


SOUTHERN

Management Plan

Yancoal Warkworth Mine, New South Wales | December 2017



This Management Plan is the framework for the protection and management of a 986 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 (SSD-6464).

This document has been prepared using maps prepared by:

Cambium Group

Cover Photo: Southern Biodiversity Area, 2016

Declaration of accuracy

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Southern Biodiversity Area Management Plan is complete, current and correct.

2. I am duly authorised to sign this declaration on behalf of the approval holder.

3. I am aware that:

a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.

b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.

c. The above offences are punishable on conviction by imprisonment, a fine or both.



Signed

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7 DECEMBER 2017

Date

Document Title	Version	Date effective	Comment
Southern BA Management Plan,	1	December 2016	Submitted for approval to DoEE and DPE on 17 February 2017. DPE approved on 26/6/2017. DoEE provided comments on 13/04/2017.
Southern BA Management Plan	2	7/7/2017	Coal & Allied provided response to DoEE comments on 9/06/2017. Further comments provided by DoEE provided on 22/06/2017. These changes have been included in Version 2 submitted on 10/7/2017.
Southern BA Management Plan	3	31/10/2017	Included edits from DoEE received on 12 July 2017 and update to reflect new ownership of Coal & Allied by Yancoal.
Southern BA Management Plan	4	December 2017	Draft document (V3) approved by DoEE and 'Draft' removed from the title of the document.

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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 Biodiversity Conservation Act 2016
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
DoEE	Australian Government Department of the Environment and Energy (previously Department of the Environment (DoEE))
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GDP	Ground Disturbance Permit
ha	Hectare
HLLS	Hunter Local Land Services
km	Kilometre
LLS Act	Local Land Service Act 2013
Ma	Marine Migratory
MNES	Matters of National Environmental Significance
MZ	(BioBanking) Management Zone
NPW Act	National Parks and Wildlife Act 1974
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
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 Threatened Species Conservation Act 1995
WON	Weed of National Significance
WSW	Warkworth Sands Woodland
WS Grassland	Warkworth Sands Grassland
Yancoal	Yancoal Australia Limited

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 Southern Biodiversity Area (BA). This Plan outlines conservation management actions and a monitoring programme for the Southern 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 promote the regeneration of degraded grassland into woodland communities 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. This regeneration will also contribute to increasing the extent of Critically Endangered Ecological Communities, including Central Hunter Grey Box-Ironbark Woodland and Warkworth Sands Woodlands. 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:

- Ironbark woodland and grassland;
- Warkworth Sands woodland and grassland;
- Hunter Lowland Red Gum Forest; and
- Fauna habitat (in particular habitat for Regent Honeyeater and Swift Parrot).

The regeneration of grasslands to woodlands will be measured by using monitoring to demonstrate their regeneration trajectory and improved condition. 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 are analysed to assess the trajectory towards the benchmark description for the vegetation community and improved condition in transition (grassland) and reference (woodland) habitats.
- Bird assemblages monitoring – systematic surveying are completed every two years by an external Biodiversity Auditor to collect data on bird assemblages and habitat usage. 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 are 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 Plans correlation 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 supplementary planting.

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 Southern BA is located near the township of Singleton in NSW the land is owned by Warkworth Mining Limited, Coal & Allied Operations Ltd and Miller Pohang Coal Company Pty Limited and managed by Yancoal. The total area of the BA is 1,035 hectares (ha) and contains 986ha 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.

The BA is currently managed in accordance with the Local Offset Management Plan (2014). This Plan will supersede the Local Offset Management Plan once it is approved by the Commonwealth and NSW regulators.

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

1.2.1 Commonwealth

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 Mine 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 Southern BA is to be secured with a legally binding mechanism for enduring protection of 986ha of suitable habitat for these species, with 94ha allocated to Phase 1 (Putty Road Offset Area) and 892ha allocated for Phase 2 of EPBC 2009/5081. This Plan satisfies the requirement to prepare an Offset Management Plan and Re-establishment Management Plan for the EPBC 2009/5081 approval.

1.2.2 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. This approval requires the Southern BA to be secured under a legally binding mechanism (Condition 30). This includes the Warkworth Sands Woodland (WSW) Offset Area (117ha comprising 78ha WSW and 39ha Warkworth Sands grassland re-establishment area) and Putty Road Offset Area (94ha) as identified in the prior approval DA 300-9-2002i. Offset Areas outside of the WSW and Putty Road Offset Area can be used to retire ecosystem and species credits to satisfy Condition 28. This Plan satisfies the requirement under Condition 36, for a Biodiversity Management Plan to implement the biodiversity offset strategy.

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

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

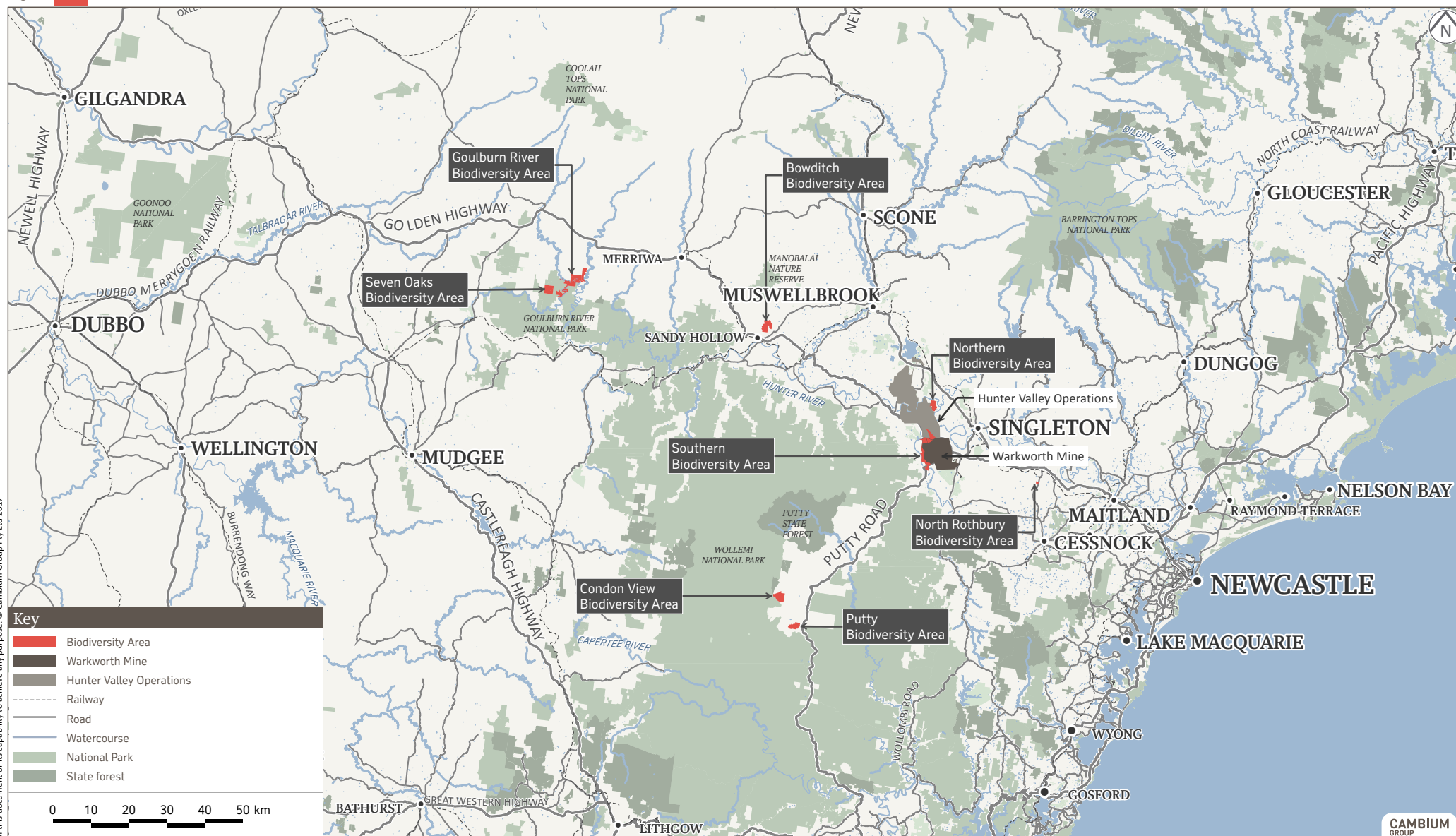
To secure monitoring data and assist in the management of the BA, Yancoal will maintain the online Biodiversity Offsets Portal whilst the BA is under their direct management. This Portal has been designed to centralise and share information among authorised users including regulators, and will include 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.

Location of the Warkworth Mine Biodiversity Areas

Management Plan 2017

Figure 1



1.3.2 Key Project Stakeholders and Roles

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

Table 2 Key roles and stakeholders

Roles	Responsible Entity	Details
NSW Regulator: Administers approvals granted under the EP&A Act – SSD-6464	Department of Planning & Environment (DPE)	Compliance (Mining) Mining & Industry Projects Department of Planning & Environment http://www.planning.nsw.gov.au
NSW Regulator: Administers the NPW Act and the <i>Biodiversity Conservation Act 2016</i> (BC Act)	Office of the Environment and Heritage (OEH)	Newcastle Office Regional Operations OEH www.environment.nsw.gov.au
Commonwealth Regulator: Administers approvals granted under the EPBC 2009/5081.	Australian Government Department of the Environment and Energy (DoEE)	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)
Land owner: Holds the title for the land.	Warkworth Mining Limited, Coal & Allied Operations Ltd and Miller Pohang Coal Company Pty Limited whose operations are managed by Yancoal Australia Ltd.	Manager - Environment NSW Phone: 1300 727 745
Project Proponent: Prepare and implement the Plan and complete reporting.	Warkworth Mining Limited, whose operations are managed and operated by Yancoal Australia Ltd	Manager - Environment NSW
Biodiversity Auditor: Monitor improvement in condition of the biodiversity values and completes ecological monitoring.	Yancoal Australia Ltd	Yancoal 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 DoEE and DPE. 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 DoEE and DPE 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 Southern BA is located approximately 15 kilometres (km) to the south west of the Singleton in NSW and adjacent to the Warkworth Mine. The Southern BA is accessible from Putty Road, Wallaby Scrub Road and the private Lemington Haul Road. It is intersected by Putty Road in the south, and Wallaby Scrub Road and the Golden Highway in the north. Wollombi Brook flows through the southern tip (near the township of Bulga), from where it continues to flow in a northerly direction near the western boundary of the BA.

The Southern BA is 1,035ha in size. It is comprised of 63 separate cadastral blocks, with three different landowners; a full list with landowner details is shown in Table 3. Figure 2 shows the location of the BA and the offset areas. The landowners and cadastral boundaries are shown in Figure 3.

This Plan identifies the 986ha offset area, which includes the Putty Road Offset Area (94ha) and 117ha of the WSW Offset Area, as identified in the prior approval DA 300-9-2002i. The BioBanking Assessment Report (Niche 2015) identified 986ha of vegetation and described Plant Community Types within 10 Management Zones (MZs) based on the vegetation and condition. Figure 4 shows the location of these areas. The remaining areas are infrastructure or within road easements that were excluded for the estimation of the area to generate species and ecosystem credits.

A summary of the credits generated from the offset area for ecosystem credits is provided in Section 2.4 and species credits in Section 2.6.

Table 3 Biodiversity Area owner and Lot and Deposited Plan (DP) summary

Figure Label	Lot	DP	Area within BA (ha)	Offset Area (ha)	Ownership
1	3	783484	35.395	22.2	COAL & ALLIED OPERATIONS PTY LIMITED
2	4	783484	36.648	35.5	COAL & ALLIED OPERATIONS PTY LIMITED
3	119	755267	9.642	9.4	COAL & ALLIED OPERATIONS PTY LIMITED
4	5	783484	14.545	13.9	COAL & ALLIED OPERATIONS PTY LIMITED
5	118	755267	19.098	18.8	COAL & ALLIED OPERATIONS PTY LIMITED
6	1	48592	1.113	1.1	COAL & ALLIED OPERATIONS PTY LIMITED
7	122	755267	17.024	16.8	COAL & ALLIED OPERATIONS PTY LIMITED
8	128	755267	15.717	15.4	COAL & ALLIED OPERATIONS PTY LIMITED
9	135	755267	15.738	15.0	COAL & ALLIED OPERATIONS PTY LIMITED
10	1	129806	12.61	11.5	COAL & ALLIED OPERATIONS PTY LIMITED
11	195	755267	7.621	7.6	COAL & ALLIED OPERATIONS PTY LIMITED
12	143	755267	16.189	15.2	COAL & ALLIED OPERATIONS PTY LIMITED
13	108	755267	3.59	3.5	COAL & ALLIED OPERATIONS PTY LIMITED
14	142	755267	20.266	19.6	COAL & ALLIED OPERATIONS PTY LIMITED
15	145	755267	4.604	4.0	COAL & ALLIED OPERATIONS PTY LIMITED
16	1	129808	20.383	19.1	COAL & ALLIED OPERATIONS PTY LIMITED
17	2	129806	0.244	0.1	COAL & ALLIED OPERATIONS PTY LIMITED
18					
19		0	3.717	3.4	Crown (Coal & Allied Operations Pty Limited)
20	350	1135536	20.751	20.3	Warkworth Mining Limited
21	1	246201	13.876	13.7	Warkworth Mining Limited
22	2	246201	8.686	8.7	Warkworth Mining Limited

