description
Veg Type ID	HU872
Vegetation type	Rough-barked Apple - Coast Banksia shrubby woodland on Warkworth Sands of the central Hunter Valley, Sydney Basin
Dominant canopy spp	Rough-barked Apple (Angophora floribunda), Coast Banksia (*Banksia integrifolia subsp. integrifolia*)
Main associated spp	Forest Red Gum (*Eucalyptus tereticornis*), Slaty Red Gum (*Eucalyptus glaucina*), Narrow-leaved Ironbark (*Eucalyptus crebra*)
Landscape position	Occurs on aeolian sand deposits of the central Hunter Valley floor south east of Singleton.
Characteristic mid-storey spp	*Acacia filicifolia*, *Melaleuca thymifolia*, Coffee Bush (*Breynia oblongifolia*), *Hovea linearis*
Characteristic groundcover spp	Bracken (*Pteridium esculentum*), Blady Grass (*Imperata cylindrica var. major*), Kidney Weed (*Dichondra repens*), *Microlaena stipoides var. stipoides, Pimelea linifolia subsp. linifolia, Glycine clandestine*
Other diagnostic features	

Attribute type	Attribute description
Profile source	NSW Scientific Committee (2002)
Full reference details	NSW Scientific Committee (2002). Warkworth Sands woodland in the Sydney Basin Bioregion - endangered ecological community listing. NSW Scientific Committee - Final determination
Vegetation formation	Dry Sclerophyll Forests (Shrubby subformation)
Vegetation class	Sydney Sand Flats Dry Sclerophyll Forests

Source: http://www.environment.nsw.gov.au/projects/biometrictool.htm

Robertson's (2013) two variants of the community: WSW (crest) and WSW (swale) are equivalent to the above two communities which are based on the depth of sand and plant community representation. The WSW grassland areas are located on sand and have some representation of the understorey components of WSW, but have been greatly disturbed by previous land management and lost the capacity to regenerate naturally.

These observations have resulted in the WSW being attributed to at least two and probably several recognisable vegetation assemblages, including:

- Rough-barked Apple (*Angophora floribunda*) and Coastal Banksia (*Banksia integrifolia*) dominated woodland on deeper sands(1-7m depth);
- Blakely's Red Gum/Forest Red Gum intergrades (*Eucalyptus blakelyi/tereticornis*) dominated woodland (sometimes open forest) on shallower sand (<1m depth) in swales; and
- Other assemblages, such as *Callitris endlicheri* dominated woodland on higher, drier portions of the sand system.

The long history of major disturbance such as land clearing, grazing and orchard growing impacts the regenerative capacity of the community and this history of disturbance may explain the differences in vegetation assemblages such as the *Callitris* dominated areas.

Figure 2 provides examples of the first two distinct vegetation assemblages.

The BMP relies on the mapping of WSW as shown in the Environmental Impact Assessment; however the re-establishment of WSW will be informed by the broader mapping of the WSW vegetation assemblages.

Figure 2 Warkworth Sands Woodlands

WSW with Rough-barked Apple canopy

WSW with Forest Red Gum / Blakely's Red Gum hybrid canopy

Dominant canopy species in the higher quality areas of this community include Rough-barked Apple (*Angophora floribunda*) and the small tree Coastal Banksia (*Banksia integrifolia*). Other small trees recorded in the canopy of this community include Bulloak (*Allocasuarina luehmannii*), Black She-Oak (*Allocasuarina littoralis*), Blakely's Red Gum/Forest Red Gum intergrades (*Eucalyptus blakelyi/tereticornis*), Black Cypress Pine (*Callitris endlicheri*) and White Cypress Pine (*Callitris glaucophylla*).

Common understorey species include Coffee Bush (*Breynia oblongifolia*), *Hibbertia linearis*, Slender Rice Flower (*Pimelea linifolia*), Silver-stemmed Wattle (*Acacia parvipinnula*) and Dogwood (*Jacksonia scoparia*). The groundcover is characterised by Bracken (*Pteridium esculentum*). Common grasses in this community are Three-awn Speargrass (*Aristida*

vagans), Weeping Meadow Grass (*Microlaena stipoides*), Purple Wiregrass (*Aristida ramosa*), Brown's Lovegrass (*Eragrostis brownii*), Blady Grass (*Imperata cylindrica*) and Hairy Panic (*Panicum effusum*). Other common groundcovers include Rock Fern (*Cheilanthes sieberi*), Berry Saltbush (*Einadia hastata*), Pomax (*Pomax umbellata*) and Variable Glycine (*Glycine tabacina*).

2.2.2 Central Hunter Grey Box-Ironbark Woodland

Central Hunter Grey Box-Ironbark Woodland (CHGBIW) is listed as a Critically Endangered Ecological Community (CEEC) under the EPBC Act and an EEC under the TSC Act. This woodland community is the most common vegetation community within the disturbance area.

Attribute type	Attribute description
Veg Type ID	HU817
Common name	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter.
Vegetation description	Open forests with a canopy dominated by *Eucalyptus crebra.* The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns. Central and Lower Hunter Valley.
Characteristic spp	Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*Eucalyptus moluccana*) / Bulloak (*Allocasuarina luehmannii*), Native Blackthorn (*Bursaria spinosa*), Coffee Bush (*Breynia oblongifolia*) / Barbed Wire Grass (*Cymbopogon refractus*), Purple Wiregrass (*Aristida ramosa*), Kangaroo Grass (*Themeda australis*), Rock Fern (*Cheilanthes sieberi*), Bristly Cloak Fern (*Cheilanthes distans*), Pomax (*Pomax umbellata*), Kidney Weed (*Dichondra sp. A*), Many-flowered Mat-rush (*Lomandra multiflora*), Amulla (*Eremophila debilis*)
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands

The dominant canopy species within this community are Grey Box (*Eucalyptus moluccana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). There are also local abundances of Bulloak (*Allocasuarina luehmannii*) and White Feather Honeymyrtle (*Melaleuca decora*) in the midstorey.

Common understorey species include Fan Wattle (*Acacia amblygona*), *Acacia falcata*, Native Blackthorn (*Bursaria spinosa*) and Coffee Bush (*Breynia oblongifolia*). Common groundcover species include Purple Burr-Daisy (*Calotis cuneifolia*), Blue Trumpet (*Brunoniella australis*), Kidney Weed (*Dichondra repens*), Blue Flax Lily (*Dianella revoluta*), Threeawn Speargrass (*Aristida vagans*), Wattle Matt-rush (*Lomandra filiformis*), Common Fringe-sedge (*Fimbristylis dichotoma*) and Rock Fern (*Cheilanthes sieberi*).

2.2.3 Regent Honeyeater

The Regent Honeyeater is listed as Critically Endangered (CE) under the EPBC and TSC Act.

The Regent Honeyeater is a medium-sized, black and yellow honeyeater with a sturdy, curved bill. Adults are between 20 and 24 cm long and have a wing-span of 30 cm. Its head, neck, throat, upper breast and bill are black and the back and lower breast are pale lemon in colour with a black scalloped pattern, as shown in Figure 3. The Regent Honeyeater is listed as Endangered and Migratory under the EPBC Act.

The Regent Honeyeater is nomadic and can undertake large-scale movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on the spatial and temporal distribution of flowering eucalypts, which are a major food source, and other resource patterns. There are only three known key breeding regions remaining: north east Victoria (Chiltern-Albury), Capertee Valley (NSW) and the Bundarra-Barraba region (NSW). In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodland.

The Regent Honeyeater typically inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Oak, particularly those on wet, fertile soils such as along creek flats and broad river valleys. These woodlands have significantly large numbers of mature trees, high canopy cover and an abundance of mistletoes. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. The species also utilises Coastal Grey Box, Narrow-leaved Ironbark, Silvertop Stringybark, Spotted Gum and Rough-barked Apple among many others. Nectar and fruit from the mistletoes *Amyema miquelii, Amyema pendula* and *Amyema cambagei* are also eaten during the breeding season.

The Regent Honeyeater Recovery Plan provides guidance on the management requirements and long term protection and conservation of the species. There are critical components of their habitat requirements across the BAs.

2.2.4 Swift Parrot

The Swift Parrot is listed as CE under the EPBC and Endangered (E) under TSC Act.

The Swift Parrot is small parrot about 25cm long. It is bright green with red around the bill, throat and forehead. It has a long (12cm), thin tail, which is dark red, as shown in Figure 4. The Swift Parrot is listed as Endangered under the EPBC Act.

The Swift Parrot is a non-breeding winter migrant to mainland Australia from Tasmania. This migratory bird species (although not listed on the EPBC Act as migratory) occurs in south-east Australia, between Tasmania and NSW. In NSW, this species occurs mainly on and to the east of the Great Dividing Range, in the Central and Southern Tableland regions and in coastal regions south of the Hunter Valley. Some rarer scattered occurrences have been recorded further north and further to the west.

On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box. Also, the swift parrot commonly forages on lerp infested trees which include Western Grey Box, Coastal Grey Box and Blackbutt. The Swift Parrot returns to some foraging sites on a cyclical basis depending on food availability.

The National Recovery Plan for the Swift Parrot provides direction on the management actions for the long term protection and conservation of the species. The Swift Parrot is likely to frequent the BAs during the winter months. The mature Yellow Box, Grey Box and White Box trees are key species across the BAs for foraging opportunities.

Figure 3 Regents Honeyeater (Chris Tzaros)

Figure 4 Swift Parrot (Chris Tzaros)

2.2.5 Southern Myotis

The Southern Myotis is listed as Vulnerable (V) under the TSC Act.

The Southern Myotis, has previously been called the Large-footed Myotis due its disproportionately large feet that are more than 8 mm long, with widely-spaced toes which are distinctly hairy and with long, curved claws. It has dark-grey to reddish brown fur above and is paler below, as shown in Figure 5. It weighs up to 15 grams and has a wingspan of about 28 cm.

The Southern Myotis roosts and breeds in tree hollows although it may also utilise caves. The Southern Myotis forages almost exclusively over water bodies, although suitable

foraging habitat may include large or small dams, wetlands, permanent or ephemeral rivers and streams and even temporary puddles. They catch insects and small fish by raking their feet across the water surface.

2.2.6 Large-eared Pied Bat

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

It is a small to medium-sized bat with long, prominent ears and glossy black fur, as shown in Figure 6. The lower body has broad white fringes running under the wings and tail-membrane, meeting in a V-shape in the pubic area. This species is one of the wattle bats, with small lobes of skin between the ears and corner of the mouth.

Figure 5 Southern Myotis

Figure 6 Large-eared pied bat

2.3 Environmental legislation and policy

The Environmental Impact Assessment prepared for WML to secure the approval of the Warkworth Continuation Project 2014 considered the following relevant contemporary government legislation and policies.

2.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on Matters of National Environmental Significance (MNES) (including nationally threatened ecological communities and species, and listed migratory species) must be referred to the Commonwealth Minister for the Environment. The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is declared a "controlled action", then Commonwealth approval is required.

Any action that is considered likely to have a significant impact on MNES must be "referred" to the Department of Environment and Energy (DoEE) to obtain confirmation of whether or not a Project constitutes a "Controlled Action". If an action is declared a Controlled Action, then Commonwealth approval is required.

2.3.2 Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, populations and ecological communities, and their habitats of biodiversity values, as listed in the TSC Act and NSW *Fisheries Management Act 1994*. The protection of the environment is addressed in Section 5A of the EP&A Act (Significant effect on species, populations or ecological communities or their habitats).

2.3.3 Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act through threat abatement and species recovery programs. The TSC Act requires consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat.

2.3.4 NSW Biodiversity Offset Policy for Major Projects

The NSW Biodiversity Offsets Policy for Major Projects applies to two categories of development proposed under the planning system: state significant development and state significant infrastructure. The policy:

- establishes a set of offsetting principles for major projects;
- defines key thresholds for when offsetting is required;
- adopts an assessment methodology to quantify and describe the offset required;
- defines preferred mechanisms to establish offset sites;
- provides a range of flexible options that can be used in lieu of providing offsets including rehabilitation actions and supplementary measures; and
- sets out how payments to the NSW Biodiversity Offsets Fund can be used to acquit offset requirements.

The NSW Biodiversity Offsets Policy for Major Projects is underpinned by seven key principles for determining biodiversity offset requirements for major projects:

- Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts;
- Offset requirements should be based on a reliable and transparent assessment of losses and gains;
- Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities;
- Offsets must be additional to other legal requirements;
- Offsets must be enduring, enforceable and auditable;
- Supplementary measures can be used in lieu of offsets; and
- Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.

2.3.5 Framework for Biodiversity Assessment

The Framework for Biodiversity Assessment (FBA) sets out the detailed operation of the NSW Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to quantify and describe the impact assessment requirements and offset guidance that applies to major projects.

The FBA comprises three broad stages that set out the biodiversity assessment requirements and offset practices for major projects.

2.4 EPBC approvals

Warkworth Mine operates under two EPBC Act approvals and the NSW Project Approval (SSD-6464).

WML were granted their first EPBC2002/629 approval in 2004 after referring a mine extension project in 2002. In 2009, WML referred a second mine extension project, which included amendments to the existing EPBC2002/629 approval. The EPBC2009/5081, approval was granted on 9 August 2012 (after the EPBC2002/629 approval was varied on 13 July 2012).

