

PUTTY

Management Plan

Yancoal Warkworth Mine, New South Wales | July 2022



This Management Plan is the framework for the protection and management of a 383 hectare offset area under a legally binding conservation mechanism to satisfy conditions of Warkworth Mining Limited's Commonwealth approval (EPBC 2009/5081) and NSW approval (NSW SSD-6464).

This document has been prepared using maps prepared by:

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Cover Photo: Putty BA 2016

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27 July 2022

Date

Document Title	Version	Date effective	Comment
Putty BA Management Plan,	1	December 2016	Submitted for approval to DAWE and DPIE on 17 February 2017. DPIE approved on 26/6/2017.
Putty BA Management Plan	2	December 2017	DAWE provided comments on 13/04/2017 and 22/06/2017 on the Southern BA Management Plan. The final text was approved by DAWE and these agreed changes have been made to V2 of the Putty BA Management Plan. Also changes to reflect the new ownership of Coal & Allied by Yancoal.
Putty BA Management Plan	3	July 2022	Revision of monitoring results and inclusion of salinity information.

Contents page

1	Introduction	6
1.1	Intent	8
1.2	Environmental Approvals	8
1.2.1	New South Wales	8
1.3	Function of the Management Plan	10
1.3.1	Information Management	10
1.3.2	Key Stakeholders and Roles	11
1.3.3	Review and reporting	11
2	Biodiversity Area	13
2.1	Location and Description	13
2.2	Vegetation communities	15
2.3	Threatened Species	15
2.3.1	Swift Parrot	16
2.3.2	Regent Honeyeater	16
2.4	Baseline Ecological Condition	19
2.4.1	Woodland condition	19
2.4.2	Habitat condition	19
2.4.3	Bird usage	20
3	Objectives, Key Performance Indicators and Completion Criteria	23
3.1	Conservation Objective	23
3.2	Key Performance Indicators	23
3.3	Completion Criteria	23
4	Conservation Management Actions	24
4.1	Controlled activities	24
4.1.1	Prohibited actions	24
4.1.2	Exemption for clearing vegetation	25
4.1.3	Access	25
4.1.4	Recreation activities and residences	25
4.1.5	Cultural Heritage	25
4.1.6	Waste	25
4.1.7	Performance Criteria	26
4.1.8	Trigger, Response and Action plan	26
4.2	Management of grazing for conservation	28
4.2.1	Performance Criteria	28
4.2.2	Trigger, Response and Action plan	29
4.3	Weed control	29
4.3.1	Control areas	29
4.3.2	Control methods and target weed species	29
4.3.3	Performance Criteria	35
4.3.4	Trigger, Response and Action plan	35

4.4	Management of fire for conservation	35
4.4.1	Performance Criteria	36
4.4.2	Trigger, Response and Action plan	36
4.5	Infrastructure improvement	37
4.5.1	Performance Criteria	37
4.5.2	Trigger, Response and Action plan	37
4.6	Maintenance or reintroduction of natural flow regimes	37
4.7	Retention of regrowth and remnant native vegetation	37
4.7.1	Encourage natural regeneration	38
4.7.2	Performance Criteria	38
4.7.3	Trigger, Response and Action plan	38
4.8	Supplementary planting	38
4.9	Erosion control	39
4.9.1	Performance Criteria	39
4.9.2	Trigger, Response and Action plan	39
4.9.3	Salinity Control	39
4.10	Vertebrate Pest and Overabundant Native Animal Control	39
4.10.1	Performance Criteria	43
4.10.2	Trigger, Response and Action plan	43
5	Monitoring	44
5.1	Monitoring objectives	44
5.2	Landscape Monitoring	45
5.3	Ecological Monitoring	45
5.3.1	Habitat Restoration Monitoring	45
5.3.1.1	Field Methods	45
5.3.1.2	Photo Reference Points	46
5.3.2	Bird Assemblage Monitoring	47
5.3.2.1	Field Methods	47
5.3.3	Data Analysis and Interpretation	48
5.4	Management Monitoring	48
5.4.1	Rapid Condition Assessment	48
5.4.2	Property inspections	48
6	Risk assessment	50
7	Compliance table	52
8	References	56
	Appendix A – Rapid Condition Assessment	58
	Appendix B - Habitat Restoration Monitoring	59

Abbreviations and Definitions

asl	Above sea level
BA	Biodiversity Area (includes the Offset Area, infrastructure and other land)
BB	Braun-Blanquet (cover abundance score)
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BFMP	Bushfire Management Plan
BVT	BioMetric Vegetation Type
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
CHWG	Cultural Heritage Working Group
CHGBIW	Central Hunter Grey Box – Ironbark Woodland
CHVEF	Central Hunter Valley Eucalypt Forest
Coal & Allied	Coal & Allied Industries Limited
COPs	National Codes of Practice
DAWE	Australian Government Department of the Environment and Energy (previously Department of the Environment (DAWE))
DPIE	NSW Department of Planning and Environment
DPIE-EES	DPIE – Environment, Energy and Science
EEC	Endangered Ecological Community
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDP	Ground Disturbance Permit
ha	Hectare
HLLS	Hunter Local Land Services
km	Kilometre
LLS Act	NSW <i>Local Land Service Act 2013</i>
Ma	Marine Migratory
MNES	Matters of National Environmental Significance
MZ	(BioBanking) Management Zone
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (now DPIE-EES – refer above)
offset area	Area of vegetation and habitat secured by legally binding mechanism.
RCA	Rapid Condition Assessment
SDS	Safety Data Sheets
SOPs	Standard Operating Procedures
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
WON	Weed of National Significance
Yancoal	Yancoal Australia Limited
Yancoal MTW	Yancoal Mount Thorley Warkworth

1 Introduction

This Management Plan (Plan) details the management activities to protect and enhance the conservation and habitat values of the offset areas located within the Putty Biodiversity Area (BA). This Plan outlines conservation management actions and a monitoring programme for the Putty BA to achieve conservation objectives.

This Plan has been prepared to satisfy the conditions of Commonwealth and New South Wales (NSW) environmental approvals held by Warkworth Mining Limited for the Warkworth Coal Mine located in the Hunter Valley NSW. The Warkworth Mine forms part of the Mount Thorley Warkworth complex managed by Yancoal Australia Limited (Yancoal).

The Plan's conservation objectives include a short term objective to measure the effectiveness of initial restoration efforts and longer term outcomes from the continued implementation of the Plan. The short term conservation objective is to protect and enhance the condition and extent of the conservation and habitat values of the offset areas within 10 years. The Plan details active restoration to increase the extent and enhance habitat for the Critically Endangered woodland birds, the Regent Honeyeater and Swift Parrot, and increasing connectivity and resilience to climate change. Section 2 provides a full description of the conservation values, including their baseline condition. In terms of measuring success of the Plan the conservation values have been identified as:

- Woodland; and
- Fauna habitat (in particular habitat for Regent Honeyeater and Swift Parrot).

Key performance criteria have been set for each of the conservation values, and a full description is provided in section 3. Attainment of the objective and performance criteria is measured using targeted monitoring, which is detailed in section 5. The following points outline the monitoring programme to measure the regeneration pathway and enhancement of habitat condition;

- Habitat restoration monitoring –27 key variables are measured every two years by an external Biodiversity Auditor to track changes in vegetation and habitat condition. The data is analysed to assess the trajectory towards the benchmark description for the vegetation community and improved condition in woodland habitats.
- Bird assemblages monitoring –systematic surveys are completed every two years by an external Biodiversity Auditor to collect data on bird usage, assemblages and habitat. Monitoring of bird assemblages is also indicative of biodiversity as a whole and environmental change.
- Rapid Condition Assessment –photo monitoring and rapid assessment of woodland condition is undertaken every year; and
- Property inspections – monitoring for early detection of potential threats to the conservation values and failures of the Plan.

The conservation management actions to be implemented are described in section 4. Each action has a specific Performance Criteria and Trigger, Response and Action plan to ensure the actions deliver the intended outcome and are adaptable. The actions are guided by relevant National Recovery Plans, as well as the requirements of the legally binding conservation mechanism. To demonstrate this alignment the conservation management actions are listed in Table 1 against the National Recovery Plan objectives or strategy for the Regent Honeyeater and Swift Parrot.

Table 1 Alignment to the National Recovery Plans for Regent Honeyeater and Swift Parrot

Actions	National Recovery Plan for the Regent Honeyeater (2016)	National Recovery Plan for the Swift Parrot (2011)	Alignment / Contribution
Controlled activities (Section 4.1)	Improve the extent and quality of regent honeyeater habitat.	To identify and prioritise habitats and sites used by the species across its range, on all land tenures. To implement management strategies to protect and improve habitats and sites on all land tenures	Protection of habitat in Hunter Valley identified as Priority habitat for conservation for both species. The prohibited activities address key threatening processes such as: habitat loss and alteration; forestry and firewood collection; and competition from honey bees.
Management of grazing for conservation (Section 4.2)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	The grazing controls address key threatening processes such as: habitat loss and fragmentation; habitat degradation; and regeneration suppression.
Weed control (Section 4.3)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Control of weeds addresses key threatening process such as: regeneration suppression; encourage regeneration; and habitat loss.
Management of fire for conservation (Section 4.4)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Control of fuel loads to address key threatening process such as: frequent fire; and high intensity fires
Infrastructure improvement (Section 4.5)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Infrastructure to protect offset areas such as: fencing to exclude persons and grazing; safe access to implement management activities; and fire protection infrastructure.
Supplementary planting, (Section 4.8)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Active restoration of areas within the offset areas that have limited regenerative capacity and require introduction of plants to trigger regeneration to establish more and enhanced habitat.
Vertebrate Pest and Overabundant Native Animal Control. (Section 4.10)	Improve the extent and quality of regent honeyeater habitat.	To implement management strategies to protect and improve habitats and sites on all land tenures	Pest control to addresses key threatening process such as: Predation– cats; and Competition – noisy miners, starlings.
Ecological Monitoring – Bird Assemblages (Section 5.3.2)	Increase understanding of the size, structure, trajectory and viability of the wild population.	To monitor population trends and distribution throughout the range.	Biennial monitoring contributing to records of sighting, breeding and numbers.

The Plan requires the preparation of an Annual Report, to review all activities undertaken and review the monitoring data against the key performance criteria and conservation management actions performance criteria. The Trigger, Response and Action plans for each action and the risk assessment in section 6 ensure the Plan is comprehensive and adaptive to new risks and changing circumstances. Key risks identified include:

- Unlawful damage;
- Bushfire;
- Suppression of regeneration from weeds and / or uncontrolled grazing; and
- Climate change impacting native regeneration.

Consistent management of the offset area is best achieved through the implementation of one plan and, therefore, this Plan has been prepared to satisfy a range of requirements including:

- compliance with Commonwealth and State environmental approvals;
- legally binding conservation mechanism;
- contractual to engage consultants and contractors; and
- operational guide for Yancoal staff.

The Putty BA is located near the township of Putty in NSW, approximately 60km south-west of the Warkworth mine. The land is owned by Warkworth Mining Limited and managed by Yancoal. The total area of the BA is 386 hectares (ha) and contains 383ha of native vegetation (offset area). Figure 1 provides the location of the BA and its proximity to Warkworth Mine, as well as the other BAs containing biodiversity offset areas.

1.1 Intent

The intent of the Plan is to ensure compliance with all environmental approvals and support the legally binding conservation mechanism by:

- implementing the conservation management actions in Section 4 and monitoring in Section 5, to meet and measure attainment of the conservation objectives set out in Section 3.

The legally binding conservation mechanism must remain on the land title in perpetuity, for the cadastral blocks listed in Table 3.

1.2 Environmental Approvals

The Commonwealth Minister for the Environment, under provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), has issued two approvals for the Warkworth Mine; the first in February 2004 (EPBC 2002/629) and the second in August 2012 (EPBC 2009/5081).

These approvals require Warkworth Mining Limited to offset the impact upon Matters of National Environmental Significance by protecting and managing habitat for the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*).

Under these approvals, the Putty BA is to be secured with a legally binding mechanism for enduring protection of 383ha of suitable habitat for these species for Phase 2 of EPBC2009/5081. This Plan satisfies the requirement to prepare an Offset Management Plan and Re-establishment Management Plan for the EPBC 2009/5081 approval.

1.2.1 New South Wales

The Warkworth Mine was granted the NSW Development Approval (SSD-6464) issued under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 26th November 2015. The 383ha offset area generates species credits for the Regent Honeyeater to be retired for compliance with Condition 28.

To ensure this Plan satisfies the requirement of all approvals Section 7 provides a compliance table to demonstrate attainment of the relevant conditions.