Figure Label	Lot	DP	Area within BA (ha)	Offset Area (ha)	Ownership
23	3	246201	9.856	9.7	Warkworth Mining Limited
24	1	129800	10.118	9.9	Warkworth Mining Limited
25	5	246201	9.958	9.8	Warkworth Mining Limited
26	1	129799	5.417	5.3	Warkworth Mining Limited
27	2	129799	1.092	1.0	Warkworth Mining Limited
28	12	246201	11.011	10.8	Warkworth Mining Limited
29	11	246201	10.139	10.1	Warkworth Mining Limited
30	10	246201	10.087	10.0	Warkworth Mining Limited
31	7	113342	0.753	0.7	Warkworth Mining Limited
32	63	755267	2.81	2.8	Warkworth Mining Limited
33	9	246201	9.042	9.0	Warkworth Mining Limited
34	5	248570	0.432	0.4	Warkworth Mining Limited
35	137	755267	1.49	1.5	Warkworth Mining Limited
36	360	1135647	19.478	19.2	Warkworth Mining Limited
37	220	1135537	42.285	41.3	Warkworth Mining Limited
38	99	755267	20.651	20.6	Warkworth Mining Limited
39	16	755267	80.049	76.2	Warkworth Mining Limited
40	92	755267	8.252	6.2	Warkworth Mining Limited
41	93	755267	3.193	3.0	Warkworth Mining Limited
42	94	755267	1.416	1.2	Warkworth Mining Limited
43	95	755267	0.224	0.2	Warkworth Mining Limited
44	129	755267	58.066	57.7	Warkworth Mining Limited
45	2	735566	92.191	89.0	Warkworth Mining Limited
46	24	755270	21.072	20.8	Warkworth Mining Limited
47	25	755270	21.245	21.0	Warkworth Mining Limited
48	26	755270	35.896	35.6	Warkworth Mining Limited
49	1	1107717	22.692	21.8	Miller Pohang Coal Company Pty Limited
50	28	1102666	19.991	19.7	Miller Pohang Coal Company Pty Limited
51	82	755270	8.912	8.8	Miller Pohang Coal Company Pty Limited
52	83	755270	1.777	1.8	Miller Pohang Coal Company Pty Limited
53	95	755270	0.71	0.7	Miller Pohang Coal Company Pty Limited
54	1	816643	32.598	32.2	Miller Pohang Coal Company Pty Limited
55	2	816643	8.299	7.7	Miller Pohang Coal Company Pty Limited
56	549	589662	42.344	41.3	Miller Pohang Coal Company Pty Limited
57	6	587986	13.156	13.0	Miller Pohang Coal Company Pty Limited
58	541	252771	17.58	17.0	Miller Pohang Coal Company Pty Limited
59	542	252771	10.298	10.1	Miller Pohang Coal Company Pty Limited
60	543	252771	5.197	4.6	Miller Pohang Coal Company Pty Limited
61	22	753821	0.866	0.7	Miller Pohang Coal Company Pty Limited
62	1	1043467	34.428	32.1	Miller Pohang Coal Company Pty Limited
63	4	10022	30.164	25.9	Miller Pohang Coal Company Pty Limited

The Southern BA is located within the Sydney Basin Bioregion, with Wollemi National Park situated to the south-west and west. The BA contributes to a south to north biodiversity corridor across the Hunter Valley floor. Biodiversity corridors are connected or stepping stones of existing native vegetation that provide connectivity at a landscape scale for flora and fauna. They are important in the ongoing conservation and protection of flora and fauna, as they enable migration, improve resilience to environmental and climatic variability and support genetic diversity. The Southern BA forms a near continuous north/south tract of vegetation and is connected to the Wambo Mine conservation and cultural heritage area to the west. The BA is situated in the Singleton Local Council and Table 4 provides the regional geographic context.

Portions of the Southern BA have previously been disturbed for a number of land uses, primarily agriculture. Significant regeneration is evident across the Southern BA, and some areas remain cleared. Small ephemeral drainage lines are located throughout, and there are numerous small dams scattered throughout the area, including purpose built habitat ponds.

The strip of land located to the west of Wallaby Scrub Road and along the eastern boundary of the Southern BA boundary, which is situated outside the BA and the Warkworth Mine disturbance footprint, has been identified as the 'buffer area'. The buffer area is to be managed in accordance with the Plan, to protect the Endangered Ecological Communities (EEC) and habitat values within the area.

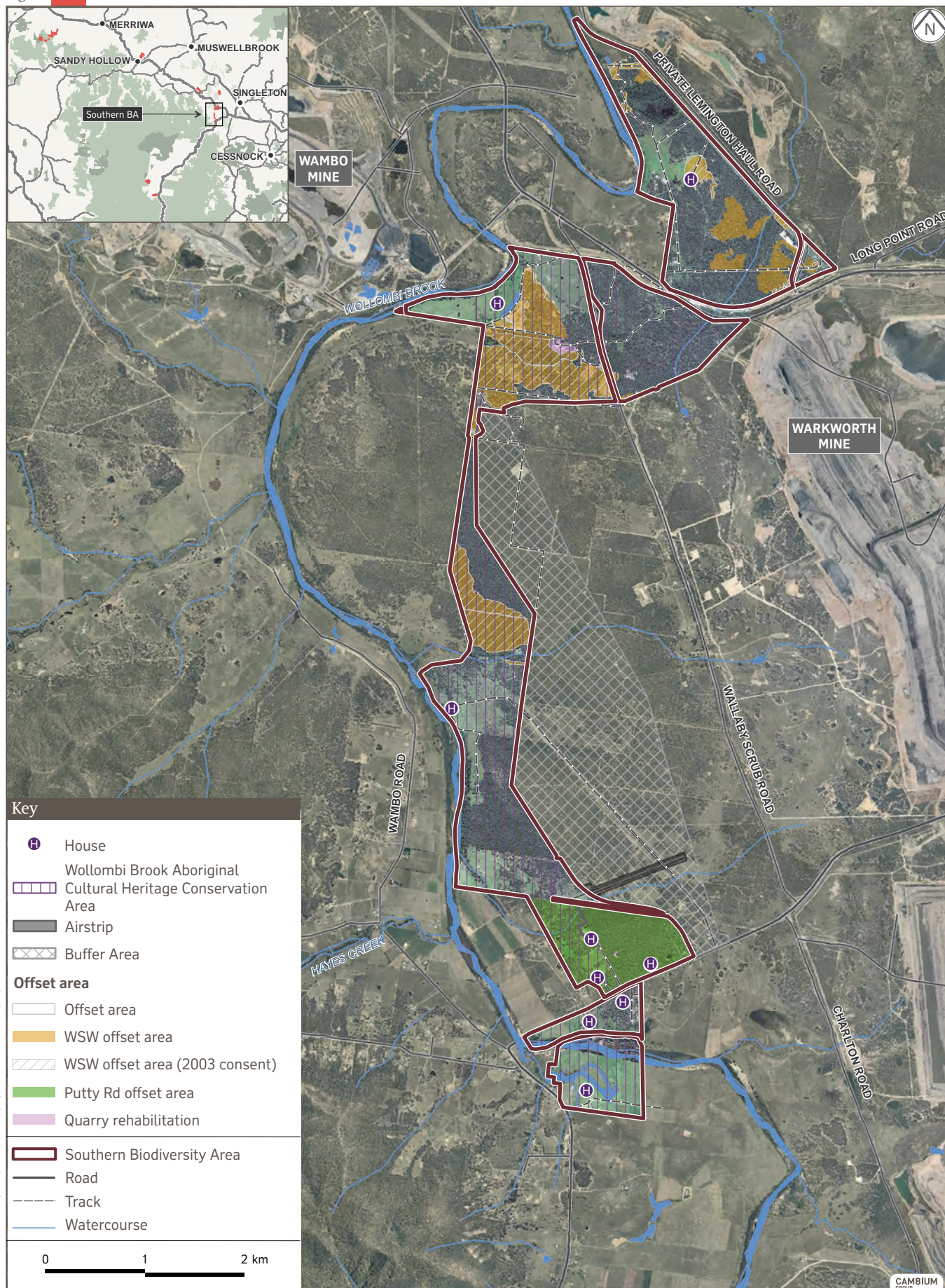
Table 4 Regional Biophysical Context

Geographical Feature	Description
Bioregion	Sydney Basin
Local Land Services Region	Hunter
CMA subregion	Hunter
Mitchell Landscape	Central Hunter Foothills Central Hunter Alluvial Plains
Watercourses	Wollemi Brook (part of the Hunter River catchment)
Elevation	110 - 300 metres
Geology	Permian Triassic
Nearby conservation areas	Wollemi National Park (adjacent to Wambo Coal operations) Yengo National Park (approximately 1 km to the south) Belford National Park (approximately 19 km to the north-east)

Offset areas at the Southern Biodiversity Area

Management Plan 2017

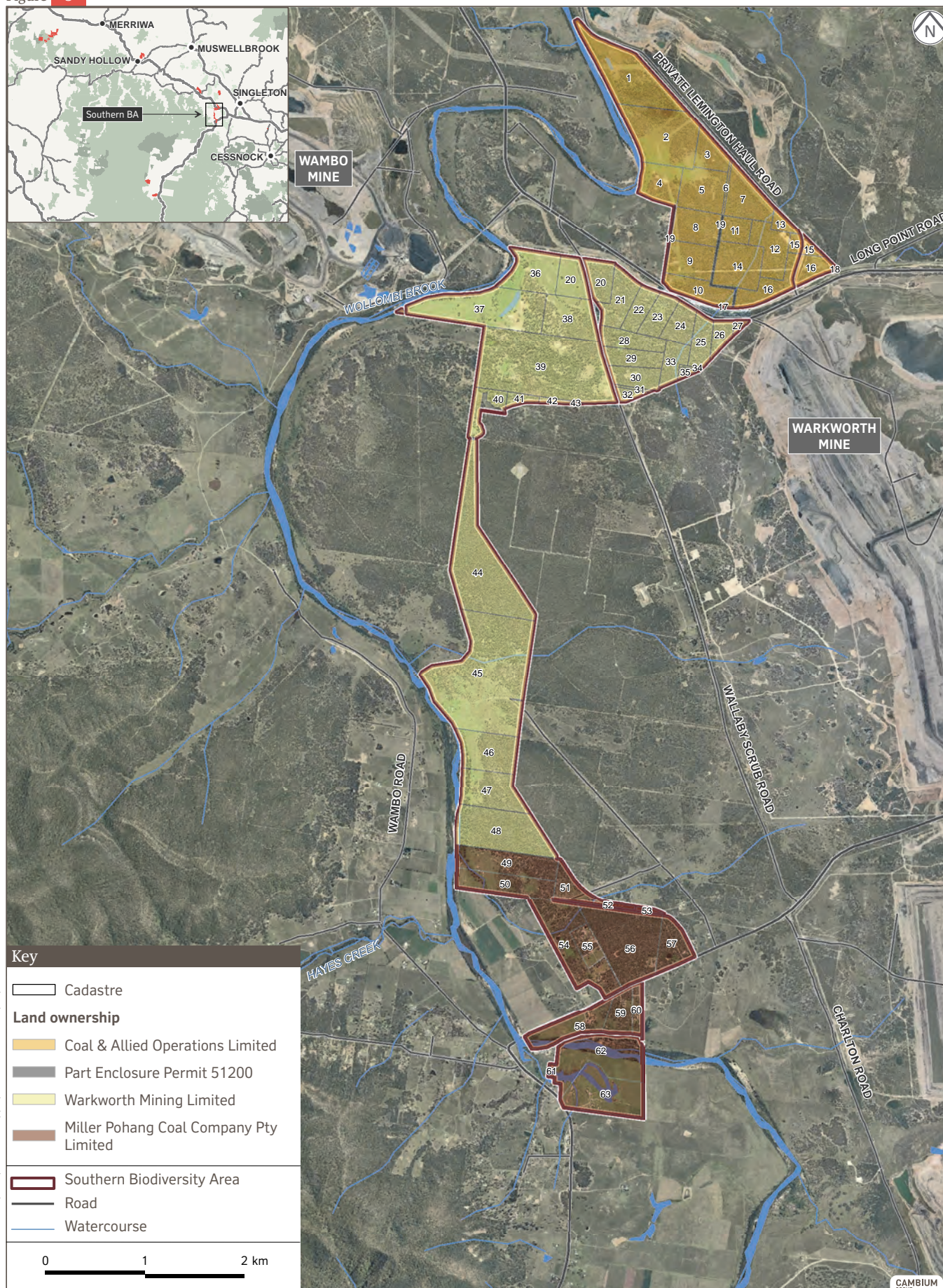
Figure 2



Cadastral boundaries and land ownership at the Southern Biodiversity Area

Management Plan 2017

Figure 3



2.2 Cultural Heritage

The Southern BA includes the Wollombi Brook Aboriginal Cultural Heritage (WBACH) Conservation Area, as shown in Figure 2. It is intended that this Plan and the WBACH Conservation Area Management Plan will be complementary. The following points outline the committed outcomes from the establishment of the WBACH Conservation Area:

- protected in perpetuity for the conservation and management of Aboriginal cultural heritage places and values. In particular, it will provide for the protective management and cultural maintenance of the Bulga bora ground and associated cultural landscape and other places;
- protected permanently from all mining (open cut, underground, highwall), exploration drilling and associated development disturbance;
- managed in accordance with a specific management plan developed in consultation with the Cultural Heritage Working Group (CHWG) and other stakeholders including DPE and OEH. This plan will include the following matters:
 - the establishment of strictly controlled non-access zones and protocols around culturally sensitive areas as determined in consultation with the CHWG;
 - the establishment of areas for use by the Aboriginal community for cultural and community purposes;
 - the establishment of areas for active Aboriginal cultural heritage and landscape management, including vegetation rehabilitation;
 - the processes and protocols by which ongoing Aboriginal community access to the WBACH Conservation Area can be facilitated;
 - procedures for access and works for maintenance of existing infrastructure, land management, environmental compliance, land management and safety requirements;
- the Aboriginal community, through a WBACH Conservation Area management committee, will oversee the implementation of the management plan;
- Yancoal will continue to ensure an active Aboriginal community role in both Aboriginal cultural heritage and environmental management activities for the WBACH Conservation Area with this including training and employment development opportunities; and
- engagement with Wambo Coal Pty Ltd with a view to developing a collaborative management protocol for highly significant areas associated with and immediately adjacent to the Bulga bora ground (which has been identified as containing portions of the extended Bulga bora ground precinct and associated places) situated on Wambo Coal lands.