The original offset package for EPBC2009/5081 agreed on 9 August 2012, included a total of 2,532 hectares (ha) of offsets located within the:

- Southern BA;
- Putty BA;
- Bowditch BA; and

- An additional 750ha of regent honeyeater and swift parrot habitat to be secured within 12 months of approval.

The EPBC2002/629 offset package as varied on 13 July 2012, specified 1,586ha of offsets located within the:

- Goulburn River BA; and
- Seven Oaks BA

Subsequently, the NSW Project Approval was appealed in the NSW Land and Environment Court. On April 15 2013, the appeal was upheld by the Land and Environment and the application was disapproved. Following disapproval the offset packages were varied as follows:

- EPBC2002/629 : Seven Oaks BA was replaced with 520ha of the 607ha Bowditch BA; and
- EPBC2009/5081: was phased to include Phase 1 Offset – 94ha Putty Road Offset Area and Phase 2 Offsets - 2,532ha of offset area.

2.5 Biodiversity Offset Strategy

The impacts from open cut mining at Warkworth have been avoided and mitigated where feasible to minimise the biodiversity impact. The significant residual biodiversity impacts are proposed to be compensated for by the provision of 'biodiversity offsets'. The Biodiversity Offset Strategy has been developed to compensate for residual significant biodiversity impacts and includes direct offset and indirect compensation measures.

Schedule 3 Condition 36 of Project Approval (SSD-6464), specifies the preparation of this BMP and the implementation of the Biodiversity Offset Strategy.

The Biodiversity Offset Strategy includes:

- Retirement of species and ecosystem credits within 3 years of the date of commencement of the action;
- Retirement of rehabilitation offsets credits, within 10 years after completion of mining operations;
- Direct land based offsets within designated BAs;
- Performance criteria for regeneration of Warkworth Sands Woodland to ensure successful regeneration in the Northern BA within 15 years after commencement of the action;
- Development of an Integrated Management Plan for the Warkworth Sands Woodland EEC; and
- $1 million contribution to the Office of Environment and Heritage (OEH's) 'Saving Our Species – Regent Honeyeater' conservation program.

Table 8 shows the designation of the offset areas for each environmental approval, indicating the offset areas that are used for compliance with both the Commonwealth and State offset obligations.

Table 8 Designation of Offset Area for each Environmental Approval

Locality	Biodiversity Area	Offset Area (ha)	Environmental Approvals				
			EPBC2002/629	EPBC2009/5081 Phase 1	EPBC2009/5081 Phase 2	NSW 2003	NSW 2014
Mine Site	Rehabilitation	2,100					2,100
Local	Southern (WSW Offset Area)	117			117	117	
	Southern (Putty Road Area)	94		94		94	
	Southern	775			775		775
	Southern Sub-total	*986*		*94*	*892*	*211*	*775*
	Northern (WSW Offset Area)	39			39	39	
	Northern	302			302		302
	Northern Sub-total	*341*			*341*	*39*	*302*
Regional	North Rothbury	41			41		41
	Goulburn River	1,066	1,066				1,066
	Bowditch	520	520				520
	Bowditch	82			82		82
	Putty	383			383		
	Seven Oaks	519			519		
	Condon View	345			345		
Total		**6,373**	**1,586**	**94**	**2,602**	**250**	**4,886**
*** Approximate areas to be confirmed in 2016**							

2.6 BCAM Ecosystem and Species credits

The Environmental Impact Assessment (2014) calculated the ecosystem credits to quantify impacts on vegetation and fauna habitat. The potential loss and gain on threatened species habitat is generally included in the ecosystem credits generated under the BCAM. However, species credits were also generated for those threatened species that cannot be reliably predicted to use an area of land based on habitat values. For example Swift Parrot habitat can be reliably predicted by vegetation therefore the impacts on Swift Parrot are included within the ecosystem credits. On the other hand Regent Honeyeater habitat is less predictable and therefore its impacts are quantified by species credits.

Table 9 describes the biodiversity impact areas for the Warkworth Continuation Project and where required the ecosystem or species credits from the impact.

Table 9 Biodiversity Impacts for Warkworth Continuation Project

Impacted Biodiversity Values	Warkworth Continuation Project	
Ecosystem	*Area (ha)*	Credit
Warkworth Sands Woodland (EEC)	72.12	3043
Warkworth Sands Grassland	0.67	16
Central Hunter Grey Box-Ironbark Woodland (EEC)	614.64	23384
Regenerating Central Hunter Grey Box - Ironbark Woodland (EEC)	6.43	108
Central Hunter Ironbark - Spotted Gum - Grey Box Forest (EEC)	16.61	633
Central Hunter Grey Box - Ironbark Derived Grassland	378.6	4516
Dam	0	0
Total Ecosystem	**1089.1**	**31700**
Species	*Area (ha)*	Credit
Regent Honeyeater (Foraging Habitat) (CE)	709.5	18932
Large-eared Pied Bat (Breeding Habitat)	10.5	139
Southern Myotis (Breeding Habitat)	237	18223
Total Species	**957**	**37294**

3 Operational land

This section of the BMP details the processes, minimisation measures and rehabilitation to mitigate the mines impact upon biodiversity values, which are consistent and also contained within the MTW Mining Operations Plan.

Interactions with flora and fauna is managed through Yancoal Environmental Procedures *5.1 – Disturbance and Rehabilitation*, *10.2 – Flora and Fauna* and *Ground Disturbance Permit* Environmental Work Instruction.

3.1 Ground Disturbance Permits

The GDP approval process applies to all areas of land owned or managed by Yancoal that have not been previously disturbed by mining or mining associated activities and rehabilitated areas. The GDP process is an internal process to ensure that all appropriate approvals and mitigation measures are in place prior to any ground disturbance.

The GDP process is an online process that requires a complete description of the activity and approvals by all relevant stakeholders.

The GDP process includes the following checklist:

- cultural heritage – search relevant sources to determine their presence;
- land ownership and tenement – ensure action is located on land owned and/or managed by Yancoal;
- environment – search relevant sources to identify presence of listed ecological communities, flora or fauna;
- regulatory approval – legal authority for the action is in place;
- offsets – is the area an offset or are offsets required;
- rehabilitation – requirement for rehabilitation; and
- water – potential water impacts, implement soil and erosion controls.

The relevant responsible stakeholder can approve the activity with or without conditions to ensure compliance and adequate mitigation controls are implemented.

3.2 Minimisation measures

3.2.1 Progressive Clearing

All vegetation clearing is progressive, that is a staged operation immediately in advance of mining operations.

Vegetation clearing is avoided during the breeding season of identified threatened fauna species.

The area of vegetation cleared ahead of mining operations is kept to a minimum, consistent with the space required by the pre-stripping fleet, which is usually about a 100m wide mining strip. The clearing area allows for the establishment of mine infrastructure, such as haul roads and access tracks, power lines, pipelines, transformers and drainage control structures.

3.2.2 Pre-clearing surveys

Pre-clearing surveys are undertaken to identify important habitats and confirm the absence of known threatened species. Habitat trees and appropriate microhabitats such as fallen logs are surveyed and marked to determine if fauna are using them. Any marked trees that show signs of current or recent use are reserved for latest possible removal to encourage fauna to abandon the area of their own accord or undertake possible physical relocation.

Following the removal of useable timber for habitat features, as well as collection of viable seed for use in rehabilitation, the remaining smaller vegetation is generally mulched and incorporated into the topsoil, and may be relocated to rehabilitation areas.

3.2.3 Translocation of salvaged resources

Resources salvaged from areas to be cleared for mining activity, such as topsoil, mulch, timber and plant material, are considered valuable resources for the re-establishment of a similar vegetation community in a different location. It provides an opportunity to transfer ecological characteristics to the re-establishment site to support natural regeneration, such as seed sources and microbial soil organisms. The use of these materials is dependent upon their availability and will be used when safe and practical.

The following outlines critical factors in the use and management of these resources:

- Topsoil management:
  - Stockpiling of material is to be avoided where possible.
  - To translocate the majority of seed it is recommended that the top ten centimetres is scalped.
  - Complete assessment of the in situ vegetation community in the area where the topsoil is to be sourced. The following performance measures and criteria are to be used as a minimum standard to assess the potential value of the topsoil to be targeted as a resource salvageable as a potential seed source.

Measure	Criteria
Weed species	Absence of noxious weeds
Ground cover	<10% weed species
Suitable growing media	Presence of A horizon in soil profile
Native species area producing seed	Evidence of recruitment of native flora; presence of fruit/ seed

- Mulch:
  - All overstorey and understorey vegetation at the disturbance site may be coarsely mulched to provide a potential seed source at the re-establishment site.
  - To mitigate the potential lock up of nutrients in the soil, composted mulch will be applied prior to application, to a depth of 5cm. This will also provide soil disturbance and prepare the restoration site.
- Timber:
  - Large trees, with their branches intact and roots removed, are to be relocated to provide seed sources, habitat augmentation and protect the soil to create an improved micro climate for restoration.
- Plant material:
  - Seeds, cuttings and plants will be salvaged from the disturbance area to further assist in the establishment of ecological characteristics in the re-establishment areas. Species that are known to be difficult to grown from seed will be targeted for cuttings and transplanting from the disturbance areas.
  - It is preferable that seed for planting and seeding activities in the BAs and rehabilitation areas is from local or endemic provenances. To support the BA re-establishment programme, viable seed is collected prior to clearing vegetation, when it is safe and practical.

3.2.4 Weed and vertebrate pest control

Across the operational areas the weed species targeted for control include those listed as Weeds of National Significance, noxious and/or environmental weeds. Yancoal Environmental Procedure *10.4– Weed Control* guides the on-ground control of weeds. The assessment of the impact of weeds across the MTW site is ongoing, with the results from the regular monitoring programmes used to update the Annual Work Schedule. Weed control treatments are conducted annually and at other times as determined by seasonal conditions that may promote excessive weed growth, and is reported in the Annual Environmental Reporting.

The management of vertebrate pests is updated seasonally based on recommendations from the quarterly Vertebrate Pest Control Reports. This approach allows maximum flexibility to react to sightings, monitoring results, or particular pest infestations and allows customisation of the programme to effectively address these infestations. The quarterly

Vertebrate Pest Control Reports provide a basis for all decision making on vertebrate pest control on the site.

Vertebrate Pest species control is undertaken quarterly and may include trapping, baiting and/or shooting. Performance of vertebrate pest species control is reported in the Annual Environmental Reporting.

3.2.5 Bushfire management

Bushfire management is undertaken in accordance with Yancoal Bushfire Management Plan (2015) that has been developed in consultation with the NSW Rural Fire Services and Singleton Council.

The following controls may be implemented to control the risk associated with bushfire:

- Fuel reduction actions, including grazing, mowing, slashing, ploughing, flailing and manual removal as required to reduce fuel loads and fire risk in peak seasons;
- Establishment and maintenance of fire breaks, including around critical infrastructure;
- Maintenance of rescue truck and water carts to be available in the event of fires; and
- Periodic review, testing and training of relevant personnel in the site Emergency Response Procedure.

3.2.6 Erosion and sedimentation control measures

Clean water diversion structures are employed to divert clean water away from the active pits. Prior to release from site this water is managed to minimise sediment load. A Ground Disturbance Permit is required for all disturbance activities. Prior to disturbance, appropriate erosion and sediment controls consistent with current best practice standards will be established. Where ground conditions allow, erosion and sediment controls will be designed generally in accordance with the 'Blue Book': Managing Urban Stormwater: soils and construction (Volume 1 and 2E – Mines and Quarries).

3.2.7 Grazing

Grazing in rehabilitation and non-operational areas returned to grasslands will be controlled through formal licence agreements with the graziers involved. The typical arrangements under Yancoal Licence Agreements include:

- Licence conditions requiring the Licensee to manage the property in accordance with best agricultural and environmental practice i.e. grazing management, bushfire management, weed management and avoidance of vegetation clearing;
- Property inspections by the Specialist – Land Management , Land & Tenements to audit quality of property management; and
- Soil testing to check nutrient and soil carbon levels are being maintained.

3.3 Rehabilitation

3.3.1 Progressive rehabilitation

The progressive rehabilitation at MTW aims to deliver a final landform that achieves outcomes for sustainable agriculture, conservation and biodiversity by integrating the rehabilitation of mined areas into the surrounding landscape, in consultation with the community.

This includes a long term vision to create a network of vegetation corridors, comprising mine rehabilitation areas, the Southern and Northern BAs and existing remnant vegetation. This will deliver conservation and biodiversity outcomes by combatting the loss of connectivity, which is recognised at the most serious long term threat to biodiversity. These corridors of vegetation will enable the successful migration of plants and animals and increase their capacity to adapt to changing climatic conditions.

3.3.2 Rehabilitation offsets

Condition 29 of the Project Approval (SSD-6464) requires that within 10 years of completion of mining operations the retirement of ecosystem credits from 2,100 ha of Central Hunter Grey Box – Ironbark Woodland. This requirement is to be delivered through the implementation of progressive rehabilitation of the site as described in the following sections, which are consistent with the Rehabilitation Plan that is contained MTW Mining Operations Plan.

3.3.2.1 Domains and rehabilitation objectives

MTW has defined primary and secondary domains as land management units across the mine site to plan and assist rehabilitation to achieve the desired final landform outcome. Primary domains are areas with unique operational and functional purposes and therefore have similar geophysical characteristics. Secondary domains are characterised by similar post mining land use purposes. The domains listed in Table 10 are allocated rehabilitation objectives and management regimes (including monitoring). The Rehabilitation Area – Woodland EEC domain aims to satisfy the requirements of Condition 29.