Location of the Warkworth Mine and Hunter Valley Operations Biodiversity Areas

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Figure 1



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1.3 Function of the Management Plan

The Plan will provide the management framework for the BA with the aim to protect and enhance conservation values through the implementation of conservation management actions.

For the Plan to be successful it needs 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 Plan comprises 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, including Trigger, Response and Action plans;
- 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: matrix of key risks in the implementation of the Plan and attainment of the objectives.

1.3.1 Information Management

To secure monitoring data and assist in the management of the BA, Yancoal will maintain the online Biodiversity Offsets Portal whilst the BA is under their direct management. This Portal has been designed to centralise and share information among authorised users including regulators, and will include spatial data, an image library, Annual Reports, plans, Biobanking reports, survey results, records of management activities such as planting and weed control and other non-spatial data. The Portal will, improve communication among stakeholders, provide transparency of management and monitoring activities and will ensure 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 will result in improved decision making and adaptive management that is responsive to seasonal conditions and current operational challenges.

The Portal will also provide access to an Interactive Map that will allow users to visualise data in a geo-spatial context, assisting in data interpretation. This data will include aerial imagery, site information (e.g. cadastral, site access, topographic, infrastructure, geology) and data relating to management and monitoring activities. The Interactive Map will allow users to query information, turn layers on and off, mark up and print maps. This is an easy to use but powerful tool that does not require knowledge of Geographic Information Systems on the part of the user.

1.3.2 Key Stakeholders and Roles

The key stakeholders are identified by their roles in Table 2.

Table 2 Key Stakeholders Roles and Responsibilities

Roles	Responsible Entity	Details
Commonwealth Regulator: Administers approvals granted under the EPBC Act - EPBC 2016/7640 and EPBC 2009/5081.	Australian Government Department of the Environment and Energy (DAWE)	PostApproval@environment.gov.au (for submission of plan and matters related to the EPBC approval) EPBCMonitoring@environment.gov.au (for submission of Annual Report and EPBC Annual Compliance reports)
NSW Regulator: Administers approvals granted under the EP&A Act – SSD-6464	Department of Planning & Industry Environment (DPIE)	Compliance (Mining) Mining & Industry Projects Department of Planning & Environment http://www.planning.nsw.gov.au
NSW Regulator: Administers the <i>National Parks and Wildlife Act 1974</i> (NPW Act) and the Biodiversity Conservation Act 2016 (BC Act)	DPIE – Environment, Energy and Science (DPIE – EES)	Newcastle Office Conservation and Regional Delivery www.environment.nsw.gov.au
Project Proponent and land owner: Prepare and implement the Plan and complete reporting.	Warkworth Mining Limited, whose operations are managed and operated by Yancoal Australia Ltd.	Environment & Community Manager
Biodiversity Auditor: Monitor improvement in condition of the biodiversity values and completes ecological monitoring.	Yancoal MTW	Yancoal MTW to engage suitably qualified person/s.

1.3.3 Review and reporting

The Plan will be reviewed within four years from the date the Plan is approved by the Commonwealth and NSW regulators. The purpose of the review is to: incorporate suggestions from the Biodiversity Auditor after completing the Ecological Monitoring; update information on the ecological condition and extent of the plant community types and habitats across the BA; and refine conservation management actions. The review will incorporate any updated National Recovery Plans and other literature to ensure the management actions of the Plan are aligned and consistent with current science and conservation management practice.

At the end of year 10, an Advisory Group comprising representatives for each of the stakeholders listed in Table 2 will be invited to complete a review of the implementation of the Plan. The review will be informed by the Annual Reports, all monitoring reports, EPBC Annual Compliance reports and NSW Independent Audit results. The outcomes from the 10 year review will include a revised timeframe for the conservation objective, conservation management actions, and monitoring programme and reporting schedule. All revisions of the Plan are to be approved by DAWE and DPIE. The document may be updated to amend contact details, agency names or other secondary information.

Annual Reports will include a summary of monitoring data, and analysis of that data and management highlights.

The Annual Reports will be prepared and submitted to DAWE and DPIE in **May 2018** following implementation of the first year (2017) and then each year following. The report will be prepared with input from a suitably qualified ecologist or environmental scientist.

Annual Reports will include the following information as a minimum:

- name and contact details of the Landholder and/or Leaseholder;
- list of conservation management actions undertaken, describing scope of works, skill and expertise of the responsible entity/ies completing the works and performance;
- monitoring results, all data will be correctly labelled with date, location and GPS points;
- analysis of monitoring results with recommendations for modifications, if any, to the management or monitoring activities;
- assessment of any new risks or potential threats to the BA and actions to be undertaken to manage these threats and/or risks; and
- assessment of the progress in attainment of the conservation objectives and key performance indicators.

2 Biodiversity Area

2.1 Location and Description

The Putty BA is located approximately 5 kilometres (km) south of Putty in NSW, approximately 60km southwest of Warkworth Mine, and is accessed via Box Gap Road.

The Putty BA is 386ha in size. It is comprised of Lot 19 DP 753816, Lot 13 DP 753816, Lot 1 DP 1059737 and Lot 2 DP 1059737, which are owned by Warkworth Mining Limited, and Crown Road EP 51293, as summarised in Table 3. Figure 2 shows the location of the BA and the cadastral boundaries.

The Putty BA falls within the Singleton Local Government Area and within the Hunter Local Land Services (HLLS) region. It is located within the *Sydney Basin Bioregion* with the western portion of the BA in the Wollemi *Interim Biogeographic Regionalisation for Australia* (IBRA) Subregion and the eastern portion in the Yengo Subregion. The Putty BA is a part of the Mellong Range (Mitchell) Landscapes (Mitchell 2002) with the Putty Sands Landscape along the valley floor. The Mellong Range landscape is characterised by undulating broad crests and wide interfluves on Triassic sandstones with thin shales. The Putty Sands landscape consists of gently sloping wide valleys with extensive swamps on the upper range of the Mellong Range landscape.

Putty BA is situated strategically with a number of important conservation areas, including:

- Yengo National Park approximately 1 km to the east;
- Wollomi National Park approximately 1 km to the south and west; and
- Putty State Forest approximately 10 km to the north.

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.

The property has been cleared along the valley floors and used for grazing over a number of years. The vegetation of the lower foothills and upper sandstone escarpments is relatively free from agricultural disturbance and retains significant biodiversity values.

This Plan identifies the offset area by mapped vegetation, however it is recognised that the surrounding infrastructure is required to provide access and protect the offset area. The Habitat Restoration Monitoring Report (Niche and Cambium Group 2016) identified 383 ha of vegetation and described three Plant Community Types with four Management Zones (MZs) based on the vegetation and condition.

Table 3 Biodiversity Areas details

Land Owner	Lot	DP	Area inside Putty BA (ha)	Offset Area (ha)
Warkworth Mining Limited	19	753816	370	368
Warkworth Mining Limited	13	753816	8	8
Warkworth Mining Limited	1	1059737	1	1
Warkworth Mining Limited	2	1059737	0.1	0.1
Crown Road EP 51293			7	6
Total			386	383

Cadastral boundaries at the Putty Biodiversity Area



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Figure 2



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2.2 Vegetation communities

Putty BA is characterised by river flats, undulating to steep slopes and ridgelines, and the vegetation types reflect these changes. The sandstone upper slopes and ridgetops were represented by relatively intact and undisturbed Smooth-barked Apple/Yellow Bloodwood and White Stringybark/Narrow-leaved Ironbark woodland communities. These communities graded down to River Peppermint/Mountain Blue Gum forest on the valley floor and river flats.

The most heavily impacted sections of the BA are the areas along the valley floor which have been historically cleared to provide grazing for cattle, resulting in patchy regrowth vegetation in moderate condition. Some erosion is evident where drainage lines have been historically cleared. Away from the valley floor there is little evidence of clearing, logging, erosion or grazing. One main track traverses the study area. The trees generally lack fire scars across the BA suggesting that the BA has not recently been burnt.

A total of three distinct vegetation communities were recorded in the study area and assigned to four Management Zones (MZs). The distribution of the vegetation is shown by plant community types in Figure 3 and listed in Table 4.

A full description of the plant community types is provided in the Putty Habitat Restoration Monitoring Report (Niche and Cambium Group 2016) located on the Biodiversity Offsets Portal.

Table 4 Plant Community Types across Putty BA

	Plant Community Type	Vegetation Community	Management Zone	Area (ha)
HN612	Yellow Bloodwood – Ironbark shrubby woodland of the dry hinterland of the Central Coast, Sydney Basin Bioregion	Smooth-barked Apple – Yellow Bloodwood woodland	MZ1	138
HN577	Rough-barked Apple – Grey Gum grassy open forest on the hinterland hills of the Central Coast, Sydney Basin Bioregion	White Stringybark – Narrow-leaved Ironbark Woodland	MZ2	166
HN553	Mountain Blue Gum - Thin-leaved Stringybark open forest on river flat alluvium in the Sydney Basin Bioregion	River Peppermint - Mountain Blue Gum Forest	MZ3	40
HN553	Mountain Blue Gum - Thin-leaved Stringybark open forest on river flat alluvium in the Sydney Basin Bioregion	River Peppermint - Mountain Blue Gum Forest-Regenerating	MZ4	39
Total				383

2.3 Threatened Species

The Putty BA provides intact and complex fauna habitat across the sandstone escarpment, slopes and deeply incised valleys. These intact landscapes represent highly valuable habitat for terrestrial mammals, reptiles, bats and a range of birds. Figure 4 shows the location of threatened species records for the BA.

The offset area is to provide suitable habitat for the Swift Parrot and Regent Honeyeater to satisfy the EPBC Act approvals and has been previously approved as suitable by DAWE as part of the 2009 EPBC Warkworth Extension Project Assessment process.

The baseline Bird Assemblage Monitoring 2016 (Niche 2016) concluded that the Putty BA is suitable habitat for Regent Honeyeater and Swift Parrot when resources are available. A brief description of these two species is provided below. An Expert Report (Niche 2017) to calculate the number of Regent Honeyeater species credit was completed in September 2017. This report calculates a total of 1,500 credits available for retirement for impacts on Regent Honeyeater for the NSW environmental approval SSD-6464. Table 5 provides a summary of the suitable habitat within the offset area for the Warkworth Mine. The area of suitable Regent Honeyeater habitat has been updated to reflect the area identified within the Expert Report (Niche 2017).

Table 5 Area of suitable habitat within offset area

Offset Area (ha)	Regent Honeyeater Habitat (ha)			Swift Parrot Habitat (ha)		
	Existing	Restoring	Total	Existing	Restoring	Total
Warkworth Mine	211.2		211.2	383		383

2.3.1 Swift Parrot

The Swift Parrot is a predominantly nectarivorous, migratory species endemic to south eastern Australia (Birds Australia 2013) and is listed as Critically Endangered under the EPBC Act and Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act). The species breeds in Tasmania and migrates to the mainland in winter, where it is most commonly found in dry, open eucalypt forests and woodlands containing Grey Box, White Box and Yellow Gum (Garnett and Crowley 2000; OEH 2012). The species is reliant on Box-Ironbark communities for winter foraging and movement is strongly associated with the availability of lerps and winter-flowering eucalypt species. Swift Parrots often occur in urban areas, including farmland with remnant patches of eucalypt woodland (DEC (NSW) 2005; Saunders and Heinsohn 2008).

2.3.2 Regent Honeyeater

The Regent Honeyeater is a winter migrant endemic to south eastern Australia where it is widespread but sparsely scattered, and strongly associated with the western slopes of the Great Dividing Range (Garnett and Crowley 2000) and is listed as Critically Endangered under the EPBC Act and the BC Act. The species is also known to forage and breed in Box-Ironbark woodland in the Hunter Valley region. It is found in temperate eucalypt forests and woodlands but prefers Box-Ironbark associations and River Oak riparian forest in wet, fertile sites along creek lines and river valleys (DEC (NSW) 2006).

The Regent Honeyeater is strongly nomadic and follows blossoming trees and mistletoe (Franklin, Menkhorst *et al.* 1989; NSW Scientific Committee 2004). Numbers fluctuate greatly between years and sites, and movement outside of breeding season is poorly understood. Only 1,500 individuals are thought to make up the single subpopulation of this species. Regent Honeyeaters forage in the canopy tops of mature feed trees, but roost in saplings (Oliver, 1998). This suggests that the species requires a more extensive area of habitat than other similar nectarivorous species.



Photo: Swift Parrot (Chris Tzaros)



Photo: Regents Honeyeater (Murray Chambers)

Vegetation communities, management zones and monitoring sites at the Putty Biodiversity Area

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Figure 3



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Threatened species records at the Putty Biodiversity Area

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Figure 4



2.4 Baseline Ecological Condition

2.4.1 Woodland condition

The BA is primarily mature woodland communities with few management issues. A Rapid Condition Assessment (RCA) technique was used as a preliminary assessment of the condition of the woodland. **Appendix A** provides details on the RCA methodology.