Historic heritage sites with the BA include a former Bulga Royal Australian Air Force base and the Springwood homestead.

The known cultural heritage sites across the Southern BA and buffer areas have been mapped and incorporated into the WBACH Conservation Area sites management database and GIS.

2.3 Vegetation communities

The Southern BA supports 13 vegetation communities as shown in Table 5, which lists the Plant Community Types code and Management Zones used in the BioBanking Assessment Report. Figure 4 shows the distribution of the vegetation communities within the Southern BA.

Table 5 Vegetation Communities across Southern BA

Code	Vegetation Communities	Management Zone (MZ)	BioBanking condition	Area (ha)
HU817	Central Hunter Grey Box - Ironbark Woodland (EEC)	MZ1	Moderate to Good	446.7
	Regenerating Central Hunter Grey Box - Ironbark Woodland (EEC)	MZ2	Low	18.3
	Central Hunter Grey Box - Ironbark Grassland		Low	168.1
	Exotic areas		Low	72.0
HU872	Warkworth Sands Woodland (EEC)	MZ3	Moderate to Good	137.0
	Warkworth Sands Grassland	MZ4	Low	40.3
HU910	Hunter Lowlands Redgum Forest (EEC)	MZ5	Moderate to Good	32.4
HU711	Hunter Valley River Oak Forest	MZ6	Low	25.7
	Regenerating Hunter Valley River Oak Forest		Low	1.1
HU730	White Box Woodland (EEC)	MZ7	Moderate to Good	27.6
HU909	Yellow Box Woodland (EEC)	MZ8	Moderate to Good	7.0
HU800	Hunter Valley Vine Thicket (EEC)	MZ9	Moderate to Good	0.6
HU599	River Red Gum Floodplain Woodland (EEC)	MZ10	Low	9.3
Total				986

2.3.1 Central Hunter Grey Box-Ironbark Woodland

The Central Hunter Grey Box-Ironbark Woodland (CHGBIW) is listed as Endangered Ecological Community (EEC) under the TSC Act and forms part of the Central Hunter Valley Eucalypt Forest ecological community listed as Critically Endangered (CE) under the EPBC Act.

The Central Hunter Grey Box-Ironbark Woodland dominant canopy species are Grey Box (*Eucalyptus molucana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). There are also local abundances of Bullock (*Allocuarina luehmannii*) and White Feather Honey Myrtle (*Melaleuca decora*) in the midstorey. Common understorey species include Fan Wattle (*Acacia amblygona*), *Acacia falcata*, Native Blackthorn (*Bursaria spinosa*) and Coffee Bush (*Breynia oblongifolia*). Common groundcover species include Purple Burr-Daisy (*Calotis cuneifolia*), Blue Trumpet (*Brunoniella australis*), Kidney Weed (*Dichondra repens*), Blue Flax Lily (*Dianella revoluta*), Threeawn Speargrass (*Aristida vagans*), Wattle Matt-rush (*Lomandra filiformis*), Common Fringe-sedge (*Fimbristylis dichotoma*) and Rock Fern (*Cheilanthes sieberi*).

2.3.2 Central Hunter Grey Box-Ironbark Grassland

This community typically lacks the dominant canopy species of Grey Box (*Eucalyptus molucana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). The groundcover is generally dominated by native grass species, however some herbs also occur. There is a low to moderate incursion of weed species within this community, particularly along areas that have been disturbed.

Significant regeneration is evident in some areas of this community.

2.3.3 Warkworth Sands Woodland

The Warkworth Sands Woodland (WSW) community is listed as an EEC under the TSC Act and in 2016 was listed as CE under the EPBC Act. Vegetation mapped as WSW conforms to the NSW Scientific Committee (2002) final determination. The final determination describes WSW as being confined to aeolian sand deposits in the vicinity of Warkworth, south-east of Singleton in the mid Hunter Valley. The determination characterises the community by the assemblage of species that are listed in Table 6. The determination recognises one community, however indicates that the community has sub communities where there is a dominant abundance of the species of the WSW. This

is generally where a thin sandy veneer overlies the Permian substrate. The NSW BioMetric Vegetation Type Database (OEH, 2012), which provides a state wide overview and definitions of NSW plant community types, also defines a single WSW community as 'Rough-barked Apple - Coast Banksia shrubby woodland on Warkworth Sands of the central Hunter Valley, Sydney Basin' .

Table 6 Species assemblage listed in the NSW Scientific Committee final determination (2002) to characterise Warkworth Sand Woodland

Scientific Name	Common Name	Strata
<i>Acacia falcata</i>	Hickory Wattle	Shrub
<i>Acacia filicifolia</i>	Fern-leaved wattle	Canopy / Mid storey
<i>Ajuga australis</i>	Austral Bugle	Ground cover
<i>Allocasuarina littoralis</i>	Black She-oak	Canopy / Mid storey
<i>Allocasuarina luehmannii</i>	Bulloak	Canopy / Mid storey
<i>Amyema pendulum</i>	Mistletoe	Shrub
<i>Angophora floribunda</i>	Rough-barked Apple	Canopy / Mid storey
<i>Aristida calycina</i>		Ground cover
<i>Aristida ramosa</i>	Purple Wiregrass	Ground cover
<i>Aristida vagans</i>	Threeawn Speargrass	Ground cover
<i>Aristida warburgii</i>		Ground cover
<i>Banksia integrifolia</i>	Coast Banksia	Canopy / Mid storey
<i>Brachyloma daphnoides</i>	Daphne Heath	Shrub
<i>Breynia oblongifolia</i>	Coffee Bush	Shrub
<i>Callitris endlicheri</i>	Black Cypress Pine	Canopy / Mid storey
<i>Calotis cuneifolia</i>	Purple Burr-daisy	Ground cover
<i>Cheilanthes sieberi</i>	Poison Rock Fern	Ground cover
<i>Chrysocephalum apiculatum</i>	Common Everlasting	Ground cover
<i>Desmodium varians</i>		Ground cover
<i>Dianella revoluta</i>	Blue Flax Lily	Ground cover
<i>Dichondra species A</i>	Kidney Grass	Ground cover
<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass	Ground cover
<i>Echinopogon intermedius</i>	Erect Hedgehog Grass	Ground cover
<i>Einadia trigonos</i>	Fishweed	Ground cover
<i>Entolasia stricta</i>	Wiry Panic	Ground cover
<i>Eucalyptus blakelyi/tereticornis</i>	Forest Red Gum	Canopy / Mid storey
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Canopy / Mid storey
<i>Eucalyptus glaucina</i>	Slaty Red Gum	Canopy / Mid storey
<i>Exocarpos cupressiformis</i>	Cherry Ballart / Native Cherry	Canopy / Mid storey
<i>Exocarpos strictus</i>	Pale-fruit Ballart / Dwarf Cherry	Canopy / Mid storey
<i>Hardenbergia violacea</i>	Purple Coral Pea	Ground cover
<i>Hibbertia linearis</i>	Showy Guinea-flower	Shrub
<i>Hovea linearis</i>	-	Shrub
<i>Hypoxis hygrometrica</i>	Golden Weather-grass	Ground cover
<i>Imperata cylindrical</i>	Blady grass	Ground cover
<i>Indigofera australis</i>	Australian Indigo	Shrub
<i>Jacksonia scoparia</i>	Winged Broom-pea	Shrub
<i>Lomandra glauca</i>	Pale Mat-rush	Ground cover
<i>Lomandra leucocephala</i>	Woolly Mat-rush	Ground cover
<i>Lomandra muticus</i>		Ground cover
<i>Melaleuca decora</i>	White Feather Honey-myrtle	Shrub
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle	Shrub
<i>Persoonia linearis</i>	Narrow-leaved Geebung	Shrub

Scientific Name	Common Name	Strata
<i>Pimelea linifolia</i>	Wedding Bush / Slender Rice-flower	Shrub
<i>Pomax umbellata</i>		Ground cover
<i>Pteridium esculentum</i>	Common Bracken	Ground cover
<i>Solanum prinophyllum</i>	Forest Nightshade	Ground cover
<i>Vittadina sulcata</i>		Ground cover

Field surveys in the Northern and Southern BAs observed dominant canopy species including Rough-barked Apple (*Angophora floribunda*) and the small tree Coastal Banksia (*Banksia integrifolia*). Other small trees recorded in the canopy of this community include Bullock (*Allocasuarina luehmannii*), Black She-Oak (*Allocasuarina littoralis*), Blakely's Red Gum/Forest Red Gum intergrades (*Eucalyptus blakelyi/tereticornis*), Black Cypress Pine (*Callitris endlicheri*) and White Cypress Pine (*Callitris glaucophylla*).

Common understorey species included Coffee Bush (*Breynia oblongifolia*), *Hibbertia linearis*, Slender Rice Flower (*Pimelea linifolia*), Silver-stemmed Wattle (*Acacia parvipinnula*) and Dogwood (*Jacksonia scoparia*). The groundcover is characterised by Bracken (*Pteridium esculentum*). Common grasses in this community are Three-awn Speargrass (*Aristida vagans*), Weeping Meadow Grass (*Microlaena stipoides*), Purple Wiregrass (*Aristida ramosa*), Brown's Lovegrass (*Eragrostis brownii*), Blady Grass (*Imperata cylindrica*) and Hairy Panic (*Panicum effusum*). Other common groundcovers include Rock Fern (*Cheilanthes sieberi*), Berry Saltbush (*Einadia hastata*), Pomax (*Pomax umbellata*) and Variable Glycine (*Glycine tabacina*).

2.3.4 Warkworth Sands Grassland

The Warkworth Sands Grassland areas are located on sand and have some representation of the understorey components of WSW, but have been greatly disturbed by previous land management and have demonstrated limited capacity to regenerate naturally. These grassland areas will be the focus of the active restoration or re-establishment.

2.3.5 White Box Woodland

The mapped White Box Woodland is consistent with the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland Critically Endangered Ecological Community (CEEC) (Box Gum Grassy Woodlands) listed under the EPBC Act and EEC listed under the TSC Act. The common canopy species occurring in the White Box form of this community include White Box (*Eucalyptus albens*), Grey Box (*Eucalyptus molucana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*). Kurrajong (*Brachychiton populneus*) occasionally occurs within the small tree stratum. Common understorey species include Coffee Bush (*Breynia oblongifolia*) and *Acacia falcata*. Common groundcover species include Common Everlasting (*Chrysocephalum apiculatum*), Climbing Saltbush (*Einadia nutans subsp. linifolia*), Kidney Weed (*Dichondra repens*), Corrugated Sida (*Sida corrugata*), Purple Wiregrass (*Aristida ramosa*), Barbed Wire Grass (*Cymbopogon refractus*), Kangaroo Grass (*Themeda australis*) and Rock Fern (*Cheilanthes sieberi*).

2.3.6 Yellow Box Woodland

The mapped Yellow Box Woodland is consistent with the Box Gum Grassy Woodlands CEEC listed under the EPBC Act and EEC listed under the TSC Act. The canopy of the Yellow Box form of the community is dominated by Yellow Box (*Eucalyptus melliodora*), Rough-barked Apple (*Angophora floribunda*), Forest Red Gum (*Eucalyptus tereticornis*) and the occasional River Red Gum (*Eucalyptus camaldulensis*). The Yellow Box form of the community contains a higher proportion of exotic weeds than the White Box form.

2.3.7 River Red Gum Floodplain Woodland

The River Red Gum Floodplain Woodland is listed as EEC under the TSC Act.

Stands on major floodplains are generally dominated by River Red Gum (*Eucalyptus camaldulensis*) in combinations with Forest Red Gum (*Eucalyptus tereticornis*), Yellow Box (*Eucalyptus melliodora*) and Rough-barked Apple (*Angophora floribunda*). Within the community stands of River Oak (*Casuarina cunninghamiana subsp. cunninghamiana*) and Swamp Oak (*Casuarina glauca*) may occur.

2.3.8 Hunter Valley Vine Thicket

The Hunter Valley Vine thicket is listed as EEC under the TSC Act.

This community typically forms a low forest, usually less than 10 m tall, with a closed canopy dominated by small trees. The canopy may include Red Olive Plum (*Elaeodendron australe*), Wilga (*Geijera parviflora*), Native Olive (*Notelaea microcarpa* var. *microcarpa*), Western Rosewood (*Alectryon oleifolius* subsp. *elongatus*), White Cedar (*Melia azedarach*) and Kurrajong (*Brachychiton populneus* subsp. *populneus*). A shrub and vine layer are present, though groundcover is generally sparse.

2.3.9 Hunter Valley River Oak Forest

Open riparian forests characterised by an overstorey dominated by River Oak (*Casuarina cunninghamiana*) and a ground layer which is typically grassy and may be dominated by Couch grass (*Cynodon dactylon*) and Slender Bamboo grass (*Austrostipa verticillata*).

Significant regeneration is evident in some areas of this community.