Table 10 Domain and rehabilitation objectives

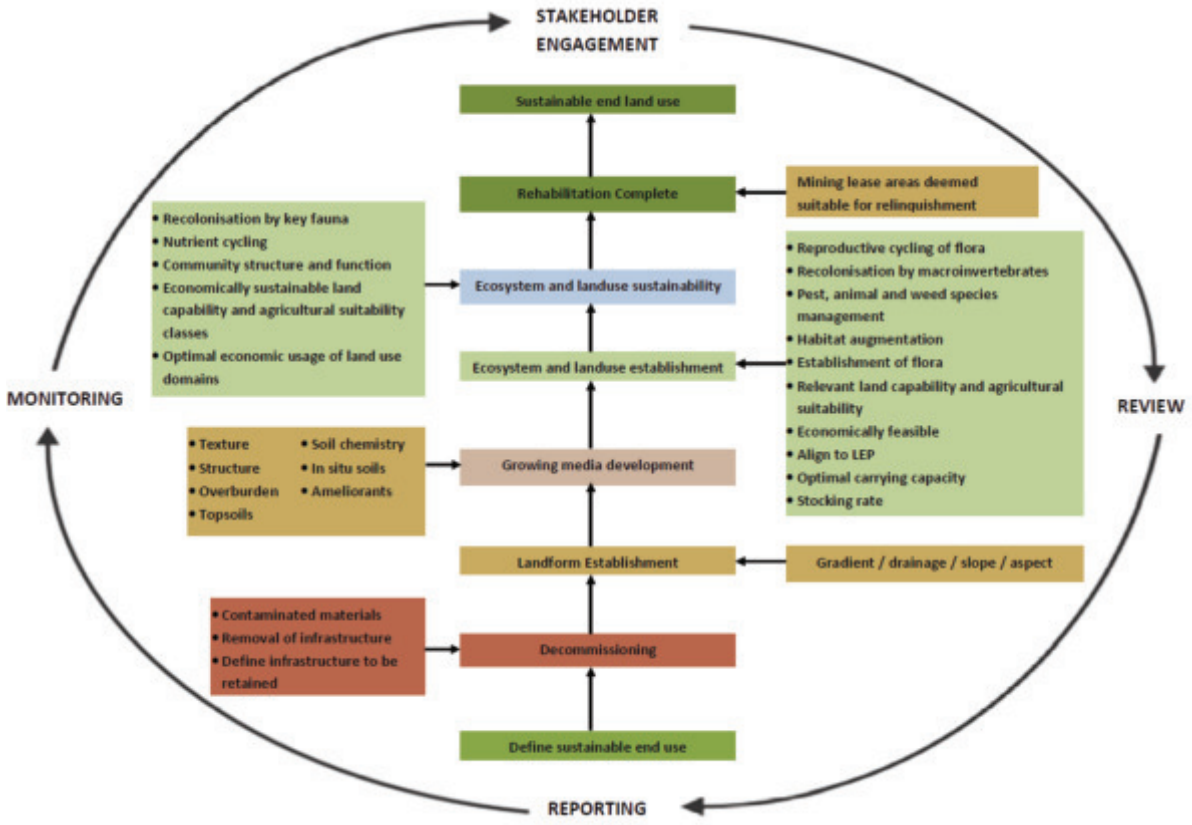
Domains	Rehabilitation Objective
Primary domain	
Final Void	Final voids will be used for water storage post-mining. The objective is for the final voids to be safe, stable and non-polluting. So far as is reasonable and feasible, final voids will be designed and constructed to: • minimise the size and depth of final voids; • minimise the drainage catchment of final voids; • minimise high wall instability risk; • maximise groundwater flows across back-filled pits to the void, having regard to their function as long-term groundwater sinks; and • minimise risk of flood interaction for all flood events up to and including the 1% AEP.
Water Management Area	The drainage pattern of the final landform will be designed to integrate with the surrounding catchments and will be revegetated to achieve long term stability and erosion control and will be integrated into the final landform and revegetation strategy. Water retained on site is fit for the intended land use. Water quality leaving site is to be in accordance with the EPL water quality criteria. The objective is for the water management areas to be safe, stable and non-polluting.
Infrastructure Area	Mining infrastructure within the identified disturbance area will be removed if no longer required and the affected lands rehabilitated. The objective is for the infrastructure areas to be safe, stable and non-polluting.
Tailing Storage Facility	Rehabilitated TSFs will be integrated into the final landform and revegetation strategy. The objective is for the tailings storage facility areas to be safe, stable and non-polluting.
Overburden Emplacement	Rehabilitated overburden emplacements will be undulating, free draining landforms capable of sustaining the intended land use. Final landforms will incorporate micro-relief and drainage lines consistent with existing topography and natural drainage. The objective is for the overburden emplacement areas to be safe, stable and non-polluting.
Secondary domain	
Final Void	As per Primary Domain.
Water Management Area	As per Primary Domain.
Rehabilitation Area – Grassland	Recreating 1,423 ha grassland communities with a native component on the residual disturbed mining areas.
Rehabilitation Area – Woodland Other	• Establishing approximately 319 ha of trees and shrubs over grassland areas, but not necessarily conforming to any particular vegetation community. • Establishing a network of tree corridors to ensure connectivity of woodland community areas. • Provide additional habitat for threatened species.
Rehabilitation Area – Woodland EEC	• Re-creating approximately 2,100 ha of EEC woodland communities to a standard comparable to similar reference EEC communities. • Establishing a network of tree corridors to ensure connectivity of woodland community areas. • Provide additional habitat for threatened species.

3.3.2.2 Performance Criteria, Measures and Indicators

The performance measures and indicators are designed to form the basis of the Performance Criteria and provide the ability to track the development of sustainable ecosystems through a series of six conceptual stages which are represented by rehabilitation phases (Figure 7):

- Stage 1: Decommissioning – removal of hard stand areas, buildings, contaminated materials, hazardous materials;
- Stage 2: Landform Establishment – incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology;
- Stage 3: Growing Media Development – incorporates physical, chemical and biological components of the growing media and ameliorants that are used to optimise the potential of the media in terms of the preferred vegetative cover;
- Stage 4: Ecosystem and Landuse Establishment – incorporates revegetated lands and habitat augmentation; species selection, species presence and growth together with weed and pest animal control / management and establishment of flora;
- Stage 5: Ecosystem and Landuse Sustainability – incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function which are the key elements of a sustainable landscape; and
- Stage 6 – Rehabilitation Complete – landuse and landscape is deemed as suitable to be relinquished from the Mining Lease.

Figure 7 Conceptual Stages of Sustainable Ecosystem Development



3.3.2.3 Monitoring and Reporting

The monitoring program will be based on the performance indicators described for each stage of rehabilitation. It will utilise methodologies that can provide quantitative data to assess changes occurring over time.

A consistent and quantitative methodology will be implemented and undertaken on a periodic basis, ensuring a satisfactory number of analogue/baseline sites are established to inform target setting. Data from analogue sites will be used to establish target values for key biophysical parameters and indicators related to vegetation diversity/structure and habitat complexity. Permanent quadrants will be established and reassessed at a maximum of two year intervals, at least in the short term, to ensure restorative strategies (i.e. maintenance of soil health, maintenance of ground cover, achievement of suitable species richness etc.) are progressing as desired.

In new revegetation sites, an annual monitoring program will be required as the site rapidly changes and can be vulnerable to effects of climate, pests and diseases. In addition, general inspections for erosion (particularly drainage lines), survival, mortality, weed control and pests will be undertaken more regularly and at least biannually until the sites have become well established. The duration between monitoring periods can be lengthened to five yearly intervals once it has been established that the restorative strategies are appropriate and that conservation objectives are being met. Inspections of drainage lines in rehabilitation areas will be conducted on a quarterly basis during the first year

The monitoring methodology adopted is a standard and simple procedure that can be replicated over any vegetation community or rehabilitation area and allows results to compare similar communities. The methodology uses a combination of:

- Landscape Function Analysis;
- accredited soil analyses and various measures of ecosystem diversity and habitat values; and
- BioBanking assessment methodology.

This combination of approaches allows a site to be assessed over time with the resultant data enabling the user to assess the trajectory of the ecosystem being monitored whilst also providing an overall assessment of lands in terms of land capability. In turn, this data can be used to decide if the site is converging on a target functional state or requires further works.

3.3.2.4 Trigger Action Response Plan

The Trigger Action Response Plan (TARP) identifies the proposed contingency strategies in the event of unexpected variations or impacts to rehabilitation outcomes. A risk-based approach has been used to assess the potential consequences and mitigation measures in terms of the Consequence Category – Environment.

The TARP provides management responses for lower (first tier) and upper (second tier) trigger values. First tier trigger values identify opportunities for closer monitoring or early intervention that may mitigate potential impacts before notable impact to rehabilitation occurs. Second tier trigger values identify when indicators have reached a threshold that requires more substantive or widespread remedial actions to remediate or mitigate rehabilitation failure.

The TARP is presented in Attachment A and will be reviewed and may be revised as conditions at MTW change or new risks to rehabilitation are identified.

4 Biodiversity Areas

WML manage several BAs to satisfy their Commonwealth and NSW approvals. The locations of BAs are shown in Figure 8 and they are referred to as local (Southern and Northern) and regional (Goulburn River, Bowditch and North Rothbury) BAs according to their proximity to the impact site. Table 11 lists all the BAs and their associated environmental approval.

For the NSW Project Approval (SSD-6464) a total of 3,036ha of offset area are to be protected. This includes a total re-establishment area of 554ha to achieve a long term conservation gain.

The NSW Project Approval (SSD-6464) also includes 2,100ha of mine site rehabilitation offsets to be retired 10 years after mine closure. The management and monitoring of these rehabilitation offsets is to be guided by the Rehabilitation Plan contained within the MTW Mining Operations Plan.

Table 11 Biodiversity Areas

Environmental Approval	Locality	Area	Total (ha)	Offset Area (ha)	Woodland (ha)	Re-establishment (ha)
NSW Warkworth Mine	Local	Mine Rehabilitation	3,219	2,100	2,100	
NSW Warkworth Mine	Local	Buffer Area	518			
Sub-total			3,737	2,100	2,100	
NSW & EPBC Warkworth Mine	Local	Southern BA	1,023	986	688	299
NSW & EPBC Warkworth Mine	Local	Northern BA	345	341	123	218
NSW & EPBC Warkworth Mine	Regional	North Rothbury BA	41	41	41	
NSW & EPBC Warkworth Mine	Regional	Bowditch BA	607	602	602	
NSW & EPBC Warkworth Mine	Regional	Goulburn River BA	1,439	1,066	1,029	37
Sub-total NSW BA			3,455	3,036	2,483	553
Total NSW Warkworth Mine			**7,192**	**5,136**	**4,583**	**553**
EPBC Warkworth Mine	Regional	Seven Oaks BA	523	522	354	168
EPBC Warkworth Mine	Regional	Putty BA	379	378	366	12
EPBC Warkworth Mine	Regional	Condon View BA	442	345	345	
Total EPBC Warkworth Mine			**4,799**	**4,280**	**3,547**	**733**
NSW HVO South	Regional	Goulburn River		140		

At this stage the EPBC Warkworth Mine only offsets are not required to satisfy the requirements of the NSW Project Approval (SSD-6464), however if this should change the EPBC offsets may be used to cover any shortfall.

The following describes the key conservation outcomes achieved by the Commonwealth and NSW offset areas.

The local BAs (Southern and Northern) include 1,326ha of local offsets, which are located 1 to 7 km away from the mine. These local offsets are situated close to the area of disturbance and include the conservation and protection of:

- Warkworth Sands Woodland (EEC), through long term management and legal protection of 157 ha of existing mature WSW and re-establishment of 233ha of Warkworth Sands grassland (grassland areas located on old sand dunes previously cleared for agriculture). The re-establishment programme aims to deliver a net conservation gain for WSW community by increasing its extent by 30%;
- Central Hunter Grey Box - Ironbark Woodland (C/EEC) (CHGBIW), through long term management and legal protection of 482ha of existing woodland and the re-establishment of 256ha of CHGBIW grasslands; and

- Threatened species, through protecting and improving up to 809ha of existing suitable habitat for Swift Parrot, Regent Honeyeater, South Myotis and Large-eared Pied Bat. As well as a net gain in habitat through re-establishment of 516ha of WSW (233ha), CHGBIW (256ha), and River Oak Forest (27ha).

The local BAs will contribute to the south to north biodiversity corridor across the Hunter Valley floor. Biodiversity corridors are connected or stepping stones of existing native vegetation that provide connectivity at a landscape scale for flora and fauna. They are important in the ongoing conservation and protection of flora and fauna, as they enable migration, improve resilience to climatic variability and support genetic diversity.

There are six separate regional BAs; Goulburn River, Bowditch, North Rothbury, Seven Oaks, Condon View and Putty. These areas contain a total of approximately 2,954ha of offsets. The regional BAs are located 30 to 110 km away from the mine and provide strategic conservation value as they adjoin or are situated close to existing conservation reserves, including the Goulburn River and Wollombi National Parks. In total they conserve and protect:

- 2,668ha of existing woodland and the re-establishment 217ha of degraded riparian areas and Box Gum Grassy Woodlands CEEC;
- existing suitable habitat for Swift Parrot, Regent Honeyeater, South Myotis and Large-eared Pied Bat of up to 2,668ha and a net gain in habitat through re-establishment of 217ha; and
- the largest sub population of the CE North Rothbury Persoonia.