Six permanent RCA sites were established across Putty BA in September 2016. All RCAs are located in MZ2, MZ3 and MZ4. Sites were selected near access tracks so that future access to the sites will be maintained. Additionally, these sites might act as early indicators of emerging threats given the greatest risks from threats are often at the more easily accessible areas.

Photo reference points were established at each RCA site where a series of photos (north, east, south, west and ground) was taken. This will provide a visual record of any changes in vegetation and habitat condition.

All RCA plot data and associated photo monitoring can be accessed from the online Biodiversity Offsets Portal.

Table 6 provides the number of RCA sites along with the average health rating of 17. All RCA sites received a health rating of >15/20 with the average being 16/20 in 2021 indicating these areas are healthy and sustainable under current management.

Table 6 Rapid Condition Assessment health rating results

RCA Plot Number	MZ	2016	2017	2018	2019	2020	2021
R1	MZ4	16	18	18	16	17	16
R2	MZ2	19	17	17	16	16	16
R3	MZ3	19	18	18	17	17	18
R4	MZ2	20	17	17	14	15	16
R5	MZ4	15	18	18	16	16	18
R6	MZ4	15	18	19	15	16	17
Average		17/20	17/20	17/20	15/20	16/20	16/20

2.4.2 Habitat condition

In September 2016, five permanent Habitat Restoration Monitoring plots were established within the Putty BA, across the valley floor in areas that have previously been disturbed for agriculture (MZ4). Section 5 describes the programme and the methodology to assess changes in habitat values within the offset area through time and relative to the benchmark values associated with the BioMetric Vegetation Type (BVT). Figure 3 indicates the location of the plots

The 2014 monitoring plot data indicated this community has been impacted by prior clearing/fragmentation and agricultural practices with a relatively sparse canopy cover and a depleted mid-storey, when compared with the benchmark values on average. The per cent cover of native grasses was above the benchmark range on average with other ground cover shrubs consistently within benchmark. Ground cover other are consistently well below benchmark values. Exotic species cover was greater than benchmark for all plots. The data is within benchmark for number of tree hollows and above benchmark, on average, for length of logs.

Regeneration of the canopy is evident throughout this community with canopy species being recorded across all three stem diameter classes in most plots, with generally a dominance of the smaller stem diameter at breast height classes (<20 cm).

Habitat features such as rocks, hollows and mistletoe are generally absent/rare and the presence of fallen logs is variable among the monitoring plots. The litter layer is varying in cover, with between 6% and 51% cover of litter recorded in monitoring plots. Bare ground accounts for between 1% and 10% of the ground cover.

Habitat Restoration Monitoring was undertaken during spring in 2018 by Niche (2018) and in 2020 by SLR (2020). The 2020 monitoring plot data indicates that the mean native

plant species richness has increased slightly but does still not reach benchmark. The mean native canopy cover has decreased and remains below benchmark values. The native mid-storey cover however has increased and is within benchmark for most plots. Exotic species cover has increased substantially and is above benchmark. Habitat features of rocks and tree hollows were absent and there was a decrease in fallen log length. The results are shown in and have been compared against benchmark.

Table 7 Summary of Habitat Restoration Monitoring Result 2020 compared to benchmark values

		NPSR	NOS	NMS	NGCG	NGCS	NGCO	EPC	Logs (m)	Hollows	No. Trees
Benchmark	Lower	33	31.5	20	29.8	0	29.8		0	0	
Benchmark	Upper		46.5	40	37.8	10	37.8	5			N/A
PM1		23	7.0	8.3	78.8	2.8	15.0	1.0	0	0	2
PM2		26	10.3	30.0	18.8	50.0	10.0	0.0	0	0	1
PM3		39	14.8	27.5	32.5	1.6	18.8	0.5	32	0	15
PM4		25	20.3	32.5	57.5	31.3	16.3	0.0	7	0	14
PM5		24	5.2	12.5	9.0	0.3	27.5	47.5	0	0	0
2020 Mean		27.4	11.5	22.2	39.3	17.2	17.5	9.8	7.8	0	6.4
2018 Mean		26.6	29.8	3.75	39.75	9.05	2.35	2.1	32.8	0	38

Benchmark values for HN553 – Mountain Blue Gum – Thin-leaved Stringybark open forest on river flat alluvium in the Sydney Basin Bioregion

NPSR	Native plant species richness	NGCO	Native ground cover (other) % cover
NOS	Native over-storey % cover	EPC	Exotic plant cover % cover
NMS	Native mid-storey % cover	Logs (m)	Length of logs (m)
NGCG	Native ground cover (grass) % cover	Hollows	No. trees with hollows
NGCS	Native ground cover (shrubs) % cover		

2.4.3 Bird usage

The Putty BA consists of forest, open woodland and regenerating woodland with a corridor of riparian habitat along Putty Creek. The site contains areas of steep rocky escarpment, with the highest diversity of birds occurring on the undisturbed woodland (MZ1 and MZ2) and within the dense vegetation of the riparian zones (MZ3). While previous clearing has impacted habitat in MZ4, natural regeneration is evident with the growth of young Eucalypts.

Bird assemblage monitoring was completed in 2016 and 2018 by Niche (2016), (2018) and by ANU Enterprise in 2020 (2020). Monitoring was undertaken during winter and early spring as described in Section 5. The bird assemblage monitoring reports are available on the Biodiversity Offsets Portal. The location of the monitoring sites is shown on Figure 3

The monitoring is designed to observe changes in ecological conditions and the habitat value over time, in particular assess the presence of Swift Parrot and Regent Honeyeater, and their movements and habitat usage within the BA.

Habitat was considered suitable for Regent Honeyeater and Swift Parrot when resources are available.

The 2020 monitoring increased the survey intensity from one visit to each monitoring site to three visits. The increase in the survey intensity has increased the measure of species richness across all Biodiversity Areas and resulted in the regent honeyeater being detected at the Putty BA during the second round of surveys. Bird assemblage monitoring will include three rounds of monitoring for all future monitoring periods.

Three threatened bird species were recorded in the Goulburn River BA during the 2020 monitoring period as presented in Table 8 below, the locations are shown in Figure 4.

Table 8 Estimated minimum count of threatened bird species detected during the 2ha 20 minute surveys in winter/spring 2020

Species	Bowditch	Condon View	Goulburn River	North Rothbury	Northern BA	Putty	Seven Oaks	Southern BA
Wedge-tailed eagle <i>Aquila audax</i>					2 (1)		1 (1)	
Glossy black cockatoo <i>Calyptorhynchus lathami</i>							6 (5)	
Little lorikeet <i>Glossopsitta pusilla</i>		4 (4)		4 (1)		26 (2)		
Barking owl <i>Ninox connivens</i>						2 (1)		
Speckled warbler <i>Pyrrholaemus sagittatus</i>	6 (4)		5 (3)	4 (2)		1 (1)	2 (1)	8 (5)
Regent honeyeater <i>Anthochaera phrygia</i>						3 (2)		
Grey-crowned babbler <i>Pomatostomus temporalis</i>		3 (1)			6 (2)			10 (3)
Varied sittella <i>Daphoenositta chrysoptera</i>	7 (3)	6 (2)	2 (1)	2 (1)		3 (2)	2 (1)	5 (2)
Brown treecreeper <i>Climacteris picumnus</i>			1 (1)					
Dusky woodswallow <i>Artamus cyanopterus</i>		4 (1)						3 (1)
Hooded robin <i>Melanodryas cucullata</i>		1 (1)						
Diamond firetail <i>Stagonopleura guttata</i>							3 (1)	

Numbers in parentheses denote number of individual monitoring site each species was detected at

After one visit to each monitoring site the number of bird species recorded was 43, slightly less than the previous year's results as presented below in Table 9 (Data for 2020 are presented first after one visit i.e. comparable with previous years' data and second after 3 visits). After three visits a total of 58 bird species were recorded including five threatened species. The threatened species included Regent honeyeater, Barking owl, Speckled warbler, Varied sittella and Little lorikeet.

Table 9 Trends in bird species richness 2016 - 2020

Biodiversity area (No of plots)	On 2ha sites 2016	On 2ha sites 2018	On 2ha sites 2020 (1 visit)	On 2ha sites 2020 (3 visits)	Detected during 2016 surveys	Detected during 2018 surveys	Detected during 2020 surveys (1 visit)	Detected during 2020 surveys (3 visits)
Bowditch (8)	45	30	42	56	49	50	53	63
Condon View (10)	36	43	30	50	44	57	40	58
Goulburn River (12)	61	63	58	71	72	82		123*
North Rothbury (4)	31	39	21	35	32	49	25	45
Northern BA (5)	18	20	22	36	23	32	28	43
Putty (10)	46	45	43	58	49	57	49	70
Seven Oaks (10)	44	48	47	67	52	68	57	67
Southern BA (9)	43	34	40	56	60	54	54	66
All sites	97	103	105	124	116	125	137	144



Photo: Regent honeyeater at Putty BA (ANU Enterprise 2020)

3 Objectives, Key Performance Indicators and Completion Criteria

3.1 Conservation Objective

The conservation objective for this Plan is to protect and enhance the condition and extent of the conservation values of the offset area within 10 years at the Putty BA.

The conservation management actions described in the following Section 4 outline activities to achieve the conservation objectives.

The methods to monitor the attainment of these objectives are described in Section 5. The monitoring data will be annually reviewed to adapt conservation management actions through continual improvement.

The key conservation outcomes from the long term management and protection of the offset areas include:

- enhanced landscape connectivity within the surrounding landscape;
- improved fauna movement and flora dispersal opportunities within the surrounding landscape;
- increased condition and area of suitable habitats for threatened fauna species within protected reserves, specifically for the Regent Honeyeater and Swift Parrot; and
- enhanced network of protected vegetation within the Hunter Valley.

3.2 Key Performance Indicators

The Key Performance Indicators will measure conservation values, being woodland and habitat to indicate an enhancement of ecological and habitat condition. The woodland area to be measured contains habitat for the Regent Honeyeater and Swift Parrot and long term conservation gains will be achieved through improved condition and connectivity of woodland habitat for these birds. Table 10 lists the key conservation values within the offset area, as well as their Key Performance Indicators and Completion Criteria. The monitoring programme, outlined in Section 5, details the attributes to be measured to provide evidence and demonstrate achievement of the Key Performance Indicators from the implementation of the conservation management actions detailed in Section 4.

Table 10 Putty BA Conservation Values and Key Performance Indicators

Conservation Values	Key Performance Indicator	Completion Criteria
Woodland	Extent and condition of 383ha over 10 years.	Observed and measured increase or maintained Rapid Condition Assessment scores over 10 years (measured annually) in MZ2, MZ3 and MZ4.
Habitat	Improved habitat condition over 10 years.	Observed trajectory towards and/ or attainment of benchmark values at MZ4 (Table 7) over 10 years (measured biennially).
	Bird usage over 10 years.	Observed increased or maintained species richness and usage by woodland birds over 10 years (measured biennially).

3.3 Completion Criteria

The objectives will be deemed to be attained when the Completion Criteria defined in Table 9 have been met to the satisfaction of the DAWE and DPIE.

4 Conservation Management Actions

This Section outlines the management actions to protect and increase the extent and condition of the conservation values in the offset area. They focus on addressing the key threats to the conservation values, such as clearing, fire, weeds, feral animals, and overgrazing.

The following details the purpose, scope and methodology for the actions. Each action has been assigned Performance and Completion Criteria (noting Year 1 is 2017), and Trigger and Response, to identify contingency strategies in the event of unexpected and outcomes from the implementation of the Plan and allow for adaptive management.

This Section outlines the management actions to protect and increase the extent and condition of the conservation values in the offset area, the offset area is defined by the vegetation community and Biobanking Management Zones as shown in Figure 3. They focus on addressing the key threats to the conservation values, such as unauthorised activity, clearing, altered fire regimes, weeds, feral animals, and overgrazing.

The following details the purpose, scope and methodology for the actions. Each action has been assigned Performance and Completion Criteria (noting Year 1 is 2017), and Trigger, Response and Action plan, to identify corrective actions in the event of unexpected outcomes from implementing the Plan, and support adaptive implementation.

Figure 5 indicates the key management infrastructure.

Yancoal is accountable for the implementation of the conservation management actions, as shown in Table 2, this key responsibility rest with the Environment and Community Manager . The Manager is supported by an Environmental Specialist and Environmental Advisor who engage and supervise qualified consultants and contractors to complete the Biodiversity Auditor role, other monitoring, weed and pest animal control, supplementary planting, construction and maintenance of infrastructure and other works as described in the following Section.