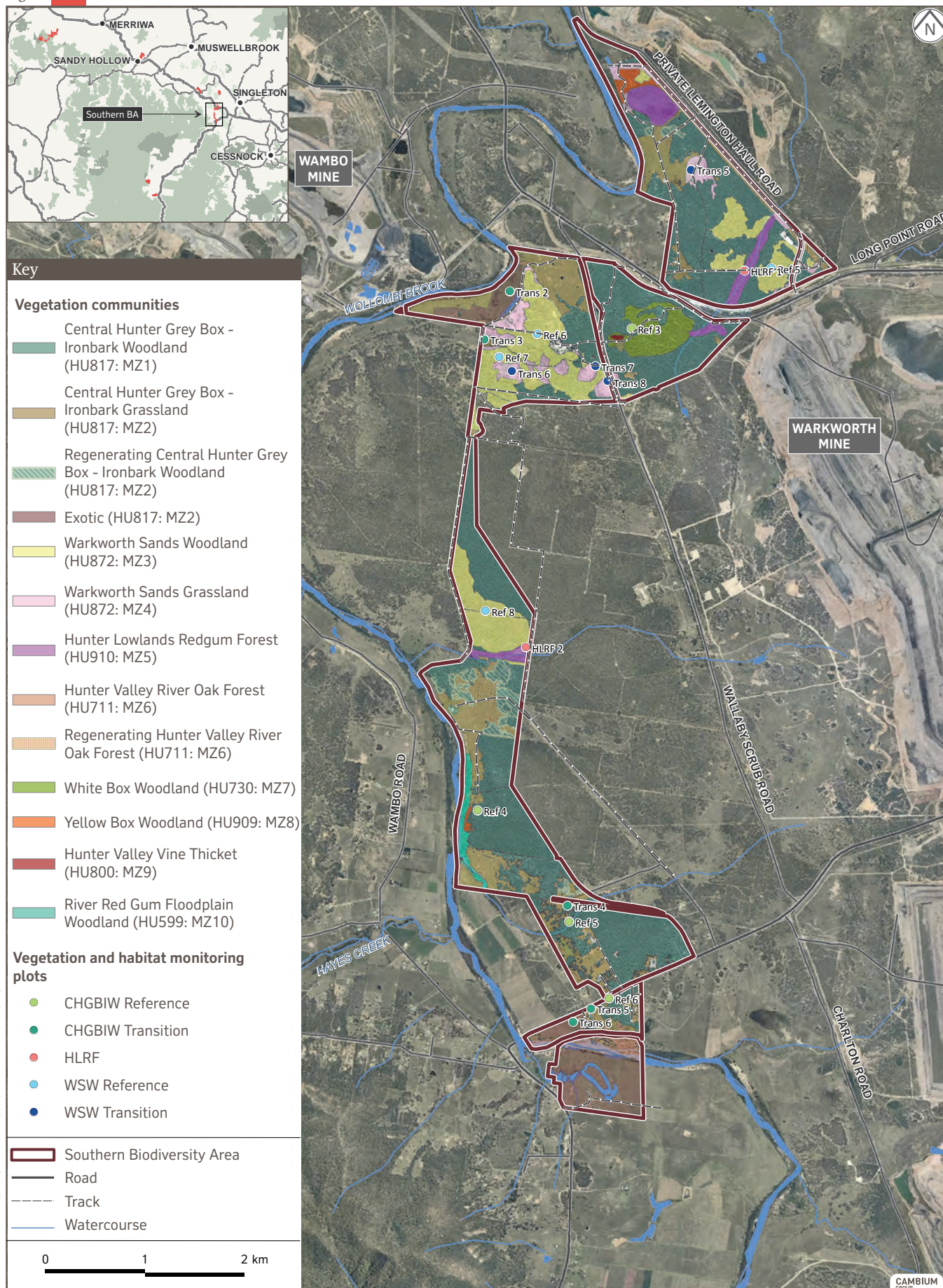
2.3.10 Hunter Lowlands Red Gum Forest

The community of Hunter Lowlands Red Gum Forest is listed as an EEC under the TSC Act. The dominant canopy species within this community are Forest Red Gum (*Eucalyptus tereticornis*), Narrow-leaved Ironbark (*E. crebra*), Rough-barked Apple (*Angophora floribunda*) Spotted Gum (*Corymbia maculata*) and Grey Box (*Eucalyptus moluccana*) with Bulloak (*Allocasuarina luehmannii*) being common as a midstorey species.

Vegetation communities, management zones and monitoring sites at the Southern Biodiversity Area - vegetation and habitat monitoring

Management Plan 2017

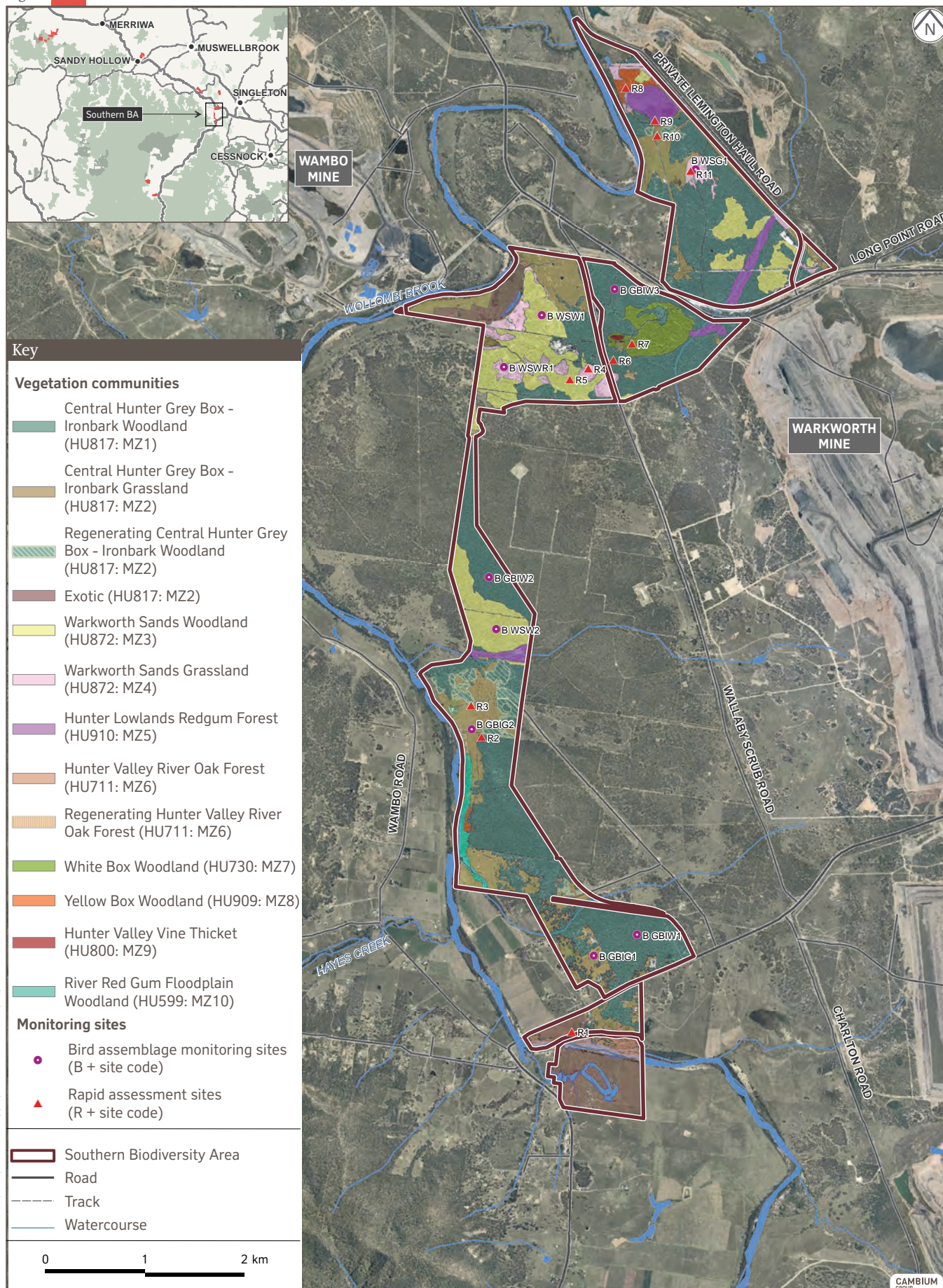
Figure 4



Vegetation communities, management zones and monitoring sites at the Southern Biodiversity Area - bird assemblage monitoring and rapid condition assessment

Management Plan 2017

Figure 5



2.4 BioBanking Ecosystem credits

The Southern BA BioBanking Assessment Report (Niche 2015) calculated a total of 14,449 ecosystem credits. However after the exclusion of credits from the Putty Road and WSW Offset Areas only 11,224 credits are available for retirement by Warkworth Mine, as shown in Table 7.

Table 7 Southern Biodiversity Area ecosystem credits for retirement

Code	Plant Community Type	MZ	Area (ha)	Ecosystem Credits
HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	MZ1	378.3	5,351
HU817	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest	MZ2	232.6	3,259
HU872	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	MZ3	59	1,029
HU872	Rough-barked Apple - Coast Banksia woodland on Warkworth sands	MZ4	1.3	18
HU910	Blakely's Red Gum - Rough-barked Apple shrubby woodland	MZ5	32.4	490
HU711	River Oak moist riparian tall open forest	MZ6	26.8	417
HU730	White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland	MZ7	27.6	401
HU909	Yellow Box grassy woodland on basalt soils	MZ8	7.0	102
HU800	White Box shrubby woodland with semi - evergreen vine thicket	MZ9	0.6	9
HU599	River Red Gum - River Oak riparian woodland wetland	MZ10	9.3	147
Total			775	11,224

2.5 Threatened Species

The Southern BA supports a wide range of fauna habitat features, including various forest and woodland communities with mixed age trees, grassland, waterbodies, hollow-bearing trees, forage resources and ground debris. These features provide suitable forage, shelter, breeding or roosting habitat for a range of fauna species.

In the 2016 bird assemblages monitoring observed two swift parrots within the Southern BA.

A number of threatened flora and fauna species have been recorded within the BA. Threatened species records for the Southern BA are shown in Figure 6.

These threatened species include:

Common name	Scientific name	Status
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V – EPBC and TSC Act
Little Eagle	<i>Aquila morphnoide</i>	V -TSC Act
Southern (Large-footed) Myotis	<i>Myotis macropus</i>	V -TSC Act
Eastern Bentwing Bat	<i>Miniopterus schreibersii oceanensis</i>	V -TSC Act
Eastern Freetail Bat	<i>Mormopterus norfolkensis</i>	V -TSC Act
Little Bentwing Bat	<i>Miniopterus australis</i>	V -TSC Act
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	V -TSC Act
Grey-crowned Babbler	<i>Pomatostomus temporalis temporalis</i>	V -TSC Act
River Red Gum	<i>Eucalyptus camaldulensis</i>	E –TSC Act
Speckled Warbler	<i>Pyrrholaemus saggitatus</i>	V -TSC Act
Spotted Harrier	<i>Circus assimilis</i>	V -TSC Act
Squirrel Glider	<i>Petaurus norfolcensis</i>	V -TSC Act
Swift Parrot	<i>Lathamus discolor</i>	CE - EPBC and TSC Act
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V -TSC Act

Notes: E – Endangered; V - Vulnerable

There is potential habitat within the Southern BA for a number of threatened flora species previously recorded in the locality. These include Hairy Geebung (*Persoonia hirsuta*), Illawarra Greenhood (*Pterostylis gibbosa*) and *Cymbidium canaliculatum* (*Cymbidium canaliculatum* in the Hunter Catchment).

The Southern BA is adjacent to the area where in April 2002 there was a recorded sighting of both Regent Honeyeater and Swift Parrot. An Expert Report (Cumberland Ecology and Merops Services 2015) was prepared to accompany the BioBanking submission, which confirms the presence of habitat for both species within the Southern BA.

Table 8 provides a summary of the suitable habitat, both existing and restoring, within the offset area for Phase 1 and Phase 2 of the EPBC2009/5081 approval. The Expert Report is available on the Biodiversity Offsets Portal.

Table 8 Area of suitable habitat within the offset area

Biodiversity Area	Offset Area (ha)	Regent Honeyeater Habitat (ha)			Swift Parrot Habitat (ha)		
		Existing	Restoring	Total	Existing	Restoring	Total
Southern – Phase 1	94	68	26	94	68	26	94
Southern – Phase 2	892	583	309	892	583	282	865
Total	986	651	335	986	651	308	959

A brief description of these two species is provided below with a summary of the habitat suitability assessment provided in the Expert Report (Cumberland Ecology and Merops Services 2015).

2.5.1 Swift Parrot

The Swift Parrot is a predominantly nectarivorous, migratory species endemic to south eastern Australia (Birdlife Australia 2013) and is listed as CE under the EPBC Act and Endangered under the *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).

Swift Parrots have been observed within the Southern BA in 2016 and recorded in 2002 less than 2km away.

Several tree species that provide feeding resources for the Swift Parrot are present within the Southern BA, including Rough-barked Apple (*Angophora floribunda*), White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Grey Box (*Eucalyptus moluccana*). These species could be used on occasion by the Swift Parrot for foraging, depending on flowering intensity. Based on this and several other factors, the Expert Report (Cumberland Ecology and Merops services 2015) concluded that the Swift Parrot is moderately-highly likely to occur in the following communities within the BA:

- HU817 – Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grass open forest;
- HU872 – Rough-barked Apple - Coast Banksia woodland on Warkworth sands;
- HU909 – Yellow Box grassy woodland on basalt soils; and
- HU910 – Blakely's Red Gum - Rough-barked Apple shrubby woodland.

2.5.2 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 CE 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.

The nearest record of the Regent Honeyeater is 300m to the west along Wollombi Brook. A range of tree species that provide feeding resources for the Regent Honeyeater are present within the Southern BA, including some that are abundant. These feed trees include Blakely's Red Gum (*Eucalyptus blakelyi*), Rough-barked Apple (*Angophora floribunda*), *Banksia* ssp, Grey Box (*E. moluccana*) and *Melaleuca* sp. These species, and other shrub species, could be used on occasion by the Regent Honeyeater for foraging, depending on flowering intensity. Another habitat often used by them is River Oak riparian forest or woodland where the Needle-leaved Mistletoe (*Amyema cambagei*) is found on the River Oaks (*Casuarina cunninghamiana*), which is present in the Southern BA.

Based on this and several other factors, the expert report (Cumberland Ecology and Merops services 2015) concluded that the Regent Honeyeater is moderately-highly likely to occur in the following communities within the BA:

- HU599 – River Red Gum – River Oak riparian woodland wetland;
- HU711 – River Oak moist riparian tall open forest;
- HU730 – White Box x Grey Box – Red Gum Rough-barked Apple grassy woodland;
- HU800: White Box shrubby woodland with semi-evergreen vine thicket;
- HU817: Narrow-leaved Ironbark - Bull Oak - Grey Box shrub-grassy open forest;
- HU872: Rough-barked Apple – Coast Banksia woodland on Warkworth Sands;
- HU909: Yellow Box grassy woodland on basalt soils; and
- HU910: Blakely's Red Gum – Rough barked Apple shrubby woodland.