A Management Plan (MP) has been prepared for each BA. The MPs establish a 15 year planning framework for the BAs and satisfy the conditions of the EPBC approvals. They describe the short, medium and long term measures to be implemented to achieve the conservation objectives for the individual BAs. The MP details a comprehensive monitoring programme to measure changes in ecological condition. The MPs are reviewed every three years which enable the incorporation of new knowledge and adjustment to planning timeframes.

The offset areas are to be protected under a long-term, legally-binding BioBanking Agreement or equivalent. In accordance with the BioBanking Assessment Methodology (BBAM, 2014) the offset area includes vegetation (existing woodland and grassland areas to be re-established) and habitat features but exclude all tracks and infrastructure that will be maintained. The individual MPs are to form part of the legally binding mechanism to inform the long term management.

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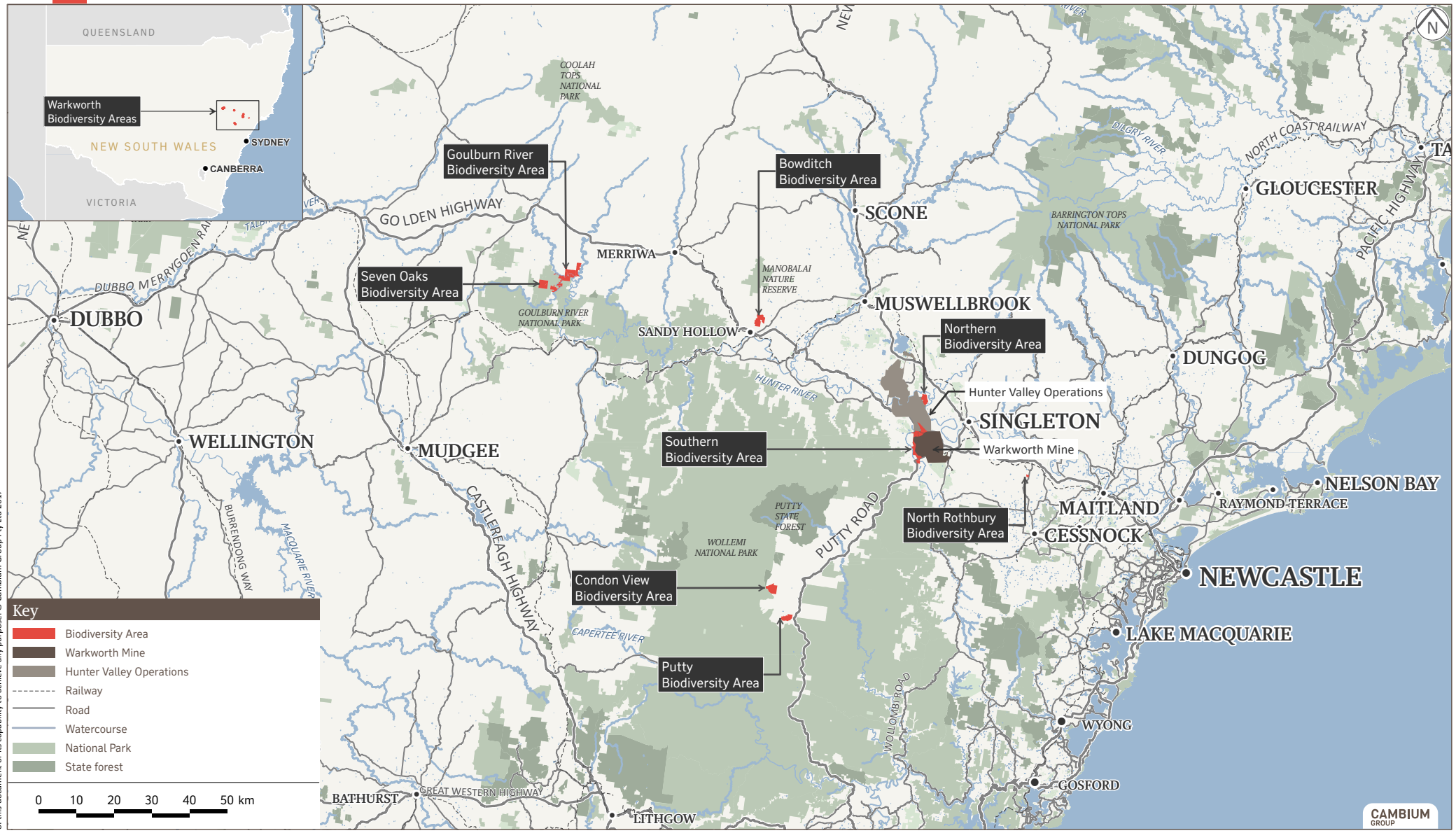
Location of the Warkworth Biodiversity Areas

Biodiversity Management Plan

Figure 8



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4.1 Biodiversity Areas descriptions

There are a total of eight BAs and each BA has its own MP. However, under Project Approval (SSD-6464) only the Southern, Northern, North Rothbury, Goulburn River and Bowditch BAs are required, therefore a summary is provided for these BAs only in the BMP.

4.1.1 Southern BA

The Southern BA is located within the Sydney Basin Bioregion, with Wollemi National Park situated to the south-west and west. The BA contributes to a south to north biodiversity corridor across the Hunter Valley floor. The Southern BA forms a near continuous north/south tract of vegetation. It is connected to the Wambo Mine conservation and cultural heritage area to the west and includes the Wollombi Brook Aboriginal Cultural Heritage (WBACH) Conservation Area.

Figure 9 indicates the location of the Southern BA and the offset areas. The 'buffer area' located to the west of Wallaby Scrub Road and along the eastern boundary of the Southern BA boundary, is to be managed in accordance with the Southern MP to protect the MNES and Endangered Ecological Communities (EEC) located in this area.

The vegetation communities are listed in Table 12. The vegetation communities with a low BioBanking condition rating will be part of the active restoration programme to re-establish woodland on existing grassland areas and improve low condition River Oak forest along Wollombi Brook.

Table 12 Vegetation Communities across Southern BA

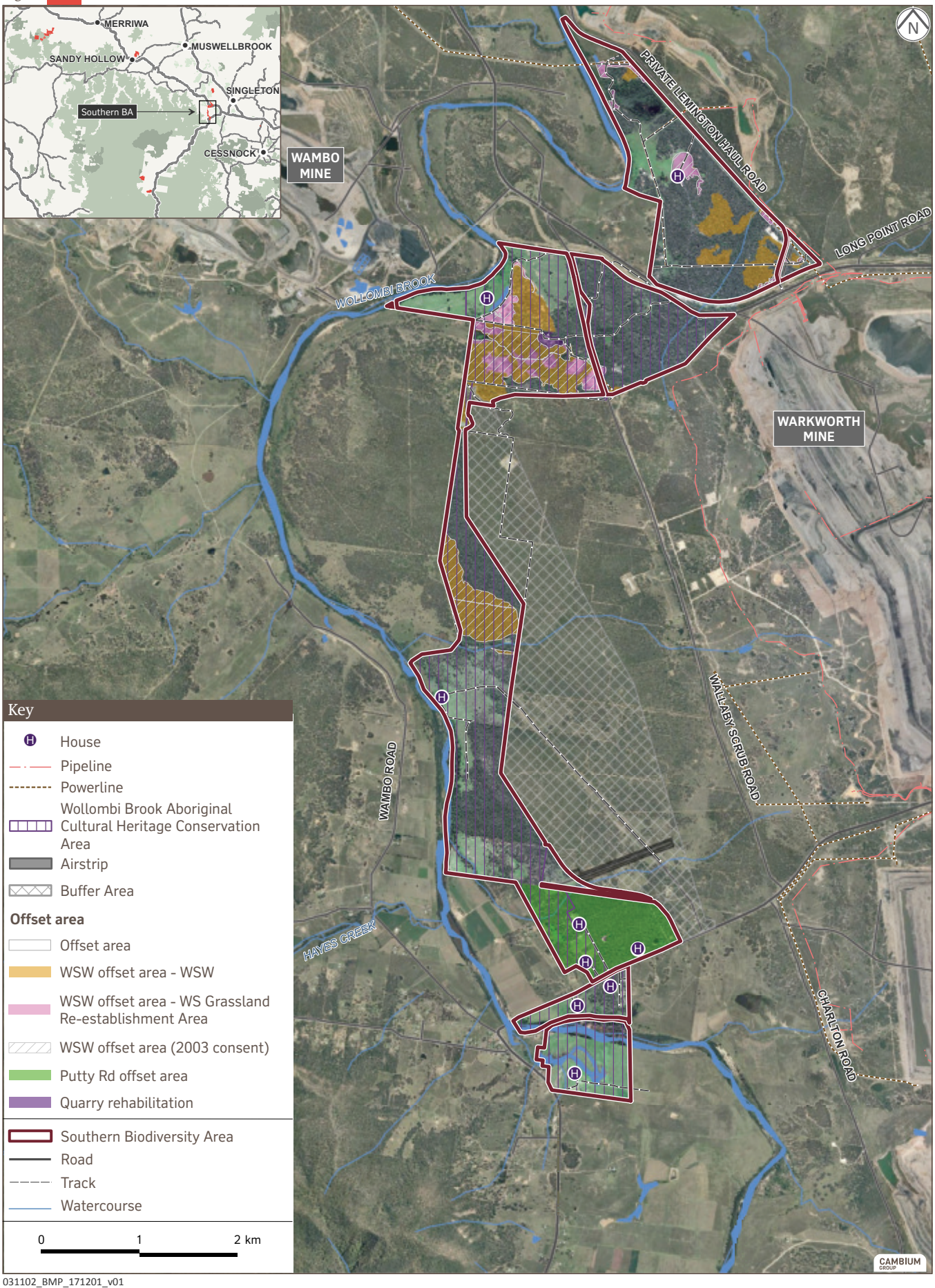
PCT code	PCT Name	Vegetation Communities	BioBanking condition	Area (ha)
HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Central Hunter Grey Box - Ironbark Woodland EEC	Moderate to Good	446.7
	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Regenerating Central Hunter Grey Box - Ironbark Woodland EEC	Low	18.3
	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Central Hunter Grey Box - Ironbark Grassland	Low	168.1
	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Exotic areas	Low	72.0
HU872	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	Warkworth Sands Woodland EEC	Moderate to Good	137.0
	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	Warkworth Sands Grassland	Low	40.3
HU909	Yellow Box grassy woodland on basalt soils	Yellow Box Woodland CEEC	Moderate to Good	7.0
HU730	White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland	White Box Woodland CEEC	Moderate to Good	27.6
HU910	Blakely's Red Gum - Rough-barked Apple shrubby woodland	Hunter Lowlands Redgum Forest EEC	Moderate to Good	32.4
HU599	River Red Gum - River Oak riparian woodland wetland	River Red Gum Floodplain Woodland EEC	Low	9.3
HU800	White Box shrubby woodland with semi - evergreen vine thicket	Hunter Valley Vine Thicket EEC	Moderate to Good	0.6
HU711	River Oak moist riparian tall open forest	Hunter Valley River Oak Forest	Low	25.7
	River Oak moist riparian tall open forest	Regenerating Hunter Valley River Oak Forest	Low	1.1
Total				**986.1**

Notes: PCT = Plant Community Type

Offset areas and infrastructure at the Southern Biodiversity Area

Biodiversity Management Plan 2017

Figure 9



4.1.2 Northern BA

The Northern BA is located within the Sydney Basin Bioregion, with Wollemi National Park situated to the south-west and west. The BA contributes to a south to north biodiversity corridor across the Hunter Valley floor and provides an important habitat refuge within the Hunter Valley floor as a 'stepping stone'.

Figure 10 indicates the location of the Northern BA and the offset areas.

The vegetation communities are listed in Table 13. The vegetation communities with a low BioBanking condition rating will be part of the active restoration programme to re-establish WSW and CHGBIW woodland on existing grassland areas.