4.1 Controlled activities

4.1.1 Prohibited actions

The offset area will have legal protection that includes penalties to enforce its protection. Yancoal will ensure that all employees or representatives, contractors, consultants and visitors are aware of these legal protections and penalties prior to entering the offset area.

The following activities will not be permitted within the offset area (Figure 3):

- littering or dumping of waste;
- removal of standing or fallen dead timber, firewood, native plants or animals;
- removal of rocks, sand or gravel;
- clearing or destruction of native vegetation (unless required to implement conservation management actions , such as infrastructure construction or re-vegetation);
- hunting;
- trapping or shooting (unless controlling pest animals);
- broad-acre use of fertilisers;
- broad-acre aerial application of pesticide from planes or helicopters;
- continuous grazing;
- use of livestock feed; or
- keeping of European bee hives, domestic cats and/or dogs.

4.1.2 Exemption for clearing vegetation

Native vegetation cannot be cleared or disturbed within offset area with the exception of:

- clearing to implement the conservation management actions described in this Section, being:
 - a) infrastructure improvements;
 - b) control of weeds and vertebrate pests;
 - c) protect personal safety;
 - d) establish and/or maintain firebreaks, to manage fuel loads; and
 - e) ground preparation or thinning to support revegetation activities, including care and maintenance of planting areas (even if not currently prescribed in this Plan).

To ensure compliance with all legal and environmental protection measures the Yancoal Ground Disturbance Permit (GDP) process will be adopted prior to any planned disturbance.

The GDP process is a checklist that considers the impact of the disturbance on:

- cultural heritage – search relevant sources to determine their presence;
- land ownership and tenement – ensure action is located on land owned 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;
- rehabilitation – requirement for rehabilitation; and
- water – potential water impacts and mitigation.

4.1.3 Access

Access to the offset area will be controlled through locked gates and fences and signs at main access points to inform all visitors they are entering a protected area. Routine inspections and maintenance of infrastructure (access/fire tracks, fence lines and gates) will be undertaken to ensure they are to standard and fit for purpose.

Vehicles may cause soil compaction, dispersal of weeds and vegetation disturbance. To minimise the impact vehicles on the BA, vehicle access will be restricted to authorised personnel only and vehicle speed should not exceed a maximum of 40km/h.

4.1.4 Recreation activities and residences

Passive recreation activities are permitted, where they do not negatively impact upon the biodiversity values being protected, and only after permission is granted by Yancoal and a risk assessment is completed and approved.

The residences within the BA may be leased to provide increased security to deter detrimental activities such as illegal harvesting of firewood, rubbish dumping and hunting. The residences are outside the offset areas and the lease arrangement will provide clear directions to ensure protection of the BA.

4.1.5 Cultural Heritage

No cultural heritage sites will be disturbed by any management actions implemented through the provisions of this Plan. Any identified cultural heritage sites or values have been recorded and will be managed to ensure their protection.

4.1.6 Waste

Removal of waste from identified areas and periodic waste removal to be completed as required.

4.1.7 Performance Criteria

Controlled Activities	Annual Criteria from Year 1 to Year 10
Prohibited actions	No reported incidents of prohibited actions undertaken by Yancoal, contractors, consultants or other agents of Yancoal.
Exemption of clearing vegetation	Any clearing of vegetation reported in Annual Report.
Access	Signage and locks (where required) maintained.
Recreation and residences	Completed risk assessment for any recreation activities. All occupants of residences compliant with requirements of the Plan
Cultural heritage	No Cultural heritage sites knowingly disturbed and any protective barricading maintained.
Waste	Removal of waste from known sites and as required.
Monitoring	All Property Inspections (Section 5.4) completed.

4.1.8 Trigger, Response and Action plan

Trigger	Response and Action
Damage to conservation values by persons undertaking controlled activities – reported through Management Monitoring (Section 5.4) or other visitors to the BA.	Report incident to relevant authority within 30 days. Include incident report in the Annual Report complete self-assessment of the significant residual impact from the damage. In situations where there is assessed to be a significant residual impact a rehabilitation plan including active and or passive restoration works is to be prepared and implemented. Review security measures and offset induction procedure.

Infrastructure and waste at the Putty Biodiversity Area

Management Plan 2022

Figure 5



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4.2 Management of grazing for conservation

Strategic grazing will be used as a management tool to promote regeneration, control weeds, and reduce excessive fire fuel loads. Strategic grazing is preferred because the short duration and intensive regimes prevent or minimise selective grazing and thereby ensure that overall gains in biodiversity can be achieved.

Grazing will be excluded from the Putty BA, except to improve conservation values or reduce fire risk. Grazing will only be implemented where prescribed by the biodiversity auditor or BioBanking accredited assessor. The trigger point to cease grazing will be less than 70 % ground cover (i.e. no greater than 30% bare ground) and average height of ground cover of less than 12cm (approximately 2500kg dry matter per/ha). The trigger point will be measured using the following quadrat sampling method for ground cover and herbage mass (Lang 2005) by the Biodiversity Auditor:

Using a wooden or metal square (quadrat) of at least 0.5m x 0.5m internal dimensions, undertake the following steps:

- a. Walk at random path within each area to be assessed and throw the quadrat a short distance.
- b. For each throw look only at the area within the quadrat and assess and record the following:
 - A = the percentage of total pasture cover (living and dead);
 - B = the percentage cover of live native plants;
 - C = the percentage cover of live non-native plants; and
 - D = measure height of pasture cover using Meat and Livestock Australia Pasture Ruler to estimate herbage mass.
- c. Take at least 10 random samples for each assessment area (the number of sample will be increased by 1 for each addition 5ha for areas greater than 50ha).
- d. Calculate the percentage of the assessment area covered by vegetation (living or dead): $\text{Sum of A} / \text{Number of samples}$.
- e. Calculate the percentage of the living vegetation that is live native groundcover by: $(\text{Sum of B} \times 100) / (\text{Sum of B} + \text{Sum of C})$.
- f. Calculate average mass by: $\text{Sum of D} / \text{Number of samples}$.

This quadrat data will be provided for the commencement and at the completion of grazing in the annual reports along with the following information:

- livestock movement including dates of entry and removal from the grazing area;
- a map of the grazed offset area;
- number of livestock, type and condition;
- quantity of supplement (if any);
- any livestock health or other management issues; and
- daily rainfall data.

Grazing periods will not exceed four weeks and temporary watering points and fencing will be used to protect sensitive areas, such as planting areas.

4.2.1 Performance Criteria

Strategic Grazing	Annual Criteria from Year 1 to Year 10
Grazing	Grazing is conducted in accordance with this Plan and reported in annual report
Unauthorized stock grazing is prevented	Boundary fences maintained
Monitoring	Complete Rapid Condition Assessment and Property Inspections (Section 5.4)

4.2.2 Trigger, Response and Action plan

Trigger	Response and Action
Fence damaged and not excluding stock from neighbouring property– impact reported through Management Monitoring (Section 5.4) or visitor to BA.	Repair fence within 15 days and inspect fence at least one month after repair completed and continue Management Monitoring. Return stock to owner and discuss the importance of maintaining stock exclusion from the offset area and options to improve the efficacy of the fencing.
Over grazing – groundcover less than 70 % ground cover and average height of ground cover of less than 12cm as reported by Ecological monitoring or trigger point exceeded under strategic grazing.	Undertake ground cover survey, advise auditor and determine whether/not the trigger values are exceeded (ie less than 70% groundcover, less than 12 cm height). If confirmed remove stock from affected management area.
Biodiversity Audit recommends strategic grazing is required to reduce weed competition and / or encourage regeneration of native plants when completing Ecological Monitoring.	Biodiversity auditor or BioBanking accredited assessor to prepare plan to implement strategic grazing to control weeds, manage fire hazard and/or encourage regeneration. Record and report all strategic grazing activities and outcomes.
Neighbour raises concerns over high biomass increasing fire risk - observed high levels of biomass/grass prior to fire season.	Review monitoring reports and Bushfire Management Plan. Discuss appropriate course of action with neighbour and Rural Fire Service. Review and update Bushfire Management Plan.

4.3 Weed control

Control of weed species is critical to restoring the natural species composition, diversity and structure of the vegetation communities across the BA. Weeds are typically non-indigenous plants that invade areas after significant disturbance, such as land clearing or over grazing. Weed control will focus on species that exclude or have the potential to exclude native species, disrupt recruitment of native species or impede ecological processes. It is important to keep un-infested areas clear of weeds. Outbreaks in these areas will be a priority for intensive eradication and will be closely monitored to identify re-infestation or spread.

The aim of weed control is to incorporate a variety of control methods and reduce the reliance on herbicides to keep un-infested areas clear of weeds and control the spread of existing weed infestations.

4.3.1 Control areas

The 2016 Habitat Restoration Monitoring and BioBanking Assessment Reports indicated that the Putty BA had low levels of weed infestation. The majority of weeds were located in MZ4, due to the disturbance history. These areas will be the primary focus of control actions. In addition, to limit weed dispersal from tracks and incursions from the neighbouring farming areas, weed management will also focus on containment zones of 50 m from the tracks. Figure 6 indicates the location of the control areas. Any weeds outside of these areas will be controlled based on the observations for the monitoring programme. 2020 Habitat Restoration Monitoring indicated weed levels have increased following higher than annual rainfall across the region

4.3.2 Control methods and target weed species

An integrated weed management approach will be implemented utilising a range of suitable control methods that include:

- biological control - a long term technique;
- herbicide control - a short to medium technique;
- land management – a medium to long term technique; and
- manual control – a short term technique.

The preferred control methods are described in Table 11.

All noxious weeds declared under the *Biosecurity Act 2015* will be given priority for weed control. Noxious weeds recorded at the BA are *Rubus fruticosus* (Blackberry) and *Senecio*

madagascariensis (Fireweed). In addition, environmental weeds and/or exotic plants recorded with a relatively high Braun-Blanquet (BB) cover abundance ranking (Braun Blanquet 1928) will also be controlled only where they pose a risk to native species recruitment particularly of native grasses.

The BB cover abundance ranking included:

- 1 = < 5% (rare number of individuals);
- 2 = < 5% (species common at the site);
- 3 = 5 – 25%
- 4 = 25 – 50%;
- 5 = 51 – 75%; and
- 6 = 76 – 100%.

Table 12 lists the target weed species to be controlled, their declaration class under the *Biosecurity Act 2015* or nomination as a Weed of National Significance (WON), control methods, timing and intensity required to manage these weeds, based on the *NSW Department of Primary Industries Noxious and Environmental Weed Control Handbook* (NSW DPI 2014). The photos have been sourced from <http://weeds.dpi.nsw.gov.au/>. Should a control event not be required or conditions are unsuitable (due to dry plants under stress) then evidence of this will be provided in the Annual Report.

The use of chemicals in the BAs will be undertaken by accredited professionals with verified specific experience in native plant and weed identification and management. All chemical weed control will be in accordance with the registered label or current minor use permit, Safety Data Sheets and appropriate safety standards. Chemical use in the vicinity of waterways will be restricted to herbicides and adjuvants registered for use in or near aquatic environments.

Chemical weed control operations pose a substantial risk to successful natural regeneration processes unless carefully planned, implemented and monitored. Planning considerations relevant to weed control operations in natural or assisted revegetation areas include:

- Selection of personnel based on demonstrated experience and skill in selective weed control methods in regeneration areas; and
- Timing of proposed application in relation to recent or planned revegetation works.