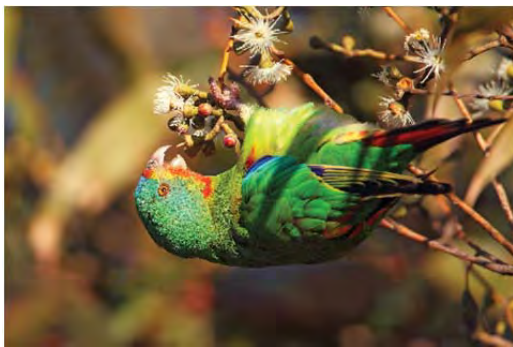


Photo: Swift Parrot (Chris Tzaros)

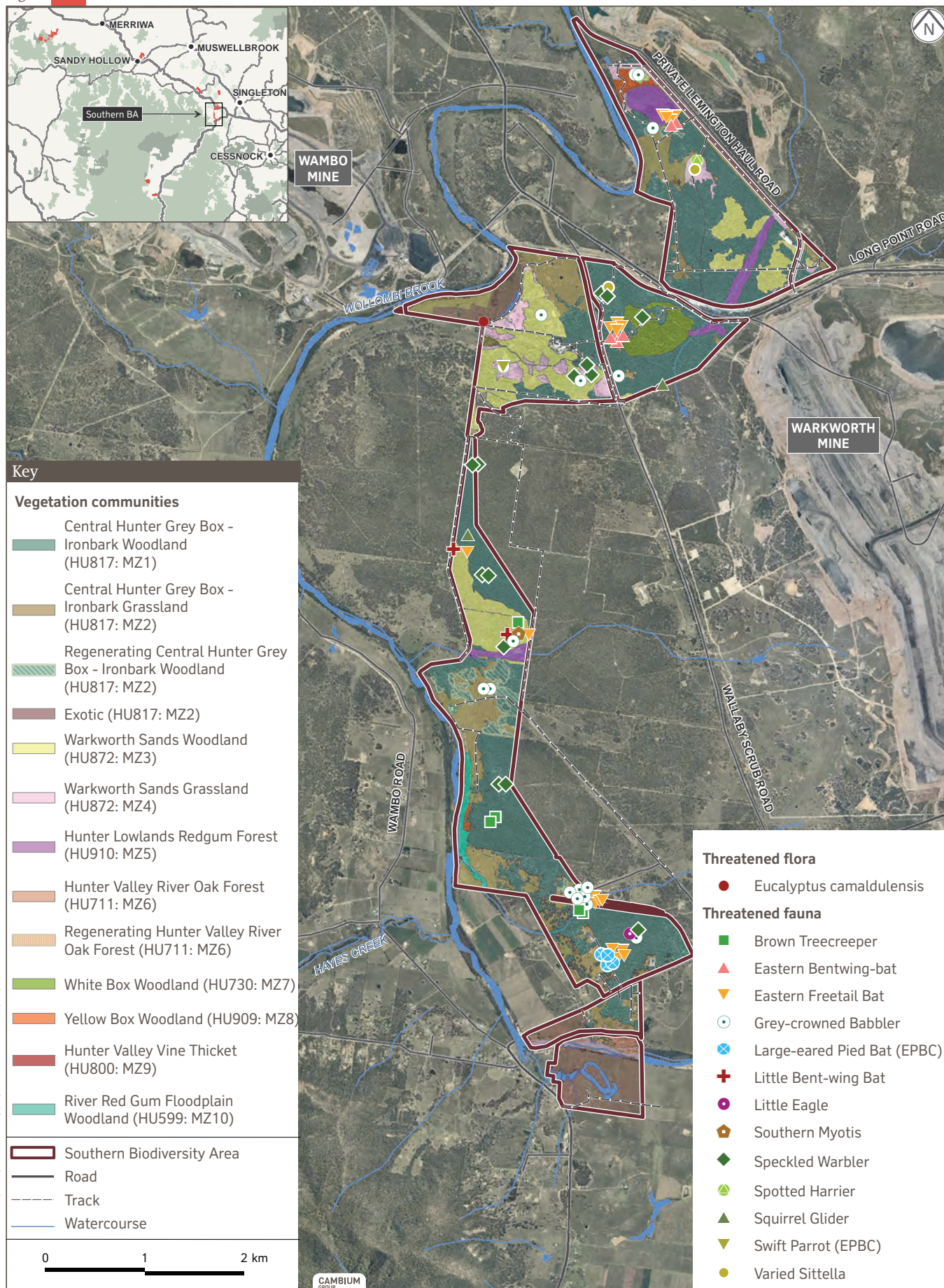


Photo: Regents Honeyeater (Murray Chambers)

Threatened species records at the Southern Biodiversity Area

Management Plan 2017

Figure 6



2.6 BioBanking Species Credits

The Southern BA BioBanking Assessment Report (Niche 2015) identified a total of 4,882 species credits. However after exclusion of the Putty Road and WSW Offset Areas only 3,843 are available for retirement by Warkworth Mine, as shown in Table 9.

Table 9 Southern Biodiversity Area species credits for retirement.

Scientific name	Common name	Species credits
<i>Eucalyptus camaldulensis</i>	River red gum	14
<i>Anthochaera phrygia</i>	Regent Honeyeater	3,581
<i>Myotis macropus</i>	Southern Myotis	248
Total		3,843

2.7 Baseline Ecological Condition

2.7.1 Woodland condition

A Rapid Condition Assessment (RCA) technique is used as a preliminary assessment of woodland condition within the BA. **Appendix A** provides details on the RCA methodology.

Thirteen permanent RCA sites were established across the Southern BA in November 2013 and data has been collected annually since. All RCA were undertaken in areas of suitable habitat for woodland birds. 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. Five grassland sites have been included for monitoring purposes.

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

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

Table 10 provides the number of RCA sites along with the average health rating. All woodland RCA sites received a health rating of >14/20 with the average being 17/20 in 2013, 18/20 in 2014, and 19/20 in 2015 indicating these areas are healthy and sustainable under current management. Figure 5 indicates the location of the plots.

Table 10 Rapid Condition Assessment summary results

RCA Plot	MZ	2013	2014	2015
RS1	MZ2	Grassland	Grassland	Grassland
RS2	MZ1	17	18	18
RS3	MZ2	Grassland	Grassland	Grassland
RS4	MZ4	Grassland	Grassland	Grassland
RS5	MZ3	15	16	18
RS6	MZ1	18	18	18
RS7	MZ7	17	18	18
RS8	MZ8	17	18	19
RS9	MZ5	16	17	20
RS10	MZ2	Grassland	Grassland	Grassland
RS11	MZ4	Grassland	Grassland	Grassland
Average		17/20	18/20	19/20

2.7.2 Habitat condition

In October 2014, 19 permanent Habitat Restoration Monitoring plots were established within the Southern BA, across five MZs. 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). In addition the monitoring aims to observe the transition from grassland to woodlands in the CHGBIW (HU817) and WSW (HU872) vegetation communities. Monitoring plots include a series of transition (trans) and reference (ref) plots.

The results are shown in Table 11 and have been compared against the benchmark. Figure 4 indicates the location of the plots. A full description of the baseline monitoring results is provided in the Habitat Restoration Monitoring Report (Cambium Group and Niche 2015) and is available on the Biodiversity Offsets Portal.

Central Hunter Grey Box - Ironbark Woodland assessment

Nine monitoring plots were established including four reference plots in MZ1 and five transition plots in MZ2.

When compared with the benchmark values, the plot data for the Central Hunter Grey Box-Ironbark Woodland (reference plots) indicate native species richness approaching the benchmark range, but lower than the minimum value. The percent cover of the canopy is relatively sparse as is the mid-storey which is often absent. The per cent cover of native ground stratum (grasses) is mostly within the benchmark range but the native ground stratum (shrubs) and native ground stratum (other) is considerably lower than benchmark. The per cent cover of exotic species is consistently low and logs are abundant and exceed the benchmark criteria. The lack of tree hollows within this regenerating community relative to the benchmark is also evident.

On average, Central Hunter Grey Box-Ironbark grassland (transition plots) is considerably modified away from the benchmark values for all site attributes except the per cent cover of native ground stratum (grasses). In addition to the structural impact of the cleared canopy and mid-storey, the native plant species richness is very low. The ground cover composition has shifted to a very high per cent cover of exotic plants and reduced per cent cover of native shrubs and other ground cover species relative to the benchmark values. Habitat features such as hollows and logs are absent and therefore do not meet the benchmarks.

Warkworth Sands Woodland

Eight monitoring plots were established including four reference plots in MZ3 and four transition plots in MZ4.

The monitoring plot data for the WSW indicates a relatively sparse canopy cover and a depleted mid-storey, when compared with the benchmark values. The per cent cover of native grasses is consistently above the benchmark range with other ground cover and exotic species cover within or close to the benchmark. Habitat features such as rocks, hollows are generally absent/rare and the presence of fallen logs is variable among the monitoring plots.

The WS grasslands retain some ground stratum components of WSW, but have been disturbed by previous land management and consequently native species richness is low. The ground cover composition has shifted to an elevated per cent cover of native grasses and reduced per cent cover of native shrubs and other ground cover species relative to the benchmark values. As would be expected, exotic plants are more abundant in the grasslands than the woodland and habitat features such as trees and logs are absent.

Hunter Lowland Red Gum Forest assessment

Two plots were established in the Hunter Lowland Red Gum forest in MZ 5.

When compared with the benchmark values, the plot data for Hunter Lowland Red Gum Forest indicates a native species richness approaching the benchmark range, but lower than the minimum value. The per cent cover of the canopy is relatively sparse as is the mid-storey. The per cent cover of native ground stratum (grasses) and native ground cover (shrubs) is within (or very close to) the benchmark range but native ground stratum (other) is considerably lower than benchmark. The per cent cover of exotic species is consistently low and logs are abundant, therefore exceeding the benchmark criteria. The lack of tree hollows within this community relative to the benchmark value is also evident.

Table 11 Summary of Habitat Restoration Monitoring Result 2014 compared to benchmark values

Attributes		NPSR	NOS	NMS	NGCG	NGCS	NGCO	EPC	Logs(m)	Hollows
MZ1 HU817: Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion (IBW)										
Benchmark	min	41	15	5	30	5	20	<5	5	3
	max		40	20	50	10	40			
IBWRef 3		27	5.33	0	34.67	7.33	6.67	1.33	36	0
IBWRef 4		29	7.17	1.33	48.67	2	3.33	5.33	22	0
IBWRef 5		27	7.17	3	38	3.33	5.67	0	82	0
IBWRef 6		29	5.17	0.33	38.67	2	17.33	8.67	15	0
average		28	6.21	1.17	40	3.67	8.25	3.8	39	
MZ2 HU817: Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion										
IBWTrans 2		3	0	0	46.67	0	0.67	62	0	0
IBWTrans 3		6	0	0	32	0	1.33	53.33	0	0
IBWTrans 4		6	0	0	82.67	0	4	7.33	0	0
IBWTrans 5		12	0.9	0	18	0.67	33.33	38.67	0	0
IBWTrans 6		4	0	0	35.33	0	0	56.67	0	0
average		6.2	0.18	0	42.93	0.13	1.87	43.6	0	0
MZ3 HU872: Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area (WSW)										
Benchmark	min	26.0	13.0	10.0	4.0	5.0	5.0	<5	20.0	0.8
	max		40.0	50.0	15.0	30.0	25.0			
WSWRef 5		27	4.7	1.7	37.3	2.0	24.7	0.0	45.0	0.0
WSWRef 6		17	2.2	2.3	51.3	6.0	8.7	4.0	30.0	0.0
WSWRef 7		25	2.8	15.0	41.3	8.7	14.7	6.0	0.0	0.0
WSWRef 8		18	3.0	3.5	17.3	3.3	44.7	4.7	43.0	0.0
average		21.75	3.18	5.6	36.8	5	23.2	3.68	29.5	0
MZ4 HU872: Rough-barked Apple - Narrow-leaved Ironbark - Blakely's Red Gum - Bull Oak - Coast Banksia woodland on sands of the Warkworth area (WSW)										
WSWTrans 5		2	0.0	0.0	58.9	0.0	0.0	6.3	0.0	0.0
WSWTrans 6		6	1.0	0.0	22.7	0.0	7.3	54.7	49.0	0.0
WSWTrans 7		11	0.5	0.0	4.0	0.7	1.3	87.3	0.0	0.0
WSWTrans 8		3	0.7	0.0	0.0	0.3	0.0	87.3	0.0	0.0
average		5.5	0.55	0.0	21.4	0.25	2.15	58.9	12.3	0.0
MZ5 HU910: Blakeley's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter										
	min	41	15	5	30	5	20	<5	5	3
	max		40	20	50	10	40			
HLRG 1		31	4.5	1.67	34.67	8	2.67	6.67	12	0
HLRG 2		27	4.83	1	50.66	7.33	14	1	40	0
average		29.0	4.7	1.3	42.7	7.7	8.3	3.8	26.0	0.0

	0-10% or >200% of benchmark (>66% cover for EPC)
	10-50% or 150-200% of benchmark (33-66% cover for EPC)
	50-100% or 100-150% of benchmark (5-33% cover for EPC)
	within benchmark or > benchmark for NPSR, Hollows and Logs (0-5% cover for EPC)

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		

2.7.3 Bird usage

A bird monitoring programme was implemented from 2005 until 2011, with the aim to use avifauna as indicator species to monitor the enhancement of remnant woodland/open woodland, by comparing bird populations at the same sites originally surveyed by Andrews Neil (2006). Surveys were completed in autumn and spring 2008 and July 2011. The results from the survey completed by Dr Stephen Debus are provided in **Appendix B**.

In 2014 bird assemblages monitoring as described in Section 5 of this Plan was commenced with surveys undertaken from 28 July to 02 August, the location of the nine monitoring plots is shown on Figure 5. The monitoring is designed to observe changes ongoing habitat usage by woodland birds and a decrease in the abundance of bird species typical of forest margins and grasslands. The monitoring will also assess the status of Swift Parrot and Regent Honeyeater within the BA and their movements and habitat usage.