Table 13 Vegetation Communities across Northern BA

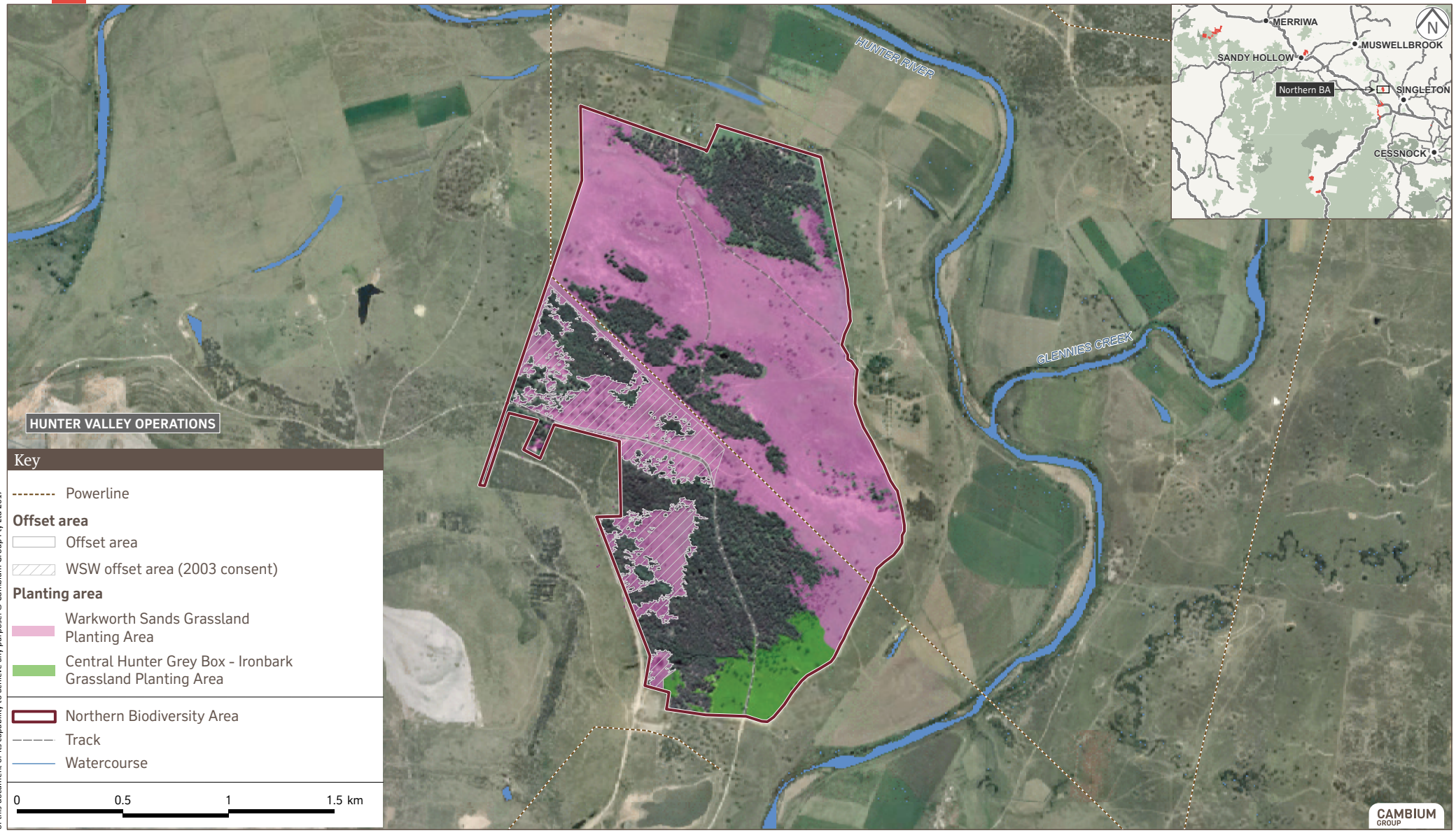
PCT code	PCT Name	Vegetation Communities as mapped in 2010	BioBanking condition	Area (ha)
HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Central Hunter Grey Box - Ironbark Woodland EEC	Moderate to Good	103.6
	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	Central Hunter Grey Box - Ironbark Grassland	Low	23.1
HU872	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	Warkworth Sands Woodland EEC	Moderate to Good	19.5
	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	Warkworth Sands Grassland	Low	194.5
Total				340.7

Notes: PCT = Plant Community Type

Offset area, planting areas and infrastructure at the Northern Biodiversity Area

Biodiversity Management Plan 2017

Figure 10



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4.1.3 North Rothbury BA

The North Rothbury BA is located within the Sydney Basin Bioregion, and directly connects with the Huntlee conservation area (803ha) to the south and the west. The BA contributes to a south to north biodiversity corridor across the Hunter Valley floor and supports 155 individuals of the North Rothbury Persoonia (*Persoonia pauciflora*). The conservation of this area and the special 17ha Personnia Park established by Huntlee for the conservation of the North Rothbury Persoonia, are significant contributions for the long term survival of this CE species listed under the EPBC Act and TSC Act.

Figure 11 indicates the location of the North Rothbury BA and the offset areas. Table 14 lists the vegetation communities represented across the BA.

Table 14 Vegetation Communities across North Rothbury BA

PCT code	PCT Name	NSW	BioBanking condition	Area (ha)
HU812	Forest Red Gum grassy open forest	Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions (EEC)	Moderate to Good	16.5
HU814	Spotted Gum – Grey Box shrub-grass open forest	Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions (EEC / CE)	Moderate to Good	24.5
-	Transmission line	-	-	0.5
Total				**41.5**

Notes: PCT = Plant Community Type

Offset area and vegetation communities the North Rothbury Biodiversity Area

Management Plan 2017

Figure 11

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4.1.4 Goulburn River BA

The Goulburn River BA is mostly located within the Brigalow Belt South Bioregion with the southern portion extending into the Sydney Basin Bioregion. It includes the convergence of the Munmurra and Goulburn Rivers. Goulburn River BA is situated strategically within a number of important conservation areas including:

- The Goulburn River National Park directly adjacent to the south and west;
- The Munmurra Nature Reserve approximately 1.6 km to the west; and
- The Durridgere State Conservation Area approximately 12 km to the north-west.

The protection and enhancement of the BA will help facilitate the movement of fauna across the landscape and extend broad areas of suitable habitats for threatened fauna species.

Figure 12 indicates the location of the Goulburn River BA and the offset areas, including those designated for the NSW HVO South environmental approval.

The vegetation communities are listed in Table 15. The vegetation communities with a low Biobanking condition rating will be part of the active restoration programme to re-establish the cleared land to Box Gum Grassy Woodland community. To increase the suitability of habitat for Regent Honeyeater active restoration is also planned for the River Oak riparian woodland.

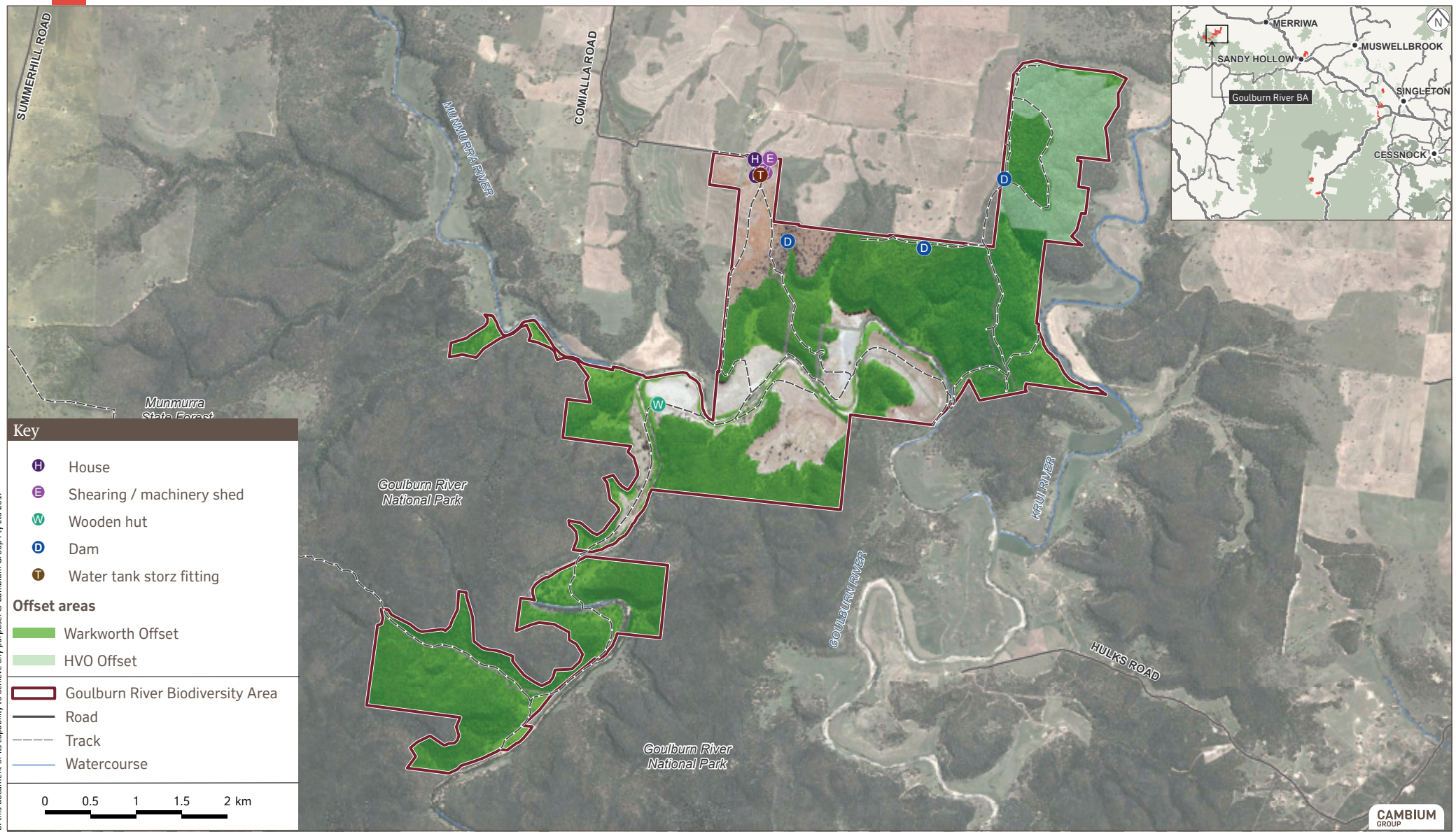
Table 15 Vegetation communities across Goulburn River BA

PCT Code	Plant Community Type (PCT)	Vegetation Community	BioBanking Condition	Area (ha)
HU690	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	White Box grassy woodland CEEC/EEC	Moderate / Good_Medium	22.0
HU714	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Yellow Box - Grey Box - Red Gum grassy woodland CEEC/EEC	Moderate / Good_Poor	180.8
HU714	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Cleared land	Low	36.9
HU825	Narrow-leaved Ironbark – Black Cypress Pine shrub-grass woodland upper Hunter and northern Wollemi	Ironbark – Callitris woodland	Moderate / Good_Medium	178.0
HU843	Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	Ironbark / Stringybark shrubby woodland	Moderate / Good_High	662.9
HU618	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Slaty Gum - Grey Box shrubby woodland VEC	Moderate / Good_Medium	96.4
HU712	River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	River Oak riparian woodland	Moderate / Good_Poor	29.0
Total				**1206**

Offset areas and infrastructure at the Goulburn River Biodiversity Area

Biodiversity Management Plan 2017

Figure 12



4.1.5 Bowditch BA

The Bowditch BA is located within the Sydney Basin Bioregion. The Bowditch BA is situated strategically within a number of important conservation areas including the:

- Manobalai Nature Reserve approximately 6 km to the north;
- Goulburn River National Park approximately 7.4 km to the south-west; and
- Wollemi National Park approximately 11.3 to the south.

The protection and enhancement of the BA will help facilitate the movement of fauna across the landscape and extend broad areas of suitable habitats for threatened fauna species.

Figure 13 indicates the location of the Bowditch BA and the offset areas.

The vegetation communities are listed in Table 16 including the BioBanking condition.

Table 16 Vegetation communities across Bowditch BA

PCT Code	Plant Community Type (PCT)	Vegetation Community	BioBanking Condition	Area (ha)
HU883	Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	Ironbark – Narrow-leaved Stringybark shrubby woodland	Moderate / Good_High	507.1
HU702	Narrow-leaved Ironbark- Black Cypress Pine - Stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Grey Gum - Narrow-leaved Ironbark shrubby woodland	Moderate / Good_Medium	61.5
HU693	Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	Grey Myrtle dry rainforest	Moderate / Good_Medium	3.6
HU821	Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter	Red Gum – Rough-barked Apple grassy woodland	Moderate / Good_Poor	29.3
Total				601.5

Offset areas at the Bowditch Biodiversity Area

Biodiversity Management Plan 2017

Figure 13

4.2 Management Plan

The MPs provide the management framework for the BAs with the aim to protect and enhance conservation values through the implementation of conservation management actions.

For the MPs to be successful they need to define the baseline ecological condition of the BA, provide clear conservation objectives, detail the conservation management actions and measure success. To that end the MPs comprise the following sections:

- Biodiversity Areas: description of the BAs and baseline ecological condition of the vegetation communities and habitats, including the biodiversity credits to be retired;
- Conservation Objectives, Key Performance Indicators and Completion Criteria: outlines the conservation objectives for the Plan, conservation values and key performance indicators that have guided the development of conservation management actions and the monitoring programme;
- Conservation Management Actions: lists the primary management actions to be implemented to increase the extent, connectivity and condition of the plant community types and habitats;
- Monitoring: details the approach to data collection, analysis and interpretation to measure impacts of the conservation management strategies, to guide adaptive management, to identify positive trends in conservation values and assess attainment of Key Performance Indicators; and
- Risk Assessment: a risk matrix to cross check activities against key risks to ensure the Plan is comprehensive and adaptive.

Successful implementation of the MPs relies upon the sharing of skills, knowledge and resources, as well as careful monitoring of activities.

The sharing of information is facilitated through the online Biodiversity Offsets Portal. This Portal has been designed to centralise and share information among authorised users and includes spatial data, an image library, reports and other non-spatial data as well as project management information such as stakeholder details and safety information. The Portal greatly improves communication among stakeholders, transparency of management and monitoring activities and ensures data security and integrity (e.g. preventing risks of data loss due to staff turnover and minimising the risk of using superseded information). Ultimately, this results in improved decision making and adaptive management that is responsive to seasonal conditions and current operational challenges.