Weed control areas at the Putty Biodiversity Area

Management Plan 2022



Figure 6



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Table 11 Weed Control Methods

Control Method	Potential use in control regime
Chemical Control – is the application of chemicals to kill the weed by interfering in the plants growth processes.	<p>Spot application of herbicide is the preferred method of application. Boom spray application is permissible as part of ground preparation for re-establishment activities. Areas that cannot be accessed safely by ground based methods the use of Unmanned Aerial Vehicles (UAV) can be used.</p> <p>Herbicides:</p> <p>Only registered herbicides will be used for the control of the weed species and used in accordance with the directions on the label. Users have a legal obligation to read and follow the instructions on the label. Where appropriate, selective herbicides will be used to minimise impacts on native vegetation.</p> <p>Handling and application:</p> <p>Herbicide is to be applied to actively growing plants.</p> <p>Herbicides must be handled and applied with consideration of their toxic nature and potentially harmful effects on human health, livestock and the environment. Only accredited and trained in the identification of native plant operators are permitted to apply herbicides.</p> <p>During application weather condition, nozzles, equipment and operator are to be closely monitored throughout application to reduce the risk of drift and subsequent off- target damage. Coarse to very coarse nozzles should be used to increase droplets size.</p> <p>Suitable weather conditions for spraying are extremely important.</p> <p><u>Weather guidelines</u></p> <ul style="list-style-type: none"> • Read the product label and follow all label instructions. • Spray when wind is steady and ideally 3–15 km/h. • Avoid variable or gusty wind conditions. • Avoid calm conditions - small droplets remain suspended for long periods. • Spray when wind blows away from sensitive areas. • Avoid spraying in temperatures above 28 °C. • Aim to spray when Delta T is between 2 and 8 and not greater than 10. • Do not spray when inversion conditions exist. • Aim to spray when the atmosphere is neutrally stable. • Most chemicals require a rain free period – check the label. • Be aware of local topographic and convective influences on wind speed and direction. • Record on-site weather conditions at spray time. <p>For more detail please refer to www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf.</p> <p>Reporting:</p> <p>All commercial pesticide users (that includes farmers, leaseholders and spray contractors) must keep records on their pesticide application.</p>
Land Management – good land management practices can reduce the incidence and impact of weeds.	<p>Weed hygiene:</p> <p>All machinery will be cleaned and washed down to reduce the spread of weed seed.</p> <p>Livestock being introduced to a BA will be quarantined for several days, so any potential weed seeds can pass through their system in a known area and be treated later.</p> <p>Weed Identification:</p> <p>Yancoal staff and other key stakeholders visiting the BA will be required to report any new infestation of weeds.</p>
Grazing management	<p>Grazing may be used to control weeds subject to not meeting or exceeding ground cover trigger values (section 4.2) and there is evidence the weed species are preferentially grazed by stock.</p> <p>Spray graze - applying a hormone herbicide and grazing 7-10 days later. Other grazing management practices that are recommended by the Biodiversity Auditor or the Hunter Local Land Services (HLLS).</p>
Biological Control – is a long term control technique.	<p>This is a complementary strategy and alone it may not eradicate the weed. Any use of biological controls will be undertaken in conjunction with advice from OEH and the HLLS.</p>

Control Method	Potential use in control regime
Slashing – mechanical cutting of weeds to prevent seed production	Areas heavily infested with exotic grasses can be treated with slashing equipment mounted on a tractor prior to flowering (likely to be late spring/ early summer).
Manual removal – removal of the weed plant and roots from the site.	Physical removal of new weeds, unearthing of root systems and containment and removal of seed.

Table 12 Target weed species, treatment method and control period and intensity

Species	Photo	Class*	WON	Distribution	Control method	Control period and intensity
Fireweed (<i>Senecio madagascariensis</i>)		4	✓	MZ4 – BB cover abundance score 3 (5 - 25%)	Spot spray with registered herbicide whilst the plant is actively growing and not under stress. Hand pulling individual plants	Autumn to Spring - control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Blackberry (<i>Rubus fruticosus</i>)		4	✓	abundance score 2 = < 5% (species common at the site)	Spot spray (small infestations) or aerial spray UAV (large infestations) with registered herbicide Biological control (Blackberry Rust <i>Phragmidium violaceum</i>)	Spring to autumn From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

*Control Class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the state or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also 'notifiable' and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also 'notifiable' and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are 'notifiable' and a range of restrictions on their sale and movement exist.

The impact of weeds will be assessed through the ecological monitoring programmes. This information will be used to monitor the success of the weed control methods.

4.3.3 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Weed control	At least two weed control events each year for species listed in Table 11, and any other weeds recorded from monitoring activities. All actions recorded in Annual Report.	At least one weed control event each year for species listed in Table 11, and any other weeds recorded from monitoring activities. All actions recorded in Annual Report.	Ecological monitoring data indicates a trajectory for reduction in exotic plant cover over three consecutive assessments.
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

4.3.4 Trigger, Response and Action plan

Trigger	Response and Action
Weeds having detrimental impact - Ecological Monitoring results indicate low native plant recruitment and regeneration and / or no trajectory to benchmark values and increase in exotic plant cover.	Increase the number of weed control events. Suitably qualified and experienced person to review weed control action. Revise the Plan.
New noxious and/or environmental weed is identified within BA.	Notify Government Agency and neighbours of new noxious and/or environmental weed outbreak. Implement new hygiene controls. Review Plan. Follow all directions given by relevant government agency to assist in control.

4.4 Management of fire for conservation

Bushfire prevention is required under the *Rural Fires Act 1997* and a fire regime is required to maintain ecological condition and reduce the risk of damage from wildfire. The absence of fire and the reduction of livestock grazing may lead to a build-up of fire fuel and risk of high intensity bushfire. The land manager is required to take practicable steps to prevent the occurrence of bush fires on the land and minimise the spread of bushfire.

Yancoal, with assistance from the Hunter and Liverpool Range Rural Fire Services, has prepared a Regional BA Bushfire Management Plan, that covers the Putty BA, it identifies fire risks, control measures and communication procedures. A copy of this plan is available on the Biodiversity Offset Portal.

The quick identification of a threatening bushfire, notification of the Rural Fire Service and suppression is the primary goal.

Key control measures include:

- documentation of access and water supply points for suppression activities;
- maintain safe and clear access tracks that also form fire breaks;
- use of grazing to reduce fuel build-up along potential ignition sources, such as public roads, prior to the fire season;
- use of ecological burns (with any required approvals and/or permits from Rural Fire Service) to reduce fuel build-up to protect the conservation values;
- establishment of asset protection zones around priority infrastructure;
- investment in water and other fire suppression assets; and
- communication of the Bushfire Management Plan and response procedures with key stakeholders, including Leaseholders, neighbours, consultants, contractors and employees.

Key management and safety restrictions for total fire ban and very high fire danger rating days include:

- no working alone;
- travel plans on these days are to be communicated to staff or family member, so you can be located in the case of an emergency; and
- no contractor, consultant or visitor access or undertaking 'hot works', unless these activities are required for firefighting purposes.

Any fuel hazard reduction burns will be planned in accordance with the Bush Fire Environmental Assessment Code for New South Wales (Rural Fire Service, February 2006) and the guidelines contained in the Threatened Species Hazard Reduction Lists for the Bush Fire Environmental Assessment Code.

Current recommendations under the Code are:

- in woodland vegetation, fire should not occur within 5 years of a previous fire and consideration should be given to burning within 40 years of any previous fire; and
- in grassland vegetation derived from the woodland vegetation, the recommended fire intervals are the same as woodland vegetation.

Based on the Code recommendations an ecological burn should be completed across MZ1, MZ2, MZ3 and MZ4 within the next 10 to 15 years, unless otherwise specified by the Biodiversity Auditor.

All ecological burns are dependent upon suitable climatic conditions and appropriate level of risk. The advice of a suitably qualified person experienced in ecological fire management will be required to plan and implement the ecological fire management plan, including a post fire monitoring programme to specifically assess the impact of the ecological burn. Any burns are to be scheduled to occur when conditions are suitable for a low intensity burn. Typically this is winter or early spring. Burning should also be scheduled prior to a significant rain event to assist in extinguishing the fire.

Data is to be recorded for all ecological burns including the date and intensity of the fire, the area burnt (shown on a map) during fire, any canopy scorch and percentage of leaf litter remaining. Any additional damage, including fire breaks or new tracks, must also be recorded.

4.4.1 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Regional BA Bushfire Management Plan (BFMP),	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.
Ecological burn		Completed ecological fire management plan.	
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

4.4.2 Trigger, Response and Action plan

Trigger	Response and Action
BA impacted by wildfire.	Map fire damaged area. Prepare fire restoration plan to reinstate infrastructure and monitor post fire to evaluate regenerative capacity and regeneration. Suitably qualified and experienced person to review BFMP Revise the Plan to include actions from the fire restoration plan.
Post fire monitoring results indicate a reduction in native plant cover and increase in exotic cover.	Evaluate active regeneration, increase in weed control and implement supplementary planting. Revise Plan.

4.5 Infrastructure improvement

Construction of new or maintenance of existing infrastructure (such as access tracks/ fire breaks, fences, off-stream watering points or pipes and removal of dam structures) will be required to maintain safe access to complete weed and feral animal control, fire management, and monitoring activities.

Infrastructure improvement action may cause localised site disturbance.

During the construction or maintenance of infrastructure the following guidelines apply:

- Vegetation clearing is only permissible for actions that are required to achieve the objectives of the Plan, for:
 - (a) permanent boundary fence - three metres either side;
 - (b) permanent internal fence - six metres total width of clearing;
 - (c) temporary fence - six metres total width of clearing; or
 - (d) road or track - six metres total width of clearing.
- constructed fences will be stockproof;
- fallen timber and any other obstructions can be removed to maintain access and retained on ground for habitat;
- standing timber that poses an unacceptable safety risk can be felled;
- all works will be undertaken in a manner that minimises disturbance to soil and hydrological characteristics, and avoids erosion, as per OEH guidelines Erosion and Sediment Control on unsealed roads (OEH 2012);
- old fences will be removed and unwanted tracks closed and rehabilitated within the offset area; and
- site disturbance will be required to facilitate certain revegetation activities, such as soil cultivation and slashing.

4.5.1 Performance Criteria

Annual Criteria from Year 1 to Year 10	
Infrastructure improvements	Completed GDP for all infrastructure improvement actions. Maintenance of tracks and fences completed at least every 3 years.
Monitoring	Property Inspections (Section 5.4)

4.5.2 Trigger, Response and Action plan

Trigger	Response
Unauthorised clearing of vegetation	Report and review incident within 30 days. Complete significant residual impact assessment of the incident. For incidents with a significant residual impact a rehabilitation plan is to be prepared and implemented. Review the Plan.
Fencing continually damaged by flood waters.	Replace fence with floating fences or re align fence. Update the Plan.

4.6 Maintenance or reintroduction of natural flow regimes

Artificial structures on waterways or waterbodies restrict natural flows, however dams and habitat ponds support strategic grazing and other management actions. There are no artificial structures on waterways or waterbodies within the BA.

4.7 Retention of regrowth and remnant native vegetation

Remnant native vegetation and regrowth is important as it is the key component of the BA. The retention of this native vegetation and its regrowth is important to maintain and enhance the biodiversity value of the offset area.

Natural regrowth of remnant vegetation will be preferentially retained to promote recovery of native vegetation. Dense patches of native regrowth will be allowed to self-thin unless new plantings require regulated control.

Exceptions to this rule include maintenance of fence lines and management tracks associated with the BA (Section 4.5).

4.7.1 Encourage natural regeneration

The woodlands on the valley floor have been impacted by agriculture and the native plant diversity, community structure and habitat values have been degraded. Consequently, re-instating/restoring these components will aim to:

- Increase native mid-storey cover,
- Increase native ground cover (herbs, ferns, lilies, rushes, sedges), and
- Maintain and/or increase woodland canopy cover.

The regenerative potential is substantial and natural regeneration is already evident in many areas, particularly where grazing pressure has been removed/substantially reduced. In the absence of disturbance, these areas are likely to regenerate with minimal assistance. Low to moderate management intervention is required in this region and will be implemented in accordance with the management actions outlined in this Section.

4.7.2 Performance Criteria

	Year 1 to Year 10	Completion Criteria
Natural regeneration	Annual weed control, vertebrate pest and fire management actions implemented as per management plans	Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

4.7.3 Trigger, Response and Action plan

Trigger	Response and Action
No active regeneration and native plant recruitment within 5 years in MZ4 recorded through the ecological monitoring, indicated by no trajectory towards benchmark ranges.	Consider planting actions and revise the Plan. Planting actions to be considered include direct seeding, tube stock planting of species selected from the description of the plant community type, details of the methodology and maintenance to be included in the revised Plan.
Single species and age class domination constraining species diversity observed by Ecological Monitoring (Section 5.3)	Prepare ecological thinning plan to increase species and age class diversity. Implement ecological thinning plan and revise this Plan.

4.8 Supplementary planting

No planting actions are required at present. If ecological monitoring indicates or the Biodiversity Auditor advises then this Plan shall be updated.

4.9 Erosion control

Soil erosion occurs when vegetation has been removed exposing bare soils, making them susceptible to erosion where water flow is able to mechanically remove or disperse the soil. This often occurs along creek lines but can occur in bare paddocks where vegetation clearing or over grazing exposes bare soils. Bare soils in locations where high volumes of water occur can lead to severe soil erosion.

There is some potential for erosion to occur within the BA. Management options for erosion control include excluding grazing, controlling vehicle access, maintenance of tracks and rehabilitation of drainage lines, watercourses and riparian areas where erosion impacts are identified.

Erosion within the BA will be monitored through biannual inspections by Yancoal, as well as other observations recorded during the ecological monitoring programme. Appropriate erosion remediation measures will be undertaken in consultation with the Hunter Local Land Service (HLLS) and NSW OEH.