Most recently 2 Swift Parrots were observed during the 2016 monitoring, however in 2014 Regent Honeyeater and Swift Parrot were not detected. The Southern BA supports potential habitat for the two species which could visit any of the areas to forage when trees are in flower.

Sixty-six species of birds were recorded at the Southern BA sites. The highest diversity was observed in woodland areas and the lowest was at the degraded grassland sites. Two threatened birds recorded were:

- Little Eagle (*Aquila morphnoides*) recorded as flying-over WSW re-establishment areas; and
- Varied Sittella (*Daphoenositta chrysoptera*) recorded in Central Hunter Grey Box-Ironbark Woodland



Photo: Swift Parrot, Southern Biodiversity Area 2016 (Niche)

3 Objectives, Key Performance Indicators and Completion Criteria

3.1 Conservation Objectives

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 Southern 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 grassland vegetation attributes 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 the regeneration of the grassland to create additional woodland habitat for these birds. Table 12 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 12 Southern BA Conservation Values and Key Performance Indicators

Conservation Value	Key Performance Indicator	Completion Criteria
Ironbark Woodland	Extent and condition of 446.7ha over 10 years.	Observed and measured increase and / or maintained Rapid Condition Assessment scores over 10 years (measured annually) in MZ1.
Ironbark Grassland	Transition 258.4ha of grassland to woodland.	Observed and measured trajectory towards and / or attainment of benchmark values or reference site attributes at MZ2 (Table 11) over 10 years (measured biennially).
WSW	Extent and condition of 137 ha over 10 years.	Observed and measured increase and / or maintained Rapid Condition Assessment scores over 10 years (measured annually) in MZ3.
WS Grassland	Transition 40.3ha of grassland to woodland.	Observed and measured trajectory towards and / or attainment of benchmark values or reference site attributes at MZ4 (Table 11) over 10 years (measured biennially).
Hunter Lowland Red Gum Forest	Extent and condition of 32.4ha over 10 years.	Observed and measured increase and / or maintained Rapid Condition Assessment scores over 10 years (measured annually) in MZ5.
Fauna Habitat	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 12 have been met to the satisfaction of the DoEE and DPE.

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, the offset area is defined by the vegetation community and Biobanking Management Zones as shown in Figure 4. 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 7 highlights key management infrastructure this includes:

- approximately 35.6km boundary fences;
- 46 boundary gates;
- approximately 32.7 km of access tracks; and
- houses (6 are currently occupied) outside the offset area.

To assist in the implementation of the weed control and planting actions five vegetation management areas, SBA1, SBA2, SBA3, SBA4 and SBA5, as shown in Figures 8 and 9, have been established across the Southern BA.

Yancoal is accountable for the implementation of the conservation management actions, as shown in Table 2. This key responsibility rest with the Manager, Environmental. The Manager is supported by staff 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

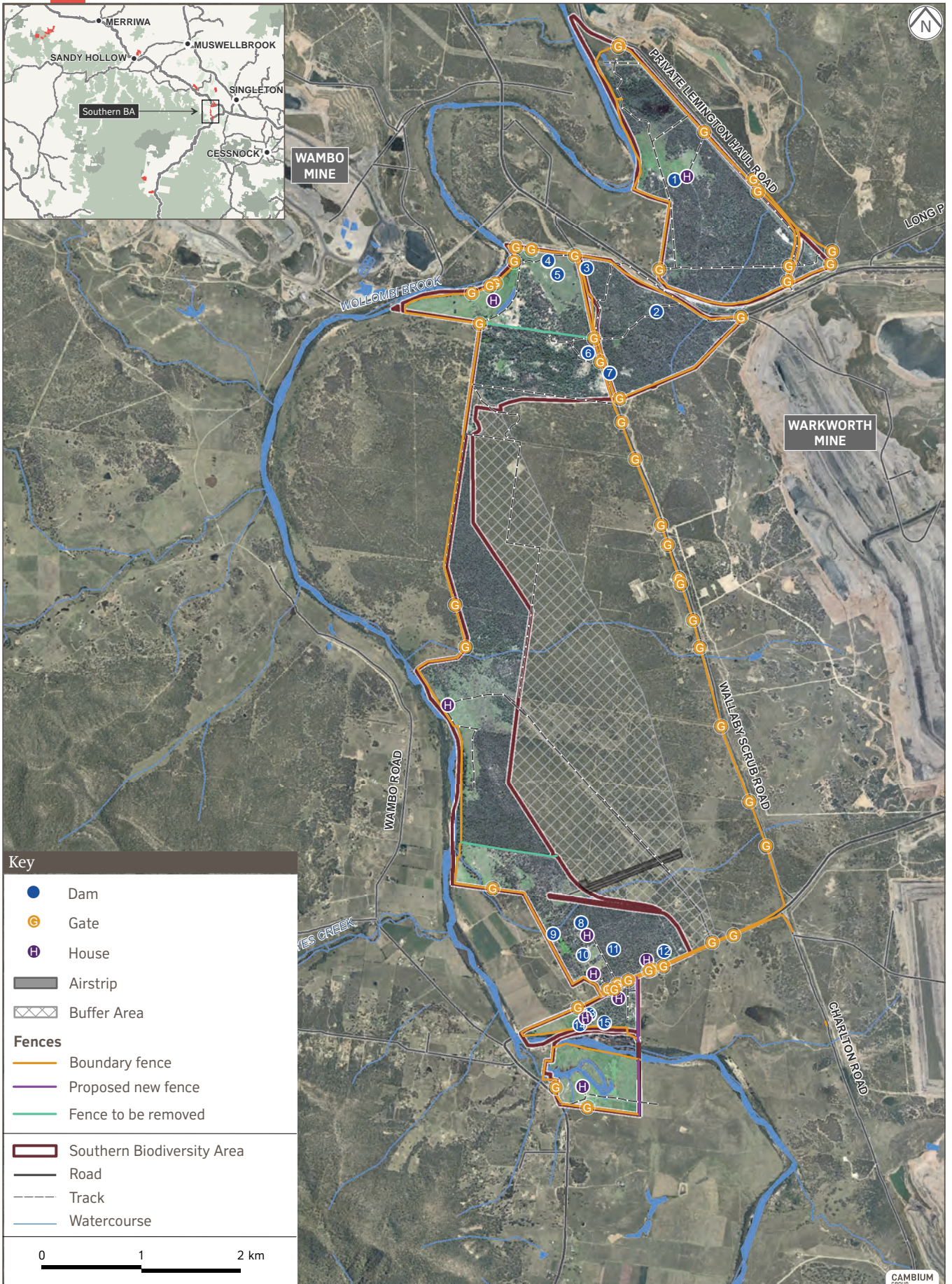
The offset area will have legal protection that includes penalties to enforce its protection. Yancoal will ensure that all employees or representatives, contractors, consultants and visitors are aware of these legal protections and penalties prior to entering the offset area.

The following activities will not be permitted within the offset area (Figure 4):

- 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.

Key infrastructure and waste at the Southern Biodiversity Area Management Plan 2017

Figure 7



4.1.2 Exemption for clearing vegetation

Native vegetation cannot be cleared or disturbed within the 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); and
- drilling to monitor impacts of surrounding mining operations and support future underground mining operations (excluding the Wollombi Brook Aboriginal Cultural Heritage Conservation Area). Prior to any drilling disturbance, a detailed re-establishment plan will be prepared and approved by the appropriate authorities. Immediately after drilling the re-establishment plan will be implemented. The number and location of the drill sites will be reported in the Annual Report.

To ensure compliance with all legal and environmental protection measures the Yancoals 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 Yancoals;
- 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. Wambo Coal has legal access through the BA to access their land adjoining SBA3. 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 of 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 conservation values being protected, and only after permission is granted by Yancoals 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. Any new sites identified will be managed in accordance with WBACH Conservation Area Plan of Management.

4.1.6 Waste

Approximately 12km of internal fences and periodic waste removal will be undertaken.

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 the 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	Damaged and unwanted fences removed.
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.

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 that prevent or minimise selective grazing and thereby ensure that overall gains in biodiversity can be achieved.

Grazing will be excluded from the Southern 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:

- Walk at random path within each area to be assessed and throw the quadrat a short distance.
- 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

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, impede ecological processes, or impact native animals.

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

To assist in the implementation five vegetation management areas have been identified across the Southern BA, these are shown in 0. There have been ongoing weed control actions since 2004 within the Southern BA and actions in this Plan have been informed by this work. Due to the shape of the Southern BA and its large areas of grassland, control efforts will be focused on targeted weed species and on limiting weed dispersal from tracks. Weed management containment zones of 50m from the tracks will be maintained. Any weeds outside of these areas will be controlled based on the observations from the monitoring programme. The weed control areas are shown in 0 along with the observation of noxious weeds from all of the BioBanking assessment data collected in 2014 to target control efforts.

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 13.

All noxious weeds declared under the *Biosecurity Act 2015* will be given priority for weed control. 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 = 26 – 50%;
- 5 = 51 – 75%; and
- 6 = 76 – 100%.

Table 14 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 suitably qualified, accredited and experienced personnel (bush regenerators) with 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

Table 13 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>Weather guidelines</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>
Slashing – mechanical cutting of weeds to prevent seed production	<p>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).</p>
Manual removal – removal of the weed plant and roots from the site.	<p>Physical removal of new weeds, unearthing of root systems and containment and removal of seed.</p>

Weed control areas at the Southern Biodiversity Area

Management Plan 2017

Figure 8

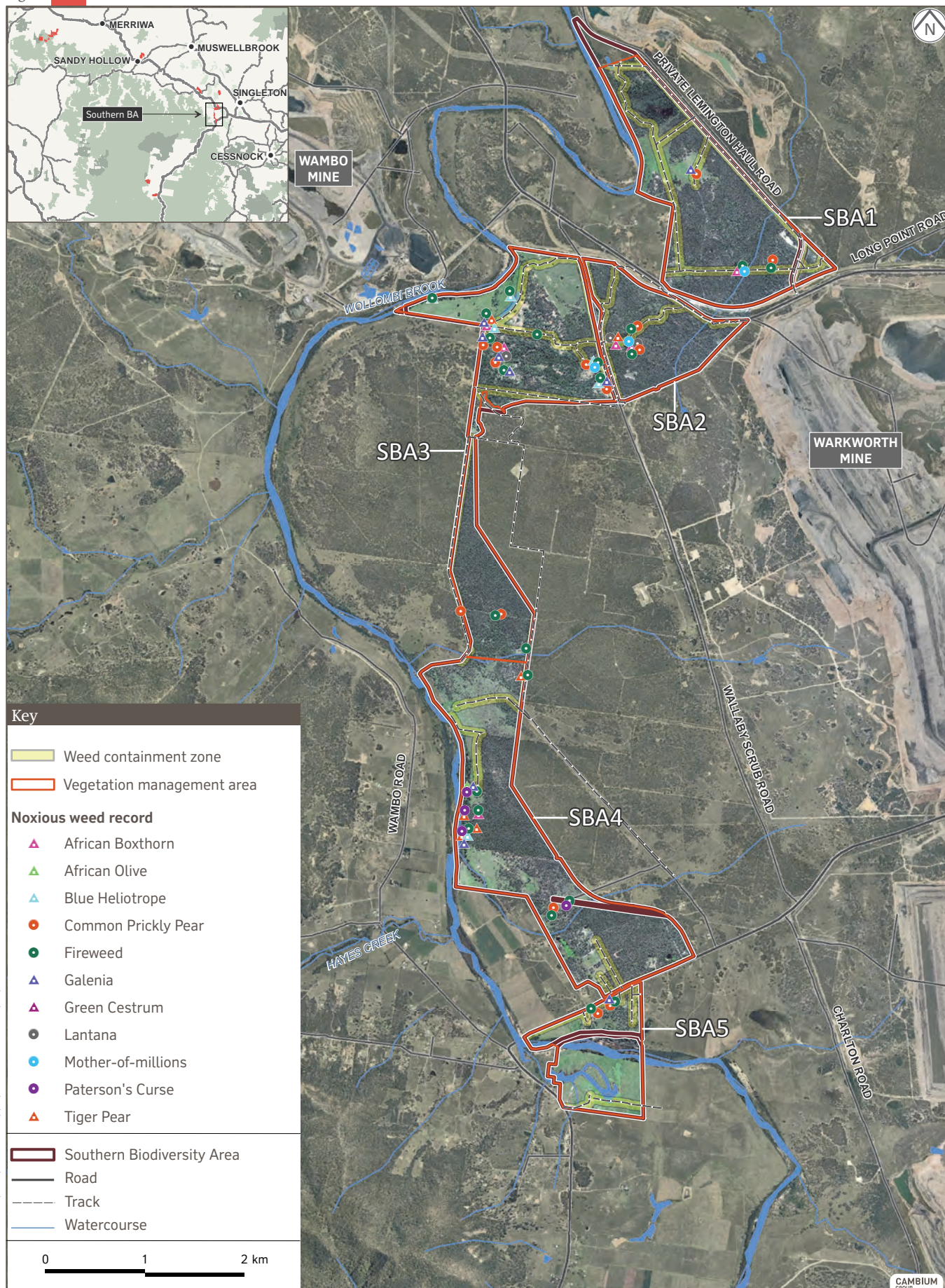













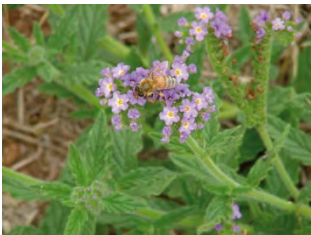
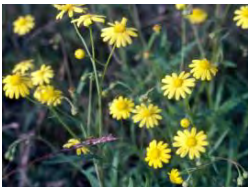