The conservation management actions adopt passive and active restoration approaches to protect and enhance the biodiversity values across the BAs. Passive restoration involves encouraging the natural regeneration of a plant community using minimal management intervention. These practices assume that the current plant community retains moderate to high resilience. The following passive restoration techniques apply to the management of the BAs:

- weed control;
- management of human disturbance - controlled activities that are constrained to protect the biodiversity values;
- retention of regrowth and remnant native vegetation;
- erosion control; and
- vertebrate pest control.

Active restoration refers to direct land management interventions to restore areas that have demonstrated limited capacity to naturally regenerate due to a history of prolonged disturbance. The following active restoration techniques apply to the BAs:

- management of grazing for conservation;
- management of fire for conservation;
- restoration and re-establishment of vegetation communities; and
- relocation of salvaged resources.

4.2.1 Conservation objectives

The MPs establish conservation objectives for a 10 year timeframe to:

- enhance biodiversity values across the BAs;
- protect the BAs under legally binding conservation covenants;
- increase the condition of EECs and observe a transition from grassland to woodland;
- provide refuge and habitat for local fauna populations and transient species, particularly threatened species
- provide an extension of protected reserves for threatened fauna species, including the Regent Honey-eater and Swift Parrot and other woodland fauna species known to occur in the area; and
- contribute to and enhance the existing network of protected vegetation within the Hunter Valley.

Each MP has its own Key Performance Indicators that are aligned with the biodiversity values and any nested conservation values of the Offset Area. The MP monitoring programme details the attributes to be measured to provide evidence and demonstrate achievement of the Key Performance Indicators.

4.2.2 Conservation Management Actions

The MPs include full descriptions of the conservation management actions to be implemented and Table 17 provides a summary of the short term (3 year) performance criteria and completion criteria for each.

Table 17 Performance and Completion Criteria for the conservation management actions

	Year 1 PC (2016)	Year 2 PC (2017)	Year 3 PC (2018)	Completion Criteria
Management of grazing for conservation				
Fencing	Boundary fence condition assessed, and maintenance schedule established	Maintenance programme commenced	Maintenance programme continued	Boundary fences constructed and maintained
Monitoring	Assessment to ensure all cattle removed	Assessment of weed and fire hazard and presence of rogue cattle	Assessment of weed and fire hazard and presence of rogue cattle	Assessment completed and no cattle present
Weed Control				
Weed extent and density	Baseline and year 1 revision completed as part of ecological monitoring.	Year 2 revision completed as part of ecological monitoring programme Reduction in Exotic Plant Cover as recorded during monitoring programme compared to previous year	Year 3 revision completed as part of ecological monitoring programme Reduction in Exotic Plant Cover as recorded during monitoring programme compared to previous year	All revisions completed Weeds should not have spread to previously un-infested areas.
Weed control programme	Weed control programme implemented, mapped and reported	Weed control programme implemented. mapped and reported	Weed control programme implemented, mapped and reported	All weed control events implemented mapped and reported
Management of Fire for Conservation				
Bushfire Management Plan (BFMP)	Actions implemented Review and revise if required	Actions implemented Review and revise if required	Actions implemented Review and revise if required	All required actions of BFMP have been implemented BFMP has been reviewed annually and revised if required
Management of Human Disturbance				
Signage	BioBanking signs installed.			All signs installed.
Map access track and fences	Data collected, inventory compiled and saved on to Portal. The inventory shall identify distances of fences, distances of fences to be replaced, removed or relocated.	Data layer revised.	Data layer revised.	All data accessible from Biodiversity Offset Portal.

	Year 1 PC (2016)	Year 2 PC (2017)	Year 3 PC (2018)	Completion Criteria
Inspections and reports	Complete biannual inspection and report all works completed and actions for next year.	Complete biannual inspection and report all works completed and actions for next year.	Complete biannual inspection and report all works completed and actions for next year.	Inspections and reports completed
Retention of regrowth and remnant native vegetation				
Monitoring, inspections and reports	Complete biannual inspection and report all works completed and actions for next year.	Complete biannual inspection and report all works completed and actions for next year.	Complete biannual inspection and report all works completed and actions for next year.	Inspections and reports completed
Southern BA Supplementary planting				
WSW planting	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Ecological monitoring demonstrates a positive trend toward the reference site or the benchmark values for HU872 for all attributes measured over three consecutive assessments (the average of all plots).
CHGBIW	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Ecological monitoring demonstrates a positive trend toward the reference site or the NSW Biometric HU817 for all attributes measured over three consecutive assessments (the average of all plots).
River Oak Forest		Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Survival assessment greater than 70%.
Northern BASupplementary planting				
WSW :	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Ecological monitoring demonstrates a positive trend toward the reference site or the benchmark values for HU872 for all attributes measured over three consecutive assessments (the average of all plots).
CHGBIW)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment.	Ecological monitoring demonstrates a positive trend toward the reference site or the NSW Biometric HU817 for all attributes measured over three consecutive assessments (the average of all plots).
Goulburn River BA Supplementary planting				
Zone 3: Yellow Box – Grey Box – Red Gum grassy woodland (21.5ha)	Collection of seed commenced.	Collection of seed and plant propagation commenced.	Collection of seed and planting commenced. Survival Assessment completed.	Planting achieves above 70% survival.
Zone 7: River Oak riparian woodland (24.2ha)	Collection of seed commenced.	Collection of seed and plant propagation commenced.	Collection of seed and planting commenced. Survival Assessment completed.	Planting achieves above 75% survival.
Relocation of salvaged resources	Record the amount and location of resources	Completed targeted monitoring of locations to assess usage.	Completed targeted monitoring of locations to assess usage.	Ecological monitoring demonstrates similar habitat attributes as reference site or benchmark values.
Erosion Control				
Monitoring inspections and reports	Complete biannual inspection and report all works completed and actions for next year	Complete biannual inspection and report all works completed and actions for next year	Complete biannual inspection and report all works completed and actions for next year	Inspections and reports completed

	Year 1 PC (2016)	Year 2 PC (2017)	Year 3 PC (2018)	Completion Criteria
Vertebrate Pest and Overabundant Native Herbivore Control				
Vertebrate Pest monitoring and control	At least one monitoring and control period complete.	At least one monitoring and control period complete.	At least one monitoring and control period complete.	All control events completed
Overabundant native herbivore monitoring and control	Control programme completed if recommended through ecological monitoring	Control programme completed if recommended through ecological monitoring	Control programme completed if recommended through ecological monitoring	Control events completed (if required)
Reporting	Reporting completed as per plans and recommendation(s) adopted	Reporting completed as per plans and recommendation(s) adopted	Reporting completed as per plans and recommendation(s) adopted	Reporting completed as per plans

4.2.3 Monitoring Programme

The monitoring programme comprises three components to capture environmental change at different scales:

- Landscape monitoring: to assess vegetation changes and habitat connectivity at the landscape scale in the long-term (7-10 years);
- Ecological monitoring: Vegetation and habitat, and bird assemblage to quantify changes in vegetation structure, key fauna habitat features and bird assemblages in the medium-term (biennially); and
- Management monitoring: Rapid Condition Assessments and Property inspections to identify threats and inform management activities consistent with the adaptive management approach in the short term (biannually/annually) and survival assessments to assess the performance of planting activities.

All monitoring results will be stored and accessible on the Biodiversity Offsets Portal.

The ecological monitoring programmes, described within the each BA MP and measures changes in vegetation, habitat and bird assemblages.

The objectives of the vegetation and habitat monitoring are to:

- demonstrate changes in vegetation community composition, structure and habitat features in the Transformation sites towards the Reference sites;
- demonstrate changes in vegetation composition, structure and habitat features towards the BioMetric Vegetation Types benchmarks; and
- demonstrate recruitment of canopy species through transition up age classes (measured as Diameter at Breast Height (DBH)).

The objectives of the bird assemblage monitoring are to:

- demonstrate ongoing habitat usage by woodland birds and a decrease in the relative abundance of bird species typical of forest margins and grasslands; and
- assess the presence of Swift Parrot and Regent Honeyeater within the offset areas and collect information regarding their movements and habitat usage.

The performance criteria and completion criteria for the ecological monitoring is shown in Table 18.

Table 18 Performance and Completion Criteria for the ecological monitoring

	Year 1 PC (2016)	Year 2 PC (2017)	Year 3 PC (2018)	Completion Criteria
Ecological Monitoring				
Vegetation and habitat	Completion of monitoring between September and November		Completion of monitoring between September and November	Monitoring continues until the MP KPIs and completion criteria are achieved.
Bird Assemblage	Completion of monitoring between July-Aug		Completion of monitoring between July-Aug	Monitoring continues until the MP KPIs and completion criteria are achieved.
Management Monitoring				
Rapid Condition Assessment	Completion of monitoring between September and November	Completion of monitoring between September and November	Completion of monitoring between September and November	Monitoring continues until the MP KPIs and completion criteria are achieved.
Biannual property inspection	Completion of monitoring in April and November	Completion of monitoring in April and November	Completion of monitoring in April and November	Monitoring continues until the MP KPIs and completion criteria are achieved.
Survival Assessment (where required)	Completion of assessment 3 to 6 month post planting	Completion of assessment 3 to 6 month post planting	Completion of assessment 3 to 6 month post planting	Monitoring continues until the MP KPIs and completion criteria are achieved.
Habitat usage assessment	Completion of assessment 12 month post relocation of salvaged materials	Completion of assessment 12 month post relocation of salvaged materials	Completion of assessment 12 month post relocation of salvaged materials	Monitoring continues until the MP KPIs and completion criteria are achieved.

4.3 BioBanking Agreements

The offset areas within the BAs are to be secured under a BioBanking Agreements under the TSC Act. The BioBanking Application will be supported by the following documentation:

- BioBanking Assessment Report, to verify the offset areas and calculate the ecosystem and species credits, completed by an OEH accredited BioBanking Assessor;
- Expert report, to verify species credits when there are no recorded sighting within the offset area; the report is prepared by a specialist expert approved by OEH;
- BioBanking Management Plan; and
- Total Fund Deposit Calculation; summary of costs to manage the offset areas over 40 years.

The BioBanking Assessment Report for the Southern, Northern, North Rothbury, Goulburn River and Bowditch BA were completed in June 2015. Table 19 provides a summary of the ecosystem and species credits required for the disturbance area and those generated by the land based offset areas. It also indicates the credits generated from each separate BA and those credits that have been estimated from existing offsets areas that cannot be retired to offset the Warkworth Continuation Project disturbance credits.

Table 19 Summary of Ecosystem and Species Credits

Warkworth Continuation Project	Credits	Southern	Northern	Goulburn River	Bowditch	North Rothbury
Ecosystem Credits Required (by disturbance)	31,700					
Ecosystem Credits Generated (by offsets)	37,463	11,231	4,214	16,717	4,985	316
Ecosystem Credits Net Difference	**5,763**					
Species Credits Required (by disturbance)	37,293					
Species Credits Generated (by offsets)	56,630	3,845	895	30,001	20,498	1,391
Species Credits Net Difference	**19,337**					
Credits not available for retirement						
Ecosystem Credits (WSW Offset Area)		1,938	562			
Species Credits (WSW Offset Area)		551				
Ecosystem Credits (Putty Road Offset Area)		1,329				
Species Credits (Putty Road Offset Area)		486				
Ecosystem Credits (HVO Offset)				2,213		
Species Credits (HVO Offset)				4,970		
Ecosystem Credits (Biodiversity Area Total)		14,498	4,776	18,948	4,985	316
Species Credits (Biodiversity Area Total)		4,882	895	34,971	20,498	1,391

Noting that if required WML can use ecosystem and species credits generated from the Condon View, Putty and Seven Oaks BAs to cover any shortfall.

Condition 28 requires the retirement of credits with 3 years of the date of commencement of the consent. Table 20 establishes the criteria to retire the credits.

Table 20 Performance and completion criteria to retire credits

Biodiversity Area	PC Year 1 (2016)	PC Year 2 (2017)	PC Year 3 (2018)	Completion Criteria
Southern Northern North Rothbury Goulburn River Bowditch	Completion of: • Biobanking Assessment Report • Expert report • BioBanking Management Plan • Management Plan Lodgement of BioBanking Application.	BioBanking Agreement executed	Lodged application to retire credits.	Credits retired
Condon View Putty Seven Oaks	Completion of: • Biobanking Assessment Report • Expert report • BioBanking Management Plan • Management Plan	Lodgement of BioBanking Application BioBanking Agreement executed	Lodged application to retire credits.	Credits retired

5 Projects

These projects are supplementary conservation measures that indirectly offset the impact of the mine and deliver improved biodiversity outcomes through:

- co-ordination of conservation effort from integrated and/or improved planning; and
- contribution to strategic conservation programmes.

5.1 Warkworth Sands Woodland Restoration Manual

The WSW Restoration Manual is to be update to include suitable performance criteria, to the satisfaction of OEH, for determining the successful regeneration of WSW EEC in the Northern BA within 15 years for the commencement of Project Approval (SSD-6464).

A revised WSW is to be submitted by before end July 2016, in accordance with Condition 32 (a) Project Approval (SSD-6464).

5.2 Warkworth Sands Woodland Integrated Management Plan

Condition 34 of Project Approval (SSD-6464) requires the preparation of an Integrated Management Plan for the Warkworth Sands Woodland EEC to the satisfaction of OEH. This plan must be prepared in consultation with the owners of the Wambo and Bulga mines, and outline the measures that would be implemented to co-ordinate management and recovery efforts for the EEC.