4.9.1 Performance Criteria

	Year 1 to Year 10	Completion Criteria
Monitoring inspections and reports	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

4.9.2 Trigger, Response and Action plan

Trigger	Response and Action
Active erosion observed through monitoring.	Install erosion control measures, within 30 days of detection of active erosion, undertake monitoring of the area over 12 months post event to ensure the site is stabilised. Repeat area inspections annually to monitor stability. Report and review incident, within 30 days. Review the Plan.

4.9.3 Salinity Control

Dryland salinity occurs where salt in the landscape is mobilised and redistributed closer to the soil surface or into waterways. This often occurs along creek lines and in bare paddocks where vegetation clearing or over grazing exposes bare soils. There is potential for dryland salinity to occur within the BA. Management options for salinity control include excluding grazing and active re-establishment of trees and shrubs where salinity impacts are identified. Visual assessments of land can provide an indication of the severity of salinity.

Salinity within the BA will be monitored through biannual inspections by Yancoal, as well as other observations recorded during the ecological monitoring programme. Appropriate salinity remediation measures will be undertaken in consultation with the HLSS and DPIE-EES

4.10 Vertebrate Pest and Overabundant Native Animal Control

Vertebrate pest species and overabundant native herbivores can pose a threat to native flora and fauna through degradation of habitat, competition for habitat resources, and direct predation.

The recovery plans for Swift Parrot and Regents Honeyeater list the following key threatening processes, which are relevant to the pest animal control across the BA:

- competition and grazing by the feral European rabbit;
- competition and habitat degradation by feral goats;
- competition from feral honey bees;
- environmental degradation caused by feral deer;
- predation by feral dogs;
- predation by the European red fox;

- predation by the feral cat; and
- competition from Noisy Miners / starlings.

This Plan will target the control of declared vertebrate pests and those that cause environmental degradation that impact on the vegetation and fauna at a regional and local level, and opportunistically control of the species listed in Table 13. Other vertebrate pests, overabundant native herbivores, or noisy miners will be managed as required under a specific management plan prepared prior to their control. If the control event is not required or conditions are unsuitable then evidence will be presented in the Annual Report.

Under the *Local Land Services Act 2013* (LLS Act), species that are currently declared pests in NSW include rabbits, feral pigs and wild dogs. Pest Control Orders can be issued by the regulator to legally enforce land managers to control the species on their land. Land managers are defined as either owners or occupiers of the land. Occupiers of land in NSW are not obliged to control other vertebrate pest animals. However, these species may have significant negative impacts on the environment and agricultural production in many areas.

The *Game and Feral Animal Control Act 2002* requires the control of feral deer.

This Plan acknowledges that populations of vertebrate pests are determined by several factors such as topography, shelter, territorial behaviour and food availability. Property fences do not restrict pests, and control actions will not therefore be limited to artificial boundaries. Most vertebrate pests are highly mobile and can readily replace those that are killed on individual properties. A variety of control methods can be utilised provided they are:

- species specific (wherever possible);
- cause no or little damage to the natural environment;
- are humane;
- meet relevant Work, Health, Safety and Environment regulatory requirements; and
- are regularly monitored.

Control programmes are likely to be far more effective when coordinated with multiple landholdings. Yancoal will endeavour to work with the HLLS on regional control programmes and supported by local on ground control actions. Neighbours are to be notified on local on-ground actions to facilitate coordination of efforts and deliver more effective control.

Design and implementation of local controls will be guided by the National Codes of Practice (COPs) and Standard Operating Procedures (SOPs) produced by the Commonwealth Department of the Environment (available at www.feral.org.au). The COPs for each of the key pest animal species provides general information on best practice management, control strategies, species biology and impact, and the humaneness of current control methods. The SOPs describe management techniques and their application for these pest animal species, including a discussion of animal welfare impacts for target and non-target species. They also cover the health and safety aspects of management techniques.

Table 13 Identified Vertebrate Pests control methods, timing and intensity

Pest	Declared	Control methods	Control timing and intensity
European rabbit (<i>Oryctolagus cuniculus</i>)	Yes	Baiting: 1080 / Pindone Trapping: cage trap Shooting: ground based Biological: Myxomatosis and / or Rabbit Haemorrhagic Disease(RHD) Other: Exclusion fencing / Warren fumigation / Warren ripping	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral Deer (<i>Cervus timorensis</i>) (<i>Dama dama</i>) (<i>Cervus elaphus</i>)	Yes	Shooting: ground based	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral cat (<i>Felis catus</i>)		Trapping: Wire mesh cage trap / Soft net trap/ Padded-jaw trap Shooting – ground based	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral cattle (<i>Bos taurus</i>)		Other - Exclusion fencing / Mustering	As required.
Feral Goat (<i>Capra hircus</i>)		Shooting – ground / aerial based Other - Exclusion fencing // Mustering	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Feral pig (<i>Sus scrofa</i>)	Yes	Baiting – 1080 Trapping - Silo, panel or box traps Shooting – ground / aerial based Other - Exclusion fencing	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Hares (<i>Lepus europaeus</i>)		Trapping – cage trap Shooting – ground based Other - Exclusion fencing / Habitat modification / Repellents	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Red fox (<i>Vulpes vulpes</i>)		Baiting – 1080 Trapping - Wire mesh cage trap / Soft jaw leg hold trap Shooting – ground based Other - Den fumigation / Exclusion fencing / Ejectors / Habitat modification	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Wild dog (<i>Canis lupus spp.</i>)	Yes	Baiting – 1080 / PAPP Trapping - Soft jaw leg hold trap Shooting – ground based Other - Exclusion fencing/ Ejectors	Control event in Autumn and /or Spring From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Local control

Local on ground control measures including trapping, baiting and shooting (as appropriate) are to occur in Autumn and Spring, to coincide with breeding seasons of many of the vertebrate pest species. Reactive control may be undertaken at other times in response to reports of threatened species and/or livestock predation.

All control actions will be undertaken by appropriately qualified personnel and are required to complete of a comprehensive job safety assessment prior to commencement of actions. Control actions must follow the Model Codes of Practice (COPs) and Standard Operating procedures (SOPs) for the humane control of pest animal (available online <http://www.pestsmart.org.au/animal-welfare/humane-codes/>).

Regional control

Yancoal will continue to participate in regional aerial and ground control programmes for feral pigs and wild dogs, managed and coordinated by the HLLS and/or National Parks and Wildlife Service. It will apply across all MZs in the BA.

Regional control programmes are managed and co-ordinated by the HLLS. The HLLS will be responsible for advising the community of the control action, while Yancoal will notify Leaseholders. The HLLS will provide a report detailing the timing, number of animal culled and the GPS output from the aircraft to Yancoal.

4.10.1 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Vertebrate pest local control	At least two control events each year for species listed in Table 12, and any other species recorded from monitoring activities. All actions recorded in Annual Report.	At least one control events each year for species listed in Table 12, and any other species recorded from monitoring activities. All actions recorded in Annual Report.	No observed vertebrate pest or damage. Ecological monitoring demonstrates a trajectory to benchmark values for all attributes measured over three consecutive assessments (the average of all plots).
Vertebrate pest regional control	Active participation in programme coordinated by HLLS, this may include local control actions.	Active participation in programme coordinated by HLLS, this may include local control actions.	
Monitoring	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	Complete Ecological Monitoring Section 5.3), (Rapid Condition Assessment and Property Inspections (Section 5.4)	

4.10.2 Trigger, Response and Action plan

Trigger	Response and Action
Vertebrate pest having detrimental impact - Ecological Monitoring results indicate no trajectory towards benchmark and management monitoring observes evidence of vertebrate pests. .	Increase the number of control events. Suitably qualified and experienced person to review control action. Revise the Plan.
New vertebrate pest is identified within BA.	Targeted vertebrate pest control. Notify Government Agency and neighbours, if required. Revise the Plan. Follow all directions given by relevant government agency to assist in control.

5 Monitoring

This Section outlines the monitoring programme designed to assess changes in the habitats of the offset areas at three different scales:

- landscape monitoring: to assess vegetation changes and habitat connectivity at the landscape scale in the long-term (10 - 15 years);
- ecological monitoring: to assess habitat restoration and bird assemblages by quantifying changes in vegetation structure, key fauna habitat features and bird assemblages in the short to medium-term (2 years); and
- management monitoring: to assess woodland condition and identify emerging threats in the short-term (biannually/annually).

5.1 Monitoring objectives

The objectives of this monitoring programme are to detect whether the conservation objectives of the Plan are being achieved, and that the Plan is being effectively implemented.

The variables to be monitored are therefore comprised of:

- the key performance and completion criteria, as listed in Table 9;
- the performance criteria and the trigger events, as specified in Section 4; and
- scenarios that represent risk to the attainment of the plans objectives, as assessed in Table 14, Section 6.

It is anticipated that effective monitoring of ecological condition, and management will demonstrate that implementation of the Plan is achieving the conservation objectives. The monitoring is designed to measure the key performance indicators/completion criteria, and identify where corrective actions are required. In this way it is intended that monitoring activities will have a clear relationship to operational decision-making such that:

- if the landscape (Section 5.2), ecological (Section 5.3), and the management (Section 5.4) monitoring demonstrate an increase in woodland extent and enhanced habitat condition then the Plan is achieving the desired outcomes and should proceed without modification;
- if the monitoring indicates no increase in extent of woodland and enhancement of ecological condition then the corrective actions listed in risk assessment at Table 14 should be implemented; and
- if the monitoring indicates that the performance criteria for the conservation management actions are not achieved, then the Trigger, Response and Action plan should be enacted.

The Annual Reports will provide ongoing review of the monitoring results; this includes the annual management monitoring and the biennial ecological monitoring reports. These reports may include recommendations to amend the monitoring programme and any recommendations will be considered and incorporated as part of the review of the Plan or immediately provided it does not diminish the monitoring effort.

The frequency of monitoring activities will vary according to the monitoring schedule provided in Table 13. To enhance understanding and knowledge of all key stakeholders in the management of the BA, Yancoal representatives, where feasible, will accompany the Biodiversity Auditors during the field based components of this monitoring programme.

Table 14 Monitoring Schedule

	2020	2021	2020	2023	2024	2025	2026
Landscape							
Aerial photo interpretation							X
Ecological							
Habitat Restoration	Sept - Nov		Sept - Nov		Sept - Nov		
Bird Assemblage	July-Aug		July-Aug		July-Aug		
Management							
Rapid Condition Assessment	Sept - Nov						
Property inspection	April / Nov						

5.2 Landscape Monitoring

Aerial photographic imagery baseline photography captured 2014 will be updated in up to 15 years, the imagery will be analysed and the findings ground-truthed to assess the extent of canopy regeneration within the BA.

The analysis of tree canopy cover will be used to map changes in the distribution and condition of woodland habitats and the connectivity of vegetation remnants. An increase in the extent and condition of woodland habitats will be indicative of successful management of the offset areas towards the Key Performance Indicators.

5.3 Ecological Monitoring

Habitat restoration and bird assemblage monitoring aims to assess changes in the condition and extent of the woodland habitats within the BAs and the ongoing usage of these habitats by woodland birds.

5.3.1 Habitat Restoration Monitoring

The objectives of the habitat restoration monitoring are to:

- Demonstrate a change in degraded habitats towards benchmark (BioMetric) values; and
- Demonstrate recruitment of canopy species through transition up age classes (measured as Diameter at Breast Height);

Five Habitat Restoration Monitoring Plots are established in MZ4, which has been degraded from previous land management practices, to monitor changes in condition across the Putty BA.

The location of the Habitat Restoration Monitoring Plots is shown in Figure 3. All monitoring results will be stored on the Biodiversity Offsets Portal.

The habitat restoration monitoring programme will assess changes in habitat values within the BAs through time and relative to the benchmark values presented in the BioMetrics Vegetation Types Database (NSW DEH 2013). These benchmark values relate to species richness and percent cover of native plants in the various vegetation layers as well as counts of tree hollows and the length of fallen timber. Additional habitat features will also be included in this monitoring programme to track canopy regeneration and health.

5.3.1.1 Field Methods

The field methods follow the 'Field methodology for measuring condition variables for Site Value and at Reference Sites' according to the BioMetric 3.1 methods (Department of Environment, Climate Change and Water, 2011). In addition, more detailed data are collected on species composition and cover abundance, canopy regeneration and health, and habitat features as outlined below.

The plots are 50m x 20m and are established such that the plot runs downslope. A 20m x 20m quadrat is positioned within this larger plot and three 50m transects run its length (Figure 7). Marker pegs are positioned at the top-middle of the plot to establish a permanent plot position. GPS coordinates have been taken to ensure monitoring plots can be relocated over time.