Table 14 Target weed species, treatment method, control period and intensity


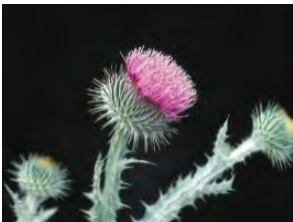


Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
WOODY WEEDS						
African Boxthorn (<i>Lycium ferocissimum</i>)		3	✓	SBA2, SBA3, SBA4 and SBA5. Average BB cover abundance score 1 (<5% - rare to common) at CHGIBW Ref 4 and HLRF 1.	Spot spray, basal bark or cut stump application with registered herbicide Mechanically remove mature bushes/thickets when soil is wet (winter) and spray regrowth	Late winter to early summer From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
African Olive (<i>Olea europaea</i> subsp. <i>Cuspidate</i>)		3		SBA, SBA4 and SBA5.	Spot spray, basal bark or cut stump application with registered herbicide	Actively growing 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	✓	SBA5	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.
Citrus				SBA3	Mechanically remove mature tree	
Cotoneaster (<i>Cotoneaster pannosus</i>)				SBA3 Average BB cover abundance score 1 (<5% - rare to common) at WSW Trans 7.	Basal bark or cut stump application with registered herbicide Hand pulling of seedlings and small plants removing all roots.	Actively growing From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
Green Cestrum (<i>Cestrum parqui</i>)		3		SBA2, SBA3, SBA4 and SBA5	Spot spray, basal bark or cut stump application with registered herbicide.	Late spring to early autumn From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Honey Locust (<i>Gleditsia triacanthos</i>)		3		SBA4	Spot spray, basal bark or cut stump application with registered herbicide.	Late spring to early autumn From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Jacaranda				SBA3	Mechanically remove mature tree	
Lantana (<i>Lantana camara</i>)		2	✓	SBA3 Average BB cover abundance score 1 (<5% - rare to common) at WSW Ref 7.	Spot spray with registered herbicide.	October to April From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Tree of heaven (<i>Ailanthus altissima</i>)				SBA3	Spot spray, basal bark or cut stump application with registered herbicide Mechanical removal	November to January From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
PRICKLY PEARS						
Common Pear (<i>Opuntia stricta</i>) Creeping Pear (<i>Opuntia humifusa</i>) Tree pear (<i>Opuntia tomentosa</i>) Tiger pear (<i>Opuntia aurantiaca</i>)		4	✓	SBA1, SBA2, SBA3 and SBA4. Average BB cover abundance score 1 (<5% - rare to common) at WSW Ref 5 & 7, WSW Trans 5 & 7, CHGBIW Ref 3 & 6, CHGBIW Trans 3 & 5.	Spot spray with registered herbicide. Biological control (<i>Cactoblastis cactorum</i>) and Cochineal (<i>Dactylopius spp.</i>) – better suited to large infestations or inaccessible areas.	All year – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
VINES / CREEPERS						
Balloon vine (<i>Cardiospermum grandiflorum</i>)		4		SBA4 and SBA5	Spot spray, basal bark or cut stump application with registered herbicide.	Actively growing From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Bridal Creeper (<i>Asparagus asparagoides</i>)		3	✓	SBA1	Spot spray with registered herbicide. Manual removal -by digging out tubers Biological control application of fungus.	Spray August to September From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
Turkey rhubarb (<i>Acetosa sagittata</i>)		4		SBA4 and SBA5	Spot spray with registered herbicide. Manual removal by digging or chipping to remove small infestations.	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.
PASTURE / ANNUALS						
African lovegrass (<i>Eragrostis curvula</i>)				SBA3	Spot spray with registered herbicide. Grazing management.	Actively growing From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Blue Heliotrope (<i>Heliotropium amplexicaule</i>)		2		SBA1 and SBA3 Average BB cover abundance score 2 (>5% - common) at WSW Trans 7 & 8, CHGBIW Trans 2.	Spot spray with registered herbicide. Biological control with Blue heliotrope leaf-beetle (<i>Deuterocampta quadrijuga</i>), establishment of the population requires multiple and short interval releases.	Treat at flowering or actively growing 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.
Fireweed (<i>Senecio madagascariensis</i>)		4	✓	SBA1 to SBA5 Average BB cover abundance score 2 (>5% - common) at WSW Ref 5 & 6, WSW Trans 6 & 7, CHGBIW Ref 3,4 & 6, CHGBIW Trans 3,4, and 5, HLRF 1 & 2.	Spot spray with registered herbicide whilst the plant is actively growing and not under stress. Manual removal by-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.

Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
Galenia (<i>Galenia pubescens</i>)		4		SBA1, SBA3 and SBA5 Average BB cover abundance score 2 (>5% - common) at WSW Ref 7, WSW Trans 5 & 6, CHGBIW Ref 6.	Spot spray with registered herbicide. Manual removal by- digging or chipping out main root tuber.	Spring/ Summer From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Mother-of-millions (<i>Bryophyllum Ssp</i>)		3		SBA1, SBA2, SBA3 Average BB cover abundance score 2 (>5% - common) at WSW Trans 7, HLRF 1.	Spot spray with registered herbicide.	Actively growing From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Paterson's Curse (<i>Echium plantagineum</i>)		4	-	SBA4 Average BB cover abundance score 1 (<5% - rare to common) at CHGBIW Trans 4.	Spot spray using registered herbicide. Control can be achieved by using spray graze.. Biological Control as advised by HLLS.-	Autumn to winter. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Red Natal Grass (<i>Melinis repens</i>)				SBA1, SBA3 and SBA5. Average BB cover abundance score 2 (>5% - common) at WSW Ref 6, CHGBIW Ref 6, CHGBIW Trans 5 and HLRF 1.	Spot spray or boom wick-wiper with registered herbicide. Slashing.	Spring/ Summer - Actively growing From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.

Species	Photo	Class *	WON	Distribution	Control method/s	Control period and intensity
St John's Wort (<i>Hypericum perforatum</i>)		4		Nil	Spot spray, with registered herbicide. Biological control with (<i>Chrysolina</i> beetles). Grazing management when hypericin levels in the plant are low – generally May through to October (may vary with climatic conditions).	Spring to late autumn. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
THISTLES						
Scotch Thistle (<i>Onopordum acanthium</i>)		4	-	SBA3 Average BB cover abundance score 1 (<5% - rare to common) at CHGBIW Trans 2.	Spot spray with registered herbicide. Manual removal by chipping to remove small infestations.	All year (actively growing rosettes to flowering stage) – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Variegated thistle (<i>Silybum marianum</i>)		-	-	Nil	Chemical – Spot spray with registered herbicide. Manual removal by chipping to remove small infestations.	All year (actively growing rosettes to flowering stage) – control period. From Year 1 to Year 4, at least two control events per year. Ongoing maintenance, minimum of one control event per year.
Saffron Thistle (<i>Carthamus lanatus</i>)		-	-	Nil	Chemical – Spot spray with registered herbicide. Slashing	Autumn to winter. All year (actively growing rosettes to flowering stage) – control period. From Year 1 to Year 4, at least two control events 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 programme. 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 14, and any other weeds recorded from monitoring activities. All actions recorded in the Annual Report.	At least one weed control event each year for species listed in Table 14, and any other weeds recorded from monitoring activities. All actions recorded in the 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 the Mount Thorley Warkworth Bushfire Management Plan, that covers the Southern BA given its close proximity to Warkworth Mine, it identifies fire risks, control measures and communication procedures. A copy of this plan is available on the Biodiversity Offsets 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;
- firebreaks along Putty and Wallaby Scrub Roads; 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.

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.

There is no reported history of wild fire in Southern BA. In 2010 and 2012 there were small grass fires less than 2ha in size. Based on the Code recommendations an ecological burn should be completed across MZ1, MZ3, MZ5, MZ7, MZ8 and MZ9 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.

No burning is recommended for MZ2 and MZ4 (post planting), MZ6 and MZ10. Records will be made if any of these areas are burnt during an ecological burn.

4.4.1 Performance Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
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 for MZ1, MZ3, MZ5, MZ7, MZ8 and MZ9.	
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:
 - (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;
 - (d) road or track - six metres total width of clearing; or
 - (e) airstrip – distance and area sufficient to meet civil aviation standards. .
- constructed fences will be stockproof;
- fallen timber and any other obstructions can be removed to maintain access;
- standing timber that poses an unacceptable safety risk can be felled and retained on ground as habitat;
- 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 and Action
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. All dams were excluded from the mapping of the offset area as specified by BioBanking assessment guidelines.

The Southern BA contains 15 dams as shown in Figure 7, dams 2 and 7 are habitat ponds constructed for compliance with the previous NSW environmental approval. The existing dams are to be maintained and converted to habitat ponds, this work will involve earthworks and localised site rehabilitation. A dam conversion plan is to be prepared prior to commencement of work.

4.6.1 Performance and Criteria

	Year 1 to Year 4	Year 5 to Year 10	Completion Criteria
Dam conversion and rehabilitation	Prepare dam conversion plan. Dam conversion complete and rehabilitation has stabilised the site.	Observed natural flow regime and no erosion.	All works completed.
Monitoring	Property Inspections (Section 5.4)	Property Inspections (Section 5.4)	

4.6.2 Trigger, Response Action plan

Trigger	Response and Action
Significant rainfall event causes erosion at dam rehabilitation area.	Install erosion control measures, within 30 days, undertake monitoring of the area for 12 months post event to ensure the site is stabilised. Report and review incident, within 30 days. Review the Plan.

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 conservation 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 across the BA 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 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 MZ1, MZ3 and MZ5 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

To increase the extent and condition of woodland, active restoration through planting is to be undertaken in the following grassland areas:

- MZ4: Warkworth Sands Woodland (WSW) (H872 Low);
- MZ2: Central Hunter Grey-Box – Ironbark Derived Native Grassland (HU817 Low) this includes 72 ha of exotic grassland; and
- MZ10: Hunter Valley River Oak forest (HU711 Low).

Areas of dense River Oak Forest (ROF) are the preferred habitat for Regent Honeyeater. However, the existing open fringe areas of River Oak Forest are the preferred habitat for the Noisy Miner, which are aggressive birds that can displace the Regent Honeyeater. Therefore planting of dense patches of River Oak (*Casuarina cunninghamiana*) will be established in these areas along the Wollombi Brook.

The re-establishment process will adopt where possible a shelter belt approach, with planting confined to strips that run perpendicular to the prevailing wind direction or patches close to remnant woodland. This approach aims to create micro climates that will encourage and support natural regeneration between the strips / patches. It minimises site disturbance to avoid damage to existing regeneration and enables natural and sustainable regeneration to increase connectivity.

Figure 9 indicates the location of planting areas based on the vegetation management area. All planting is to occur when suitable climatic conditions prevail. The proposed planting schedule is shown in Table 15, and includes the areas planted in 2014 under the Local OMP.

The 39ha of Warkworth Sand Grassland planted in 2014 and replanted in 2015 was re-assessed in 2016. Poor survival and growth in the quarry and the old orchard sites was evident, and therefore further testing of these sites is to occur and replanting of these areas is scheduled for 2017.

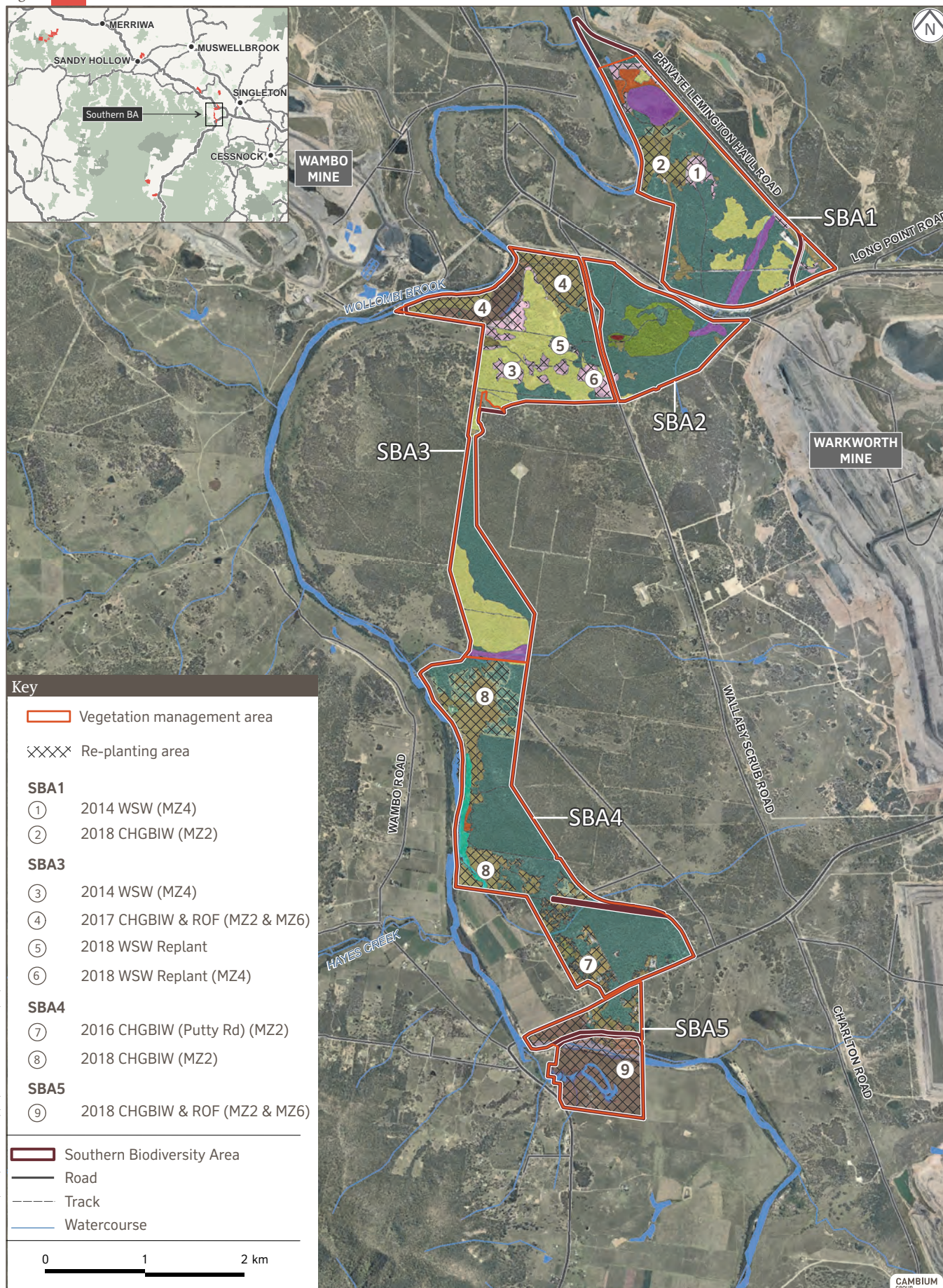
Table 15 Planting schedule

SBA	Id	Year	Timing	Area (ha)	Community	Comments
SBA1	1	2014	Spring	6.4	WSW (MZ4)	Maintenance only
	2	2018	Autumn	20	CHGBIW (MZ2)	
SBA3	3	2014	Spring	22.6	WSW (MZ4)	Maintenance only
	4	2017	Autumn	77	CHGBIW (MZ2)	
	4	2017	Autumn	11	ROF (MZ6)	Along Wollombi Brook and ox bow
	4	2017	Autumn	1	WSW (MZ4)	Fringe along existing WSW
	5	2018	Autumn	10	WSW (MZ4)	Replant of orchard areas
SBA4	6	2018	Autumn	4	WSW (MZ4)	Replant of quarry
	7	2016	Autumn	6.3	CHGBIW (MZ2)	Maintenance only - Putty Road Offset Area
	8	2018	Autumn	43	CHGBIW (MZ2)	
SBA5	9	2018	Autumn	11	ROF (MZ6)	Along Wollombi Brook and ox bow
	9	2018	Autumn	75	CHGBIW (MZ2)	