The preparation of the Integrated Management Plan will be guided by the 18 Priority Actions to help recover the WSW EEC (OEH 2014) identified by OEH, listed in Table 21. A WSW Working Group will be established, with representatives from Bulga, Wambo and Warkworth mines and Singleton Council, as owners of land with WSW. The WSW Working Group will collaborate to:

- exchange and share information;
- consolidate the WSW knowledge base; and
- coordinate activities in the control threatening processes.

Table 21 Priority Actions for Warkworth Sands Woodland Endangered Ecological Community

Action Title	Priority
Accurately survey and map the extent and condition of all remnants	High
Undertake an assessment of the conservation significance of remnants and prioritise sites for protection and active management on this basis of this assessment	High
Nominate WSW as an EEC under the EPBC Act	High
Notify landowners/managers and other stakeholders of the presence of WSW remnants under their care and/or control	High
Determine the tenure of all remnants of the EEC and identify relevant stakeholders	High
Prepare community profile and EIA guidelines and provide to Singleton Council, the DoP and any other bodies that have a consent or approval role	High
Seek to increase the level of legislative protection for sites through landuse planning mechanisms and conservation agreements	High
Undertake rehabilitation works at priority sites using approved bush regeneration techniques	Medium
Undertake regeneration works to maintain or improve connectivity between remnants	Medium
Fence remnants to exclude livestock and encourage regeneration	Medium
Prepare best practice management guidelines for remnants and provide to landowners/managers as well as other stakeholders (consent/determining authorities)	Medium
Establish incentives programs to promote and encourage best practice management of remnants on private land	Medium
Determine location, species composition and threats to remaining remnants to assist with prioritising restoration works	Medium
Collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - all known provenances (conservation collection)	Medium
Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage)	Medium
Undertake management-focused research (including investigation of an appropriate fire regime, population viability analysis)	Medium
Prepare a recommendation for the identification of critical habitat on the basis of the outcomes of extent, condition and tenure assessment	Medium
Assess opportunities for incorporating land supporting WSW into the reserve estate (biobanking)	Low

The representatives on the WSW Working Group are selected on the basis that they own and manage areas of WSW.

A small area of WSW EEC occurs in the north-west section of the Bulga Complex operated by Glencore. Additional surveys undertaken in 2004 identified additional WSW EEC adjacent to the Bulga Coal Complex.

With the presence of WSW EEC, Glencore have a number of consent conditions related to the management of WSW EEC.

Glencore has prepared two plans in response to the consent conditions. The *Rehabilitation and Offset Management Plan* (2011) provides a detailed description and direction for the rehabilitation of disturbed lands within the Bulga Coal Complex and the establishment and management of biodiversity offset areas within and outside the Bulga Coal Complex. The *Flora and Fauna Management Plan* (2013) directs the specific procedures for vegetation clearance, rehabilitation and enhancement of woodland remnants, management within conservation areas, salvage and re-erection of habitat material and the management of weeds. The plan also details the monitoring required to ensure the management procedures are successfully being implemented.

Glencore have established a conservation area (21ha in total with approximately 8ha of WSW EEC) incorporating the following management measures:

- Exclusion of stock;
- Ongoing weed management;
- Fire management;
- Habitat linkage with flora and fauna corridor through rehabilitation;
- Erection of nest boxes; and
- Relocation of salvaged habitat material to conservation areas to assist in controlling weeds and habitat linkage.

Ecological monitoring of vegetation and fauna is undertaken annually. The main objective of the ecological monitoring program is to census the microbats, diurnal birds and fauna habitats. The monitoring program comprises 13 sites, of which three are within the WSW EEC.

The Bulga Optimisation project will protect a further 18 ha of WSW EEC as part of the proposed Wollombi Brook Conservation Area, which adjoins the Southern BA.

WSW EEC occurs in the south-east section of the Wambo Coal Mine operated by Peabody Energy, in the vicinity of Wollombi Brook.

Peabody Energy has a number of consent conditions related to the management of WSW.

Peabody Energy has prepared a *Flora and Fauna Management Plan* (FFMP) to assist in the implementation of appropriate environmental management measures during Wambo's operations. The FFMP includes the Remnant Woodland Enhancement Program (RWEP). The objective of the RWEP is to help conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna. The RWEP will provide a strategy that gives protection in perpetuity for RWEP Area A (which includes WSW EEC) and long-term protection of RWEP Areas B and C.

Singleton Council has known areas of WSW within their management area.

Recent surveys of the Australian Department of Defence Singleton Military base identified that the community previously thought to be WSW does not conform to the community determination.

To ensure compliance and completion of the Integrated Management Plan performance and completion criteria have been prepared, as shown in Table 22.

Table 22 Performance and Completion Criteria for the WSW Integrated Management Plan

	Year 1 PC (2016)	Year 2 PC (2017)	Year 3 PC (2018)	Completion Criteria
Integrated Management Plan				
WSW Working Group	Within 3 month WSW Working Group to meet and agree upon a memorandum of understanding to share information.	Implement agreed components of the approved Integrated Management Plan	Implement agreed components of the approved Integrated Management Plan	Plan implemented
Draft Plan	Within 8 months provide draft for review by OEH			Draft received by OEH
Plan approval	Within 12 months submit plan for approval by OEH			Plan received by OEH

5.3 'Saving Our Species – Regent Honeyeater' conservation program

In accordance with Condition 35 a contribution of $1 million will be made to *OEH's Saving Our Species – Regent Honeyeater* conservation program. The transfer of fund to this OEH programme will be completed within 6 months and signify the completion criteria for this project.

6 References

Bell, S (2012). Expert Report: Bulga Milbrodale Progress Association v Minister for Planning and Infrastructure and Warkworth Mining Limited. Land and Environment Court Proceedings No: 10224 of 2012. Report Prepared for EDO NSW, July 2012. Eastcoast Flora Survey, Sydney. Pp 108.

Bower, C.C. (2004). Investigation of Warkworth Sands Woodland and associated soils in the extension area, NDAs, HMAs and on adjacent land. Unpublished Report. FloraSearch. August 2004.

Cohen, T and Nanson, G. (2009). Warkworth Sands Archaeological Project: A geomorphic analysis August 2009 Final Report Scarp Archaeology. School of Earth and Environmental Sciences University of Wollongong. Wollongong. Pp 207.

Cumberland Ecology (2012), Vegetation maps relevant to the proposed Biodiversity Areas, in DnA Environmental (2012). Biodiversity Management Plan for Warkworth Biodiversity Areas. Prepared for Warkworth Mining Limited. Revised September 2012.

Cumberland Ecology (2013), ADVISORY LETTER - COMPLIANCE WITH 2003 WARKWORTH CONSENT (CONDITION 2, SCHEDULE 4) prepared for Department Planning and Infrastructure.

Galloway, R.W. (1963). Geology of the Hunter Valley. Pp. 81-89 in Story, R, Tweedie, A.D., van de Graaf, R.H.M., and Galloway,R.W. (eds) (2010). General Report on the Lands of the Hunter Valley. Land Research Series No. 8. Commonwealth Scientific and Industrial Research Organisation, Melbourne. http://www.publish.csiro.au/paper/LRS08.htm [accessed on 15 December 2013]

Keith, D.A. (2004) Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT. Department of Environment and Conservation: Hurstville.

NSW NPWS (2002) Final determination- Quorrobolong scribbly gum woodland in the Sydney Basin Bioregion- endangered ecological community listing, [accessed on 16 December 2013 http://www.environment.nsw.gov.au/determinations/QuorrobolongScrib blyGumWoodlandSydneyEndComListing.htm [accessed on 15 December 2013]

NSW NPWS (2008) Approved NSW Recovery Plan- Kurri Sand Swamp Woodland Endangered Ecological Community, NSW NPWS, Sydney.

NSW Scientific Committee. (2002). Warkworth Sands Woodland in the Sydney Basin Bioregion endangered ecological community listing. Department of Environment and Conservation, Hurstville, NSW.

NSW Scientific Committee (2011). Warkworth Sands Woodland in the Sydney Basin Bioregion - Scientific Committee determination – Final. http://www.environment.nsw.gov.au/determinations/warkworthsands36a.htm

Peake, T., Bell, S., Tame, T., Simpson J., and Curran, T. (2002). Warkworth Sands Woodland - An Endangered Ecological Community Distribution, Ecological Significance and Conservation Status, December 2002. http://www.huntergardens.org.au/warkworth1.htm. [Accessed on 22 December 2013].

Peake, T.C. (2006). The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project. Hunter-Central Rivers Catchment Management Authority, Paterson.

Robertson, D. J. (2013). Statement of Evidence. Land and Environment Court of NSW: Class 1, Proceedings 10224 of 2012. Prepared for MinterEllison Lawyers on behalf of Rio Tinto Coal Australia Pty Limited. Carlingford Court, NSW.

Ryan, K., Fischer, M., and Schaeper, L. (1996). The natural vegetation of the St Albans 1:100 000 map sheet. Cunninghamia, 4(3): 433-482.

Story, R, Tweedie, A.D., van de Graaf, R.H.M., and Galloway,R.W. (eds) (2010). General Report on the Lands of the Hunter Valley. Land Research Series No. 8. Commonwealth Scientific and Industrial Research Organisation, Melbourne. http://www.publish.csiro.au/paper/LRS08.htm [accessed on 15 December 2013]

Umwelt (Australia). (2011). Review of Ecological Assessments for Warkworth Extension EA and HVO South Modification Projects. Prepared on behalf of Department of Planning & Infrastructure. Toronto, NSW.

7 Attachment A – MTW Trigger Action Response Plan

Aspect/ Category	Item	Element	Trigger	Response
Landform Stability	1	Water Management Structures	Water management structures (sediment dams, channels, contour banks) erosion &/or scouring	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as amelioration, revegetation or alternative scour protection as required. For significant failures or repeat minor failures conduct review of design criteria and construction standards.
	2	Slope Gradient – General	Overall slope grades > 10 degrees unless otherwise agreed.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area, if required. Note, localised steepening of slopes will occur due to contour bank construction etc.
	3	Slope Gradient – Ramps	Overall slope grades > 14 degrees unless otherwise agreed.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area, if required. Note, localised steepening of slopes will occur due to contour bank construction etc.
	4	Slope Gradient – Low Walls Into Voids	Overall slope grades > 18 degrees unless otherwise agreed.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area, if required. Note, localised steepening of slopes will occur due to contour bank construction etc.
	5	Batter Slopes – Final Void	Failure of final void batter slopes.	Undertake a review of final void design, including survey if required. Undertake remedial blasting &/or re-grading of the area, if required.
	6	TSF Final Capping Surface	Settlement of tailings causing ponding of water on TSF capping surface.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as backfilling, reinstating drainage lines and revegetating as required.
Spontaneous Combustion	7	Carbonaceous Material on	Active spontaneous combustion within rehabilitation areas.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as extinguishment by watering, capping with

Aspect/ Category	Item	Element	Trigger	Response
		Surface of Rehabilitation		inert material or excavation and removal as required. For widespread spontaneous combustion activity review management measures for carbonaceous material.
	8	Exposed Coal Seams	Active spontaneous combustion from exposed coal seams.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as extinguishment by watering or flooding or burial with inert material as required. For widespread spontaneous combustion activity review management measures for covering exposed coal seams.
Growth Medium Suitability	9	Acid Rock Drainage	Evidence of ARD products affecting vegetation establishment.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as capping with inert material and revegetating as required. For widespread ARD activity review management measures for burial of potential ARD producing material.
	10	Chemical and Nutritional Properties	Soil properties atypical for the surrounding landscape &/or outside desirable ranges provided by the agricultural industry: Pasture Trigger Levels pH <5.5 or >8.5; Electrical Conductivity >2 dS/m; Phosphorous <40ppm; Organic Carbon <1.5%; Cation Exchange Capacity <12 Cmol+/kg; Exchangeable Sodium Percentage >10%; and Calcium/magnesium ratio <1 or >10.	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and revegetation in accordance with the consultant recommendations as required.