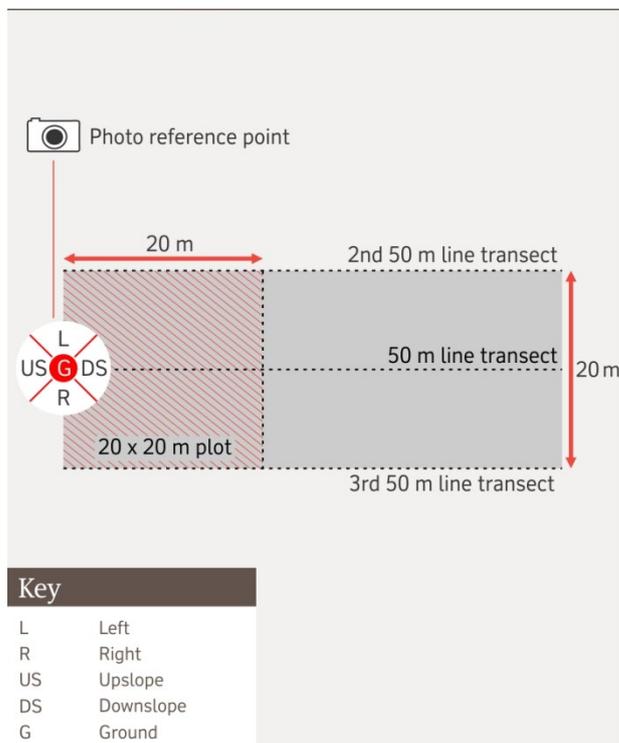
The 50m x 20m plot is used to record details of the over-storey (canopy) layer including species richness, canopy regeneration and canopy health. Specific habitat features, such as the abundance of tree hollows, flowers/fruit, mistletoe and fallen logs are also recorded at this scale

The 20m x 20m quadrat is used to record details of the mid-storey and ground stratum structure including details of the composition and % cover of native/exotic species for various plant groups (e.g. grasses, shrubs, other herbaceous plants). Additional habitat features such as rocks, litter and bare ground are also recorded at this scale.

Three 50m transects are used to assess the % foliage cover of the over-storey. These data are collected at 10 points (i.e. at every 5m) along the length of the transects.

Further details of the field sampling methods, including a table summarising the variables (measurements) that are recorded, their unit of measurement and the sampling unit are provided in **Appendix B**.

Figure 7 Monitoring plot for habitat restoration monitoring



5.3.1.2 Photo Reference Points

A photo reference point are also established and permanently marked within each habitat monitoring plot. Photo reference points are established at the top of the middle 50m transect at each monitoring site. During each monitoring event, a series of photos are taken from this point to provide a visual record of any changes in vegetation and habitat condition. Depending of the location of the monitoring plot, this might include:

- changes in vegetation structure (e.g. presence/ absence of canopy species, shrubs, tussock grasses);
- the presence/condition of special habitat features (e.g. rock outcrops, flowering/fruited species); and
- changes in identified threatening processes (e.g. weed infestations, erosion).

At each photo reference point, a minimum of five photos is taken, in the following directions:

- downslope;
- upslope;
- across the slope – left (when facing downslope);
- across the slope – right (when facing downslope); and
- directly down.

The photo records are displayed on the Biodiversity Offsets Portal such that monitoring photos can be viewed against the baseline (2016) photo. This will provide an ongoing and gradual visual record of changes in habitats as the management strategies are implemented as well as changes in existing threats and early warning of emerging threats at monitoring sites.

5.3.2 Bird Assemblage Monitoring

Bird assemblage monitoring focuses on areas of existing woodland habitat.

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.

Birds are typically abundant and widespread taxa whose populations are easily surveyed. Although they are relatively mobile, many species can show specialisation in their habitat requirements. Patterns in the distribution and abundance of bird assemblages can be indicative of biodiversity as a whole and of environmental change. Accordingly, bird assemblages are being monitored as indicators of general ecosystem condition.

A desktop study has been undertaken to predict the timing and distribution of the Swift Parrot and Regent Honeyeater in the region so that habitat and bird assemblage surveys are designed to maximise the likelihood of detecting these species. Swift Parrots are likely to occur in the region occasionally and in very low numbers between July and October to feed on winter-flowering eucalypts (Swift Parrot Recovery Team 2000; Saunders and Tzaros 2011; OEH 2012). The Regent Honeyeater is known to breed around the Upper Hunter Valley and Mudgee regions. The species has regular movements with seasonal patterns of abundance and breeding related to regional patterns in flowering of key forage species (Franklin, Menkhorst et al. 1989; Menkhorst, Schedvin et al. 1999; OEH 2012; SEWPaC 2012).

Accordingly, bird assemblage monitoring has occurred in winter/spring 2016, 2018 and 2020. Additional monitoring will be undertaken in 2022, 2024 and 2026 (Table 14). Birds Australia may be consulted prior to the commencement of these surveys to coordinate survey effort and increase the likelihood of observations, therefore the timing of survey maybe adjusted.

5.3.2.1 Field Methods

Habitat area searches are conducted in accordance with Birds Australia Atlas search methodology and EPBC Act bird survey guidelines (DEWHA 2010). This method involves searching a set area and recording data only from within the pre-defined search zone. A two ha area is surveyed for 20 minutes by two observers. Broadcast surveys are to be included in the methodology in 2018 at the same location as the monitoring plots.

At the Putty BA, 10 bird monitoring plots are established according to the following breakdown:

- 4 plots across MZ1 and MZ2 (intact woodland);
- 2 plots within MZ3 (riparian zone); and
- 4 plots within MZ4 (regenerating woodland)

Incidental and opportunistic surveys are also conducted where suitable habitat areas for the Swift Parrot or Regent Honeyeater are observed when travelling to and between monitoring sites. All opportunistic sightings of these species and their locations are recorded. General notes and important habitat resources such as tree hollows, flowering trees and nests are recorded incidentally and photographed, as well as any notable bird activities such as specific forage behaviour or signs of breeding activity.

5.3.3 Data Analysis and Interpretation

To assess the success of the management actions in meeting the Key Performance Indicators, data on vegetation, fauna habitats and bird assemblages is analysed against the predicted changes in these groups associated with implementation of the actions.

Univariate and multivariate techniques will be used to analyse and visualise patterns in the data and will include one or more of the following techniques:

- Analysis of Variance (ANOVA): to test for changes in univariate data including species richness, abundance of specific habitat features, % cover vegetation structural layers;
- distance-based permutational Analysis of Variance based on Bray-Curtis dissimilarities: to test for changes in multivariate data including fauna and plant community composition;
- graphs and charts: to summarise patterns in univariate data and visualise changes in variables relative to the reference condition (medium-high quality woodland); and
- non-metric Multidimensional scaling and SIMPER analyses: to summarise patterns in multivariate data, visualize changes in the data relative to the reference condition and assist in ecological interpretation of the results.

The ecological data will be analysed to assess the nature and extent of change through time, relative to the benchmark values. It is expected that in subsequent years, with the progressive improvement in habitat condition, the ecological data analysis will eventually show a convergence of ecological variables to that of the woodland benchmark. This is expected to be a medium to long-term upward trend that will reflect the enhancement of woodland and the development and availability of critical fauna habitat features such as hollows, ground debris and forage resources. By demonstrating this convergence through time, it will be inferred that the proposed conservation management actions have been successful in enhancing the extent and condition of the vegetation communities and restoring the lower quality vegetation and fauna habitats (in particular for Regent Honeyeater and Swift Parrot) towards the benchmark condition.

5.4 Management Monitoring

5.4.1 Rapid Condition Assessment

Each year, RCA sites in mature and regrowth vegetation are revisited to record the presence or absence of key habitat components and threatening processes.

The results of the RCA, together with property inspections and photo reference points will be used to monitor woodland condition and identify emerging threats.

5.4.2 Property inspections

Regular property inspections are undertaken to ensure that there is a systematic monitoring of the offset area, to ensure its protection and to ensure early detection of potential threats or failures. A Yancoal representative will undertake biannual inspections, to ensure regular visual inspections of the offset area to detect:

- physical condition of fencing and gates;
- disturbance factors including fire and unauthorised access e.g. hunting, fire wood collection;
- condition of erosion;
- evidence of waste dumping;

- presence/activity of feral pest species;
- grazing pressure from over-abundant native herbivores;
- presence of exotic weed species; and
- assessment of fire fuel loads in winter.



Phot0: Sand stone, Putty BA 2016

6 Risk assessment

Table 15 identifies the key risks to this Plan.

The risk assessment is undertaken in accordance with the following risk framework, having regard for the likelihood and consequence definitions used below.

		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)

Highly likely Is expected to occur in most circumstances

Likely Will probably occur during the life of the project

Possible Might occur during the life of the project

Unlikely Could occur but considered unlikely or doubtful

Rare May occur in exceptional circumstances

Qualitative measure of consequences (what will be the consequence/result if the issue does occur)

Minor Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.

Moderate Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.

High High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.

Major The plan's objectives are unable to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.

Critical The plan's objectives are unable to be achieved, may include widespread and severe environmental harm, with no evidenced mitigation strategies.

Table 15 Risk and Contingency Assessment Matrix

Objective	Scenario ¹	Likelihood	Consequence	Risk level	Trigger	Corrective Action
To protect the conservation values of the offset area within 10 years at the BA.	Delay in securing the offset area under a legally binding mechanism	Likely	Minor	Low	NSW biodiversity reforms not providing a fit for purpose mechanism to legally secure offset area.	Additional consultation with DAWE and OEH.
	Unable to attach the Plan to the land title.	Likely	Minor	Low	NSW government requires different plan to be attached to the land title.	Ensure that a new plan is equivalent to this Plan.
	Illegal access to offset area causing significant residual impact.	Unlikely	Moderate	Low	Failure in access control (Section 4.1.3) captured in management monitoring (Section 5.4.2) and reported in the Annual Report.	Review access control and improve security measures. Consider relocation of offset area.
	Uncontrolled bushfire impact offset area.	Possible	High	Medium	Bushfire on extreme or catastrophic fire danger day impacts offset area.	Implement Post Fire Event recovery with NSW Rural Fire Service. Complete post fire survey, map fire damaged areas, and revise the Plan.
To enhance the condition of conservation values of the offset area within 10 years at the BA.	No enhancement of condition in the conservation values measured by the Habitat Restoration Monitoring (Section 5.3.1) and Rapid Condition Assessment (Section 5.4.1).	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate) and monitoring effort. Revise Plan and consider new Conservation Management Action. Assess influence on success from other factors such as extreme climatic conditions. Consider relocation of offset area.
	No increase in extent of woodland from the active restoration of grassland as measured by the Landscape (Section 5.2) and Habitat Restoration Monitoring (Section 5.3.1).	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate) and monitoring effort. Revise Plan and consider new Conservation Management Action. Assess influence on success from other factors such as extreme climatic conditions. Consider relocation of offset area.
To enhance and maintain the habitat values of the offset areas within 10 years at the BA	Observed decrease in species richness and usage of the offset area as measured by the Bird Assemblage Monitoring (Section 5.3.2)	Possible	Moderate	Medium	Review of Annual Reports and Monitoring data.	Review external factors (climate / disease) and monitoring effort. Revise Plan and consider new Conservation Management Action.

Note 1 Assumes effective implementation of management actions as described in the Plan

7 Compliance table

Table 16 Compliance with relevant conditions of EPBC2009/5081

Approval Condition	EPBC 2009/5081	Reference
2	<p>To offset the impacts on the foraging habitat of the regent honeyeater and swift parrot, the person taking the action must submit to the Minister for approval an Offset Management Plan (OMP) for the Phase 1 Offset identified in <u>Attachment A</u> by no later than 13 April 2014.</p> <p>The OMP must include, but not be limited to the following:</p> <ul style="list-style-type: none"> a) a textual description and map to clearly define the location and boundaries of all of the offset areas. This must be accompanied with the offset attributes and a shapefile b) details of management actions to protect and enhance the extent and condition of habitat values of the offset areas including but not limited to rehabilitation, weed control, fire management, erosion and sediment control, management of livestock and restrictions on access to habitat for the regent honeyeater and swift parrot c) the timing, responsibilities and performance criteria for management actions d) a monitoring plan including the undertaking of ecological surveys by a qualified ecologist to assess the success of the management actions against identified milestones and objectives e) a process to report, to the department, the management actions undertaken in the offset areas and the outcome of those actions, including identifying any need for improved management f) description of the potential risks to successful management and rehabilitation in the offset areas, and a description of the contingency measures that would be implemented to mitigate these risks g) details of parties responsible for management, monitoring and implementing the plan, including their position or status as a separate contractor. <p>The approved OMP must be implemented.</p> <p><i>Note: Offset areas can accommodate offset requirements for more than one species habitat within the one area, if a qualified ecologist verifies that suitable habitat is present and includes specific habitat requirements for the relevant species.</i></p>	<p>Section 2.1 Location and description</p> <p>Section 3 Objectives, Key Performance Indicators and Completion Criteria</p> <p>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p> <p>Section 5 Monitoring</p> <p>Section 1.3 Function of the Management Plan</p> <p>Section 4 Conservation Management Actions</p> <p>Section 6 Risk assessment</p> <p>Section 1.3.2 Key Stakeholders and Roles</p>
5	<p>The approved OMP, as described in condition 2, must be revised by the person taking the action to include, but not be limited to, those activities as described in condition 2a-g for the Phase 2 Offset. The revised OMP must be submitted for approval by the Minister within 12 months of the approval of the Phase 2 Offset. The revised approved OMP must be implemented.</p>	Refer to condition 2 above.
Re-establishment of Woodland in Biodiversity Management and Offset Areas		
6	<p>Within 12 months of the Commencement of Construction of Phase 1, the person taking the action must submit to the Minister for approval a Re-establishment Plan (REP) for the Phase 1 Offset area. The REP must include, but not be limited to the following:</p> <ul style="list-style-type: none"> a) details of the areas to be re-established (re-establishment areas) including location and maps; b) documentation including mapping of current environmental values relevant to MNES of the re-establishment areas; c) where revegetation through planting seedlings and/or seeds is intended, details of appropriate species and ratios of species relevant to historically occurring listed migratory and listed threatened species' habitat; d) the source and provenance of the seeds and/or seedlings which will be used; 	<p>This Plan</p> <p>Section 4 Conservation Management Actions</p> <p>Section 2 Biodiversity Area</p> <p>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p>

	<p>e) measures to address threats to MNES including but not limited to grazing pressure and damage by livestock and adverse impacts from feral animals and weeds;</p> <p>f) measures to provide fire management regimes appropriate for the MNES;</p> <p>g) measures to manage the MNES in accordance with the recommendations of the approved recovery plan for the migratory and threatened species;</p> <p>h) monitoring measures including ecological surveys to measure the establishment and ongoing success of the revegetation based on a comparison with high quality habitat for the MNES;</p> <p>i) performance measures and reporting requirements against identified objectives, including trigger levels for contingency measures to be taken to ensure performance measures and objectives are met</p> <p>j) identify persons responsible and arrangements for implementing the REP and for reporting on performance.</p>	<p>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p> <p>Section 5 Monitoring</p> <p>Section 4 Conservation Management Actions Section 6 Risk assessment</p> <p>Section 1.3.2 Key Stakeholders and Roles</p>
	The approved REP must be implemented.	
7	The approved REP, as described in condition 6, must be revised by the person taking the action to include at least those activities as described in conditions 6a-j for the Phase 2 Offset. The revised REP must be submitted for approval by the Minister within 12 months of the Commencement of Construction of Phase 2 of the action. The approved revised REP must be implemented.	This Plan

Table 17 Compliance with relevant conditions of NSW SSD-6464

Approval Condition	Development Consent SSD-6464, Schedule 3	Reference
28	<p>Retirement of Offsets</p> <p>Within 3 years of the date of commencement of development under this consent, the Applicant shall retire biodiversity credits of a number and class specified in Tables 9 and 10 below to the satisfaction of OEH.</p> <p>The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects and can be achieved by :</p> <p>(a) acquiring or retiring credits under the Biobanking Scheme in the TSC Act;</p> <p>(b) making payments into an offset fund that has been developed by the NSW Government; or</p> <p>(c) providing supplementary measures.</p>	The credits reported in this document and the BioBanking Assessment Report will be retired to meet this condition.

Approval
Condition

Development Consent SSD-6464, Schedule 3

Reference

Table 9: Ecosystem credit requirements

Vegetation Community	Code (BVT)	Biometric Vegetation Type	Area (ha)	Endangered Ecological Community (EEC)	^a Credits required
Warkworth Sands Woodland	HU872	Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area	72.12	Warkworth Sands Woodland in the Sydney Basin Bioregion EEC	3,043
Warkworth Sands Grassland	HU872	Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area	0.87	N/A	16
Central Hunter Grey Box - Ironbark Woodland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	614.64	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC	^b 12,180
Regenerating Central Hunter Grey Box - Ironbark Woodland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	6.43	Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC	108
Central Hunter Grey Box - Ironbark Derived Grassland	HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	378.6	N/A	4,516
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	HU818	Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	16.61	Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions EEC	633

Notes:

- ^a Or as otherwise determined by OEH as part of its detailed consideration of credits retirement.
- ^b This must be read in conjunction with the similar figure in Table 11. It reflects the fact that some of these credits may be retired through mine rehabilitation.

Table 10: Species credit requirements

Species	^a Credits Required
Regent Honeyeater	18,929
Southern Myotis	18,222
Large-eared Pied Bat	139

Note:

- ^a Or as otherwise determined by OEH as part of its detailed consideration of credits retirement.

36

Biodiversity Management Plan

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. This 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;

(b) describe the short, medium, and long term measures that would be implemented to:

- manage the remnant vegetation and fauna habitat on the site;
- implement the biodiversity offset strategy described in the EIS;
- regenerate and conserve Warkworth Sands Woodland EEC in the biodiversity areas;
- integrate the implementation of the biodiversity offset strategy to the greatest extent practicable with the rehabilitation of the site;

(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy (including the regeneration of Warkworth Sands Woodland). and triggering remedial action (if necessary);

(d) include a detailed description of the measures that would be implemented over the next 3 years for:

- regenerating Warkworth Sands Woodland in the biodiversity offset areas;
- protecting vegetation and fauna habitat outside the approved disturbance area on-site;
- enhancing the quality of existing vegetation and fauna habitat on the site and in the biodiversity offset areas;
- minimising clearing and avoid unnecessary disturbance;
- 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;
- collecting and propagate seed;
- minimising the impacts on fauna on site, including undertaking pre-clearance surveys;
- managing salinity using best practice dryland salinity management

Completed – this Plan satisfies the requirements of the Biodiversity Management Plan approved in January 2016. Conditions (c) and (d) see Section 3 and Section 4.

Condition (e) see Section 5

Condition(f) see Section 6

Condition (g) see Section 1.3.2.

Approval Condition	Development Consent SSD-6464, Schedule 3	Reference
	<p>revegetation measures;</p> <ul style="list-style-type: none"> • controlling weeds and feral pests; • controlling erosion; • managing grazing and agriculture on site; • controlling access; and • bushfire management; <p>(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;</p> <p>(f) identify the potential risks to the successful implementation of the biodiversity offset strategy (including the regeneration of Warkworth Sands Woodland) and include a description of the contingency measures that would be implemented to mitigate against these risks; and</p> <p>(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.</p> <p>Note: Management measures relating to the biodiversity offset strategy may be addressed via equivalent measures required by OEH as part of a BioBanking Agreement or similar conservation agreement.</p>	

8 References

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Appendix A – Rapid Condition Assessment

The Rapid Condition Assessment (RCA) is derived from the ‘Save the Bush Toolkit’ technique (Wakefield and Goldney, 1997), which identifies the presence or absence of key habitat components and threatening processes. This technique is not applicable to all types of native vegetation (e.g. native grasslands, wetlands or pastures) but is a quick and reliable way to assess the condition of woodland communities.

The RCA requires answering true or false to a series of questions, with a tally of the “True” scores indicating woodland health. Where answers are false, improved management in these areas may be required. Sites scoring 16 - 20 “trues” are generally considered to be areas of healthy vegetation that are sustainable under current management. Sites scoring 10 - 15 “trues” are generally considered to be areas of moderately disturbed bushland that have key elements missing and need improved management. Scores lower than 10 are highly disturbed and have many key elements missing. They are generally unsustainable under the current management and require improved management. These RCA attributes are listed in Table A1 with an example score for relatively undisturbed woodland.

Table A1 Rapid Condition Assessment attributes

Remnant attribute	Site
Low grazing intensity - never farmed	True
Tree and shrub regeneration present (<2m)	True
Infrequent fire regime (<5year intervals)	True
Healthy mature trees (no dieback)	False
Little to no evidence of rabbits	True
Little to no evidence of foxes/cats	True
Low abundance of weeds (most remnants contain some weeds)	True
No evidence of firewood collection	False
No obvious signs of erosion or salinity	True
Not susceptible to fertiliser application, herbicide or pesticide drift	True
Less than 20% trees with Mistletoe (NB some mistletoe is healthy)	True
Few tracks, trails or fence lines	True
Presence of native shrubs	True
Presence of large, old growth trees with hollows	True
Dead timber is left standing	True
Fallen timber and logs are left on the ground	True
Abundance of native ground flora	True
Presence of litter, cryptogams, cracks and rocks	True
Remnant is large (> 5ha is optimum)	True
Connected to or in close proximity to other remnant vegetation	True
Total No. True answers (x/20)	18/20

Appendix B - Habitat Restoration Monitoring

Field Methods

Details of the field methods for Habitat Restoration Monitoring are provided below and a summary of the key variables that will be extracted from this data for analysis is provided in Table B1.

• 50x20m plot

Over-storey composition and species richness: Systematically cover the entire 50x20m plot identifying all over-storey species (tallest woody stratum >1m).

Over-storey regeneration: When identifying over-storey species, also record stem diameter class (0-10cm, 10-20cm or >20cm) for each tree.

Additional habitat features: When identifying over-storey species, note the presence of tree hollows (minimum entrance width of 5cm), mistletoe or flowers/fruit on each tree and any dead trees. Also record the length of fallen logs (minimum diameter 10cm and minimum length 0.5m) within the plot.

• 20x20m quadrat

Community species richness: Systematically cover the entire 20x20m quadrat identifying and recording all native species in the mid-storey (all vegetation between the over-storey and >1m including tall shrubs, under-storey trees and tree regeneration) and all native species in the ground stratum noting native grasses (plants belonging to the Family Poaceae), native shrubs (woody vegetation <1m), other native species (other native non-woody vegetation in ground stratum e.g. forbs, herbs, lilies, rushes, sedges) and exotic species.

Community structure: Divide the 20x20m quadrat into four 10x10m quarters and estimate the % cover of native species in each stratum (mid-storey, ground stratum (grasses), ground-stratum (shrubs), ground stratum (other) and exotics) within each quarter. Average the four estimates to obtain an average % cover for each stratum in the 20x20m quadrat.

Additional habitat features: Within each quarter of the quadrat, also estimate % cover of litter, rock and bare ground. Average the four estimates to obtain an average % cover for each habitat feature in the 20x20m quadrat.

• 50m transect

Community structure: At 10 points along each of the three 50m transects (every 5m) estimate % foliage cover directly overhead (over-storey) using reference images provided in the BioMetric 3.1 Operational Manual (Department of Environment, Climate Change and Water, NSW, 2011). Average the estimates to obtain an average % foliage cover for the plot.

Table B1 Key variables used to monitor changes in the vegetation/habitat condition

Variable	Measurement units	Sampling units
SPECIES RICHNESS		
Native over-storey	Species ID and No. species/sampling unit	50x20m plot
Native mid-storey	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (grasses)	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (shrubs)	Species ID and No. species/sampling unit	20x20m quadrat
Native ground stratum (other)	Species ID and No. species/sampling unit	20x20m quadrat
Exotic ground stratum	Species ID and No. species/sampling unit	20x20m quadrat
Total	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
Total Native	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
Total Exotic	Species ID and No. species/sampling unit	20x20m quadrat for mid-storey and ground strata, 50x20m plot for over-storey
COMMUNITY STRUCTURE		
Native over-storey	% cover	3x50m transects
Native mid-storey	% cover	20x20m quadrat
Native ground stratum (grasses)	% cover	20x20m quadrat
Native ground stratum (shrubs)	% cover	20x20m quadrat
Native ground stratum (other)	% cover	20x20m quadrat
Exotic	% cover	20x20m quadrat
OVERSTOREY REGENERATION & HEALTH		
Over-storey species regeneration	No. species	50x20m plot
Over-storey species stem diameter class (0-10cm)	No./sampling unit	50x20m plot
Over-storey species stem diameter class (10-20cm)	No./sampling unit	50x20m plot
Over-storey species stem diameter class (>20)	No./sampling unit	50x20m plot
ADDITIONAL HABITAT FEATURES		
Litter	% cover	20x20m quadrat
Rock	% cover	20x20m quadrat
Bare ground	% cover	20x20m quadrat
Log	Length	50x20m plot
Tree hollows	Number	50x20m plot
Dead trees	(% tree population)	50x20m plot
Mistletoe	(% tree population)	50x20m plot
Flower/fruit	(% tree population)	50x20m plot