Aspect/ Category	Item	Element	Trigger	Response
			Woodland Trigger Levels pH <5.5 or >8.5; Electrical Conductivity >2 dS/m; Phosphorous and Organic Carbon not within levels in analogue sites by Year 5; Cation Exchange Capacity, Exchangeable Sodium Percentage and Calcium/magnesium ratio not within levels in analogue sites by Year 2.	
	11	Growth Medium Depth	Soil depth (topsoil and ameliorates) is less than 100mm in areas in the Growth Medium Development phase.	Top dress with additional suitable topsoil resource and /or ameliorants if required. For repeat topsoil thickness issues conduct review of topsoil placement procedures and operational practices.
Vegetation Establishment	12	Weed Levels	>10% cover of problematic weed species present in Ecosystem Establishment phase.	Engage land management contractor to control problematic weed using methods such as removal, biological control, herbicide application and slashing. Treatment of infestations as appropriate to the species. Conduct follow-ip inspections to assess the effectiveness of weed management measures.
	13	Bushfire Resilience	Rehabilitation areas not able to recover in a reasonable time from effects of bushfire.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as re-seeding affected area as required. Review bushfire management procedures particularly with a view to protecting young rehabilitation areas.
	14	Uncontrolled Entry of Livestock or Vehicles	Damage to vegetation caused by uncontrolled access by livestock or vehicles.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as fence installation or repairs, maintaining access tracks and sign posting.
	15	Understorey Species	Understorey species diversity atypical compared to analogue	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as grazing, controlled burning, soil

Aspect/ Category	Item	Element	Trigger	Response
		Diversity	sites.	amelioration, reseeding and fertilising as required. For widespread low understorey diversity review seed mix understorey species composition and seeding rates. Review monitoring results to determine rates of successful establishment for various understorey species in seed mixes.
	16	Tree and Shrub Species Diversity	Tree and shrub species diversity atypical compared to analogue sites.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as cultivation or spraying to reduce grass competition, reseeding and fertilising as required. For widespread low tree and shrub diversity review seed mix tree/shrub species composition and seeding rates. Review monitoring results to determine rates of successful establishment for various tree/shrub species in seed mixes.
	17	Tree Density	Tree density is outside typical range for analogue sites.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as cultivation or spraying to reduce grass competition, reseeding (for low density) and thinning (for high density) as required. For widespread tree density outside analogue site ranges review seed mix tree species composition and seeding rates. Review monitoring results to determine rates of successful establishment for various tree species in seed mixes. Review seed bed preparation, weed/grass control and sowing procedures.
	18	Ground Cover	Total ground cover < 70% during Ecosystem Establishment phase.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as soil amelioration, soil aeration, reseeding and fertilising as required. For widespread low results for total ground cover review seasonal mixes and seeding rates.
	19	Tree Growth Rate	Average trunk diameter (dbh) of the tree population measuring growth rate are atypical compared to analogue sites.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as soil amelioration and fertilising as required. For widespread low results for tree growth rate review soil amelioration and preparation procedures.

Aspect/ Category	Item	Element	Trigger	Response
	20	Tree Health	Tree health is atypical compared to analogue sites. Trigger levels still to be determined for tree health in Woodland – Other and Woodland – EEC areas.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as soil amelioration and fertilising as required. For widespread low results for tree health review land management practices with a view to increasing biodiversity to provide habitat for pest insect predators.
	21	Tree Productive Health and Recruitment	Tree health and recruitment levels are atypical compared to analogue sites. Trigger levels still to be determined for tree productive health and recruitment in Woodland – Other and Woodland – EEC areas.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as soil amelioration and fertilising as required. For widespread low results for tree productive health review land management practices with a view to increasing biodiversity to provide habitat for pollinators.
Fauna Recolonisation	22	Vertebrate Pest Levels	Vertebrate pest species density increased in annual monitoring events or causing significant damage to rehabilitation.	Consult with relevant government agencies (including OEH) to develop and implement appropriate vertebrate pest control programme.
	23	Habitat – Fallen Logs	Total length of fallen logs in Woodland – EEC areas is <50% that of analogue sites.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as introducing additional fallen timber (consider pruning or thinning standing trees) as required. For widespread low results for fallen logs review land management practices with a view to reducing loss of logs through regular bush fires or fire wood collection.
	24	Habitat- Hollows	Total length of hollows/ nesting sites in Woodland – EEC areas is <50% that of analogue sites.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as introducing stag trees or nest boxes as required.
Ecosystem Function	25	Stability, Infiltration and	LFA indices values for stability, infiltration, nutrient cycling or landscape organisation are	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as soil amelioration, soil aeration, reseeding

Aspect/ Category	Item	Element	Trigger	Response
		Nutrient Cycling	trending away from the values of analogue sites.	and fertilising as required. For widespread negative trends for LFA indices review rehabilitation procedures related to soil amelioration and preparation.

8 Attachment B – OEH Consultation Response

NSW GOVERNMENT | Office of Environment & Heritage

Your reference: SSD 6464 & SSD 6465
Our reference: DOC15/506766-4
Contact: Robert Gibson, 4927 3154

Mr Andrew Speechly
Manager Environmental Services NSW
Coal & Allied Operations Pty Ltd
PO Box 315
SINGLETON NSW 2330

Dear Mr Speechly

RE: OEH REVIEW OF THE MOUNT THORLEY WARKWORTH MINING OPERATIONS PLAN AND WARKWORTH BIODIVERSITY MANAGEMENT PLAN

I refer to your letter dated 4 December 2015 requesting comment on the Mount Thorley Warkworth Rehabilitation Management Plan. It is understood that the Mount Thorley Warkworth Mining Operations Plan (MOP) provided for review was prepared to be consistent with a Rehabilitation Management Plan. The Warkworth Biodiversity Management Plan (BMP) was also provided for review in conjunction with the MOP. The Office of Environment and Heritage (OEH) understands that these documents were prepared in accordance with Schedule 58a, Schedule 2 of the Warkworth Continuation Project (SSD 6464) and Condition 36b, Schedule 2 of the Mt Thorley Continuation Project (SSD 6465) consent.

OEH has reviewed the above documents and provides comments in relation to how some sections of the plans may be clarified and how some objectives may be refined. Overall the 'Performance Indicators' and 'Completion Criteria' in the MOP and BMP are relatively easy to read and follow. The stated time frames to achieve rehabilitation outcomes may be insufficient, particularly under periods of unfavourable conditions. Elements of several proposed monitoring programmes are unclear. These comments are further expanded in **Attachment 1**.

OEH acknowledges that the MOP and BMP are high level guidance documents. Some of the points raised in the attached review may be more fully covered in the proposed Offset Management Plans for these projects.

If you have any enquiries concerning this advice, please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4927 3154.

Yours sincerely

29 JAN 2016

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Enclosure: Attachment 1

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ATTACHMENT 1: OEH REVIEW - MOUNT THORLEY WARKWORTH MINING OPERATIONS PLAN AND WARKWORTH BIODIVERSITY MANAGEMENT PLAN

OEH has reviewed the Mount Thorley Warkworth Mining Operations Plan (MOP) dated 27 November 2015 and the Warkworth Biodiversity Management Plan (BMP) dated December 2015. Detailed comments on each document are provided below.

Mount Thorley Warkworth Mining Operations Plan

OEH has focussed the review of the MOP in relation to performance indicators and relinquishment criteria for revegetation. The MOP presents a framework for recreating native plant communities by developing an appropriate growing medium, planting a selected mix of indigenous plant species in particular areas, managing revegetation for several risks, and implementing a monitoring programme to measure success at stages along the way to achieving stated goal of recreating self-sustaining, recognisable plant communities. Rehabilitation has risks, particularly due to external factors like drought, flood and fire; and these are acknowledged in the MOP. There are also questions about what to measure, how often to measure, and how long to measure particular parameters to track progress and identify when the end goal is met. To this end performance measures and associated indicators in the MOP have been designed to provide an appropriate benchmark or guide against which to assess the management of project lands and the resulting improvements (p. 53).

Performance indicators and completion criteria will be used to determine if the reconstructed ecosystem is trending towards the analogue sites. It is important to note that many of the completion criteria are considered met if the relevant Performance Indicator shows development/trend towards analogue sites. However, it is difficult to determine at what point the ecosystem will be 'deemed' to be trending 'enough' towards an analogue site. Many of the completion criteria are yet to be determined. The MOP assumes that the reconstructed ecosystem will replicate the analogue over time. This is by no means certain. It can take a very long time to match species richness and composition of the targeted reference/analogue sites. A number of factors including differences in chemical and physical properties of the growing medium and landform design can result in very different rehabilitation outcomes making it difficult to predict successional trends in these types of environments. It is noted that the MOP states that *"the areas returning to native plant communities will, in the main, be based on enhanced growing media, the basis being overburden and appropriate ameliorants i.e. organic fertilisers, gypsum and organic matter"* (p. 64). This may increase the difficulty of the rehabilitated areas trending towards matching the analogue sites.

There is a risk that the reconstructed ecosystems will not be sustainable over the long term due to a variety of factors including drought and this is acknowledged in the proposed 'Trigger Action Response Plan' (pp. 103-104). This concern can be addressed through long monitoring (how long is unclear in the MOP), setting benchmarks/thresholds/completion criteria (some have yet to be determined), and appropriate remedial action/management intervention. It is not clear from the MOP how long the proposed monitoring 'term' will be. The MOP indicates that the *"development of performance criteria for regeneration of Warkworth Sand Woodland to ensure successful regeneration in the Northern Biodiversity Area within 15 years from the commencement of the development"* (p. 38). However, is 15 years the extent of long-term monitoring? It should also be noted that it takes time for a reconstructed native ecosystem to develop and become self-sustainable (very likely greater than 15 years).

The phrase *"trending towards analogue"* is used within the MOP. However, it is unknown how close (to the analogue) is close enough? It is understood that the rehabilitated target communities will not recreate the analogue community. However, it should be noted that the MOP does indicate that it is intended to re-create approximately 2,100 hectares of endangered ecological communities (EEC) to a standard comparable to similar reference EEC communities. OEH acknowledges that the MOP (p. 12) identifies that *"...if the completion criteria are not met, or are not adequately trending towards being met, determine the likely ecological value of the rehabilitation once completed, and recommend additional measures to augment the offset strategy to ensure that it adequately offsets the project's impacts on these EECs".*

Additional comments are provided below. In most cases they come from a review of performance criteria, performance measures and completion criteria in the MOP (mainly in Tables 31 and 34) being compared with comparable measures in 'Appendix D: Guidelines for ecological rehabilitation of recognisable and self-sustaining plant community types: Guidance for the Upper Hunter Strategic Assessment' (OEH, 2015):

1. The recommended species mix (provided in the Table 34) for the establishment of 1,423 hectares of grassland communities and approximately 319 hectares of trees over grassland area omits some plant guilds, such as ferns, ground orchids and parasitic plants. OEH suggests that the list of local endemic plant species used in rehabilitation is able to be refined so that additional species may be included in rehabilitation. This may be facilitated by advances in propagation and horticultural techniques for more indigenous plants.
2. OEH recommends that consideration is given to the full time frame of monitoring of revegetation and rehabilitation. This is because long-term monitoring is essential to determine: (1) if the planted species mix matches that of the analogue site(s); and (2) if the rehabilitated ecosystem is sustainable over the long term.
3. OEH recommends that proposed use of Landscape Function Analysis to measure vegetation structure in revegetation and rehabilitation is clarified.
4. It is unclear in the MOP if, and how often, the growing medium may be tested for suitability for rehabilitation.
5. In relation to fire control of revegetation areas, OEH recommends that consideration is given to how the post-fire response to burning may be used to measure the resilience of revegetation. This will help inform how close they may be to becoming a self-sustaining ecosystem.
6. Table 10 (p. 15) indicates that some rehabilitated areas will be cleared during currently approved operations. Are these areas that are targeted for developing sustainable native ecosystems? If so, disturbance could have an adverse effect on long term ecosystem development.

Warkworth Biodiversity Management Plan

The Warkworth BMP describes how the Biodiversity Offset Strategy and biodiversity management actions on land subject to the current consents will be implemented. It supplements the MOP. Many of the issues discussed for the MOP also apply to the BMP. This is particularly so in relation to performance measures, performance indicators and completion criteria for rehabilitation and revegetation, how best to effectively monitor them and the appropriate duration of monitoring. OEH acknowledges that some of these details may be subsequently dealt with in the proposed Offset Management Plans.

It is possible that the 15 year timeframe allocated for effective restoration of Warkworth Sands Woodland may not be long enough to result in a resilient and recognisable version of this EEC. Research of other examples of rehabilitation across the country suggests it could take decades for full ecosystem function to be re-established in a recreated vegetation community.

It is not clear in the BMP how long monitoring of revegetation is proposed to occur for, and the timeframe by which successful revegetation and rehabilitation is expected. In Table 17, quantitative performance indicators are recommended, such as stem counts per quadrat, planting survival, canopy cover etc. over qualitative means as performance measures as they are more likely to be replicable and unambiguous.

Quadrat size varies in Table 18 between different attributes measured. It would help if these different quadrat sizes were explained. Where quadrat sizes differ from BioBanking methodology, the values obtained for the same site attributes cannot be reliable compared with BioBanking benchmark values for those Plant Community Types.

There is no guarantee that relocated habitat features, such as usable timber, fallen logs etc. that are relocated to the areas of revegetation and rehabilitation will be used by local fauna species. Will this be investigated

under the BMP? In addition, will the effectiveness of proposed vegetated corridors for fauna movement be monitored to gauge their success?

As a final comment, OEH notes it intended stop maintaining the current Warkworth Sands Restoration Manual and for its contents to be presented in several other documents. OEH is of the opinion that there are advantages in keeping all relevant revegetation information in one comprehensive document.

References

Coal Australia – Warkworth Mine (2015) Biodiversity Management Plan. Draft for consultation. December 2015. Coal & Allied Operations Pty Ltd, Mount Thorley.

Coal & Allied Operations Pty Ltd (2015) Mining Operations Plan: Mount Thorley Warkworth. *27 November 2015.* Coal & Allied Operations Pty Ltd, Mount Thorley.

NSW Department of Mineral Resources (1999) *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valle.* NSW Department of Mineral Resources, Sydney.

NSW Trade & Investment (2013) *ESG3: Mining Operations Plan (MOP) Guidelines. September 2013.* NSW Trade & Investment. Maitland. www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0009/475434/ESG3-Mining-Operations-Plan-MOP-Guidelines-September-2013.pdf

OEH (2015) *Guidelines for the ecological rehabilitation of recognisable and self-sustaining plant community types: Guidance for the Upper Hunter Strategic Assessment. Draft.* NSW Office of Environment and Heritage, Sydney.

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