Planting areas at the Southern Biodiversity Area

Management Plan 2017

Figure 9



4.8.1 Translocation of salvaged resources and composted mulch

Two key observations were made following the application of topsoil and composted mulch in the 2014 planting operations. The first was that the application of composted mulch visibly increased the growth of annual weeds, impacting short term survival but possibly providing longer term growth benefits. The application of topsoil initially indicated in 2015 no benefits through natural recruitment in the topsoil seed bank, however in 2016 natural recruitment of *Pimelea linifolia* was visibly evident within the strips as shown in the following photo. It has been concluded that the application of topsoil is beneficial to re-establishment actions.

To reflect these findings the guidelines from the Local OMP have been amended to include selection criteria for topsoil and the omission of composted mulch.



Photo: Strip application of topsoil in Northern Biodiversity area in spring 2016 after planting in spring 2014.

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

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

- Topsoil management:
 - Stockpiling of material is to be avoided where possible.
 - To translocate the majority of seed it is recommended that the top ten centimetres is scalped.
 - Complete assessment of the in situ vegetation community in the area where the topsoil is to be sourced. The following performance measures and criteria are to be used as a minimum standard to assess the potential value of the topsoil to be targeted as a resource salvageable as a potential seed source.
- | Measure | Criteria |
|-----------------------------------|--|
| Weed species | Absence of noxious weeds |
| Ground cover | <10% weed species |
| Suitable growing media | Presence of A horizon in soil profile |
| Native species are producing seed | Evidence of recruitment of native flora; presence of fruit/ seed |
- Timber:
 - Large trees, with their branches intact and roots removed, are to be relocated to provide seed sources, habitat augmentation and protect the soil to create an improved micro climate for restoration.

- Plant material:
 - Seeds, cuttings and plants will be salvaged from the disturbance area to further assist in the establishment of ecological characteristics in the re-establishment areas. Species that are known to be difficult to grow from seed will be targeted for cuttings and transplanting from the disturbance areas.
 - Seed for planting and seeding activities in the BAs and rehabilitation areas is from local or endemic provenances, however provenance seed from other areas can be used to increase genetic diversity to increase resilience to climate change. To support the BA re-establishment programme, viable seed will be collected prior to clearing vegetation, when it is safe and practical.

4.8.2 Seed collection

It will be permissible to collect seed from remnant patches of ecological communities across the BA. However seed collection must be for non-commercial purposes and meet the standards of the “Guidelines and Codes of Practice” developed by Florabank (www.florabank.org.au), or subsequent equivalent, and the following limitations and permissions apply:

- Collect seed in the BA only if seed of the particular species and genotype is not available elsewhere or if the seed collected is intended for seedlings that will be planted within the BA;
- Seeds may be collected from within endangered ecological communities;
- Seeds may not be collected from species individually listed on schedules 1, 1A or 2 of the TSC Act without prior written approval from the Director General, or under a licence granted under S132c of the Act or S91 of the TSC Act;
- Seeds may be collected from any protected species listed under Section 131 (Schedule 13) of the TSC Act; and
- Seeds may be collected from any other native species.

Species for seed collection will be based on the description provided in Section 2 and the following species list.

4.8.3 Species list

These species lists include species collected locally from BA and species that are listed in the relevant vegetation community species assemblage.

Table 16 lists the WSW species for planting in 2017. Selection of these species was based on results of planting trials on Warkworth sands. The distribution of the planting will include 60% canopy, 20% mid canopy, 10% shrubs and 10% ground cover species.

Table 16 Warkworth Sands Woodland species planting list

Scientific Name	Common Name	Estimated tubestock 2017
Canopy		1,350
<i>Angophora floribunda</i>	Rough-barked Apple	
<i>Banksia integrifolia</i> Subsp. <i>integrifolia</i>	Coast Banksia	
<i>Eucalyptus blakelyi/tereticornis</i>	Forest Red Gum	
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	
Mid canopy		450
<i>Acacia filicifolia</i>	Fern-leaved wattle	
<i>Allocasuarina littoralis</i>	Black She-oak	
<i>Allocasuarina luehmannii</i>	Bulloak	
<i>Brachychiton populneus</i>	Kurrajong	
Shrubs		225
<i>Breynia oblongifolia</i>	Coffee Bush	
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Blackthorn	
<i>Grevillea montana</i>		

Scientific Name	Common Name	Estimated tubestock 2017
<i>Hibbertia linearis</i>	Guinea Flower	
<i>Melaleuca thymifolia</i>		
Ground cover		225
<i>Calotis cuneifolia</i>	Purple Burr-daisy	
<i>Dianella revoluta</i>	Blueberry Lilly	
<i>Einadia nutans</i>	Climbing Saltbush	
<i>Lomandra confertifolia</i>	Mat rush	
<i>Vittadinia cuneata</i>	Fuzzweed	

Table 17 lists the CHGBIW species for planting in 2017 and 2018. The distribution of the planting will include 60% canopy, 20% mid canopy, 10% shrubs and 10% ground cover species.

Table 17 Central Hunter Grey-Box Ironbark Woodland species planting list

Scientific Name	Common Name	Estimated tubestock 2017	Estimated tubestock 2018
Canopy		6,930	11,520
<i>Angophora floribunda</i>	Rough-barked Apple		
<i>Eucalyptus blakelyi/tereticornis</i>	Forest Red Gum		
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		
<i>Eucalyptus moluccana</i>	Grey Box		
Mid canopy		2,310	3,840
<i>Acacia Implexa</i>	Lightwood		
<i>Allocasuarina luehmannii</i>	Bulloak		
<i>Brachychiton populneus</i>	Kurrajong		
<i>Melaleuca decora</i>			
Shrubs		1,155	1,920
<i>Acacia amblygona</i>	Fan wattle		
<i>Acacia falcata</i>	Sickle wattle		
<i>Acacia salicina</i>	Cooba		
<i>Breynia oblongifolia</i>	Coffee Bush		
<i>Bursaria spinosa subsp. spinosa</i>	Blackthorn		
<i>Cassinia quinquefaria</i>	Cough Bush		
<i>Dodonaea viscosa</i>	Hop Bush		
Ground cover		1,155	1,920
<i>Calotis cuneifolia</i>	Purple Burr-daisy		
<i>Dianella revoluta</i>	Blueberry Lilly		
<i>Einadia nutans</i>	Climbing Saltbush		
<i>Lomandra multiflora</i>	Many-flowered Mat-rush		
<i>Vittadinia cuneata</i>	Fuzzweed		

Table 18 lists the ROF species for planting in 2017 and 2018. The distribution of the planting will includes 60% of canopy species and 40% mid canopy species.

Table 18 River Oak Forest species planting list

Scientific Name	Common Name	Estimated tubestock 2017	Estimated tubestock 2018
Canopy		990	1,440
<i>Angophora floribunda</i>	Rough-barked Apple		
<i>Casuarina cunninghamiana</i>	River Oak		
<i>Eucalyptus camaldulensis</i>	River Red Gum		
<i>Eucalyptus teretercornis</i>	Forest Red Gum		
Mid canopy		660	960
<i>Acacia Implexa</i>	Lightwood		
<i>Breynia oblongifolia</i>	Coffee Bush		
<i>Bursaria spinosa subsp. spinosa</i>	Blackthorn		

4.8.4 Planting method

Table 19 lists the key planting criteria to increase the likelihood of planting success.

Table 19 Key planting criteria

Activity	Minimum requirement
Soil test	Complete soil test across planting site to identify soil deficiencies or impediments for plant growth
Species selection	Species selected are species listed on the description of the vegetation communities issued by the NSW Scientific Committee or NSW government description. Seed can be collected from site or regionally from equivalent vegetation communities.
Cultivation	Cultivation for tube stock planting should be to a depth of 500-600mm at least 6 months prior to planting and when soil moisture is low to improve sub surface soil shatter, this is not required on sand sites. Cultivation for direct seeding may include light soil scarification.
Preplant weed control	Chemical control of weeds at least 1 week prior to planting or seeding. An area of at least 1m diameter around each tree or seeding patch is to be sprayed to remove all competition for site resources.
Tube stock planting	Planting will only occur when there is suitable soil moisture, typically 1 -2 days after 25mm of rainfall, in spring or autumn. Tube stock is to be at least 25mm in height, with a well-established root system and in good condition. The tube stock root plug is to be saturated at the time of planting. Soil conditioner is to be applied into the planting hole and all plants should be planted deep, with their root plug at least 50mm below ground and gently firmed in to remove any air pockets in the soil. The spacing of tube stock planting will occur in rows or clusters to create appropriate shelter effects at approximately 400 stems per hectare.
Direct seeding	Seed is to be free of weed seed. Seeding must only occur when there is suitable soil moisture, typically 1 -2 days after 25mm of rainfall, in spring or autumn. Control of ants prior to seeding to reduce the impact of seed removal.
Watering	Watering is to occur at the time of planting or seeding, and if required for 6 months post planting.
Maintenance	Maintenance period will apply for at least 18months, including post plant weed control.
Replanting	Where the survival of tubestock is less than 70% the area will be replanted.

All planting activities are dependent upon suitable climatic condition and may be postponed. If this occurs, weather records will be reported to support any delay in activities.

4.8.5 Survival assessments

Survival assessments are to be completed at 3 and 6 month post planting to assess the success of tubestock planting. Details of the monitoring programme are provided in Section 5.

4.8.6 Performance criteria

	Year 1 to Year 5	Year 6 to Year 10	Completion Criteria
WSW planting (40ha)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Ecological monitoring completed.	Ecological monitoring demonstrates a trajectory toward the reference site or the benchmark values for HU872 for all attributes measured over three consecutive assessments (the average of all plots).
CHGBIW planting (240ha)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment	Ecological monitoring completed.	Ecological monitoring demonstrates a trajectory toward the reference site or the NSW Biometric HU817 for all attributes measured over three consecutive assessments (the average of all plots).
ROF planting (26ha)	Collection of seed. Plant propagation. Tubestock planted. Completed survival assessment		Survival assessment greater than 70%.

4.8.7 Trigger, Response and Action plan

Trigger	Response and Actions
Average survival assessment less than 70%	Review planting activities, including soil test result, determine if poor survival due to climatic conditions or operational matters. Complete further site assessment if cause cannot be identified. Review Plan in light of finding and replant the area.
Ecological monitoring does not show trajectory toward reference site or the NSW Biometric benchmark.	Review adequacy of management actions, assess if performance can be attributed to factors that cannot be controlled. Consider review of completion criteria. Revise Plan to include suggested remediation actions.

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 moderate 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 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 Actions
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.

4.10 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 Regent 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 causing environmental degradation at a regional and local level, and the opportunistic control of the species listed in Table 20. 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 20 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	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 across the BA 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 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 (NPWS). 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 20, and any other species recorded from monitoring activities. All actions recorded in the Annual Report.	At least one control events each year for species listed in Table 20, and any other species recorded from monitoring activities. All actions recorded in the 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 biannual inspection and report all works completed and actions for next year	Complete biannual inspection and report all works completed and actions for next year	

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 12;
- 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 22, 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 22 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 21. 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 21 Monitoring Schedule

	2016	2017	2018	2019	2020	2021 to 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	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov	Sept - Nov
Property inspection	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov	April / Nov

5.2 Landscape Monitoring

Aerial photographic imagery and baseline photography purchased in 2013 will be updated in 15 years. This 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:

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

Nineteen Habitat Monitoring Restoration Plots across the Southern BA within MZ1, MZ2, MZ3, MZ4 and MZ5 are established to monitor the condition of woodland reference sites and grassland transition sites. The location of the Habitat Restoration Monitoring Plots is shown in Figure 4. All monitoring results will be stored on the Biodiversity Offsets Portal.

The monitoring programme will assess changes in key attributes within the BA through time as grassland communities are restored to woodland. Monitoring data will also be assessed relative to the benchmark values presented in the BioMetrics Vegetation Types Database (OEH, 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 are also included in this monitoring programme to track canopy regeneration and health, and soil characteristics.

The first survey of all plots was completed in 2014 and subsequent surveys will be biennial (every two years) during late spring/early summer. A summary of results was provided in Section 2.

Field Methods

The nineteen monitoring plots established across the Southern BA are located with.

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 10). 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. This data is 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 C**.

Figure 10 Monitoring plot for habitat restoration monitoring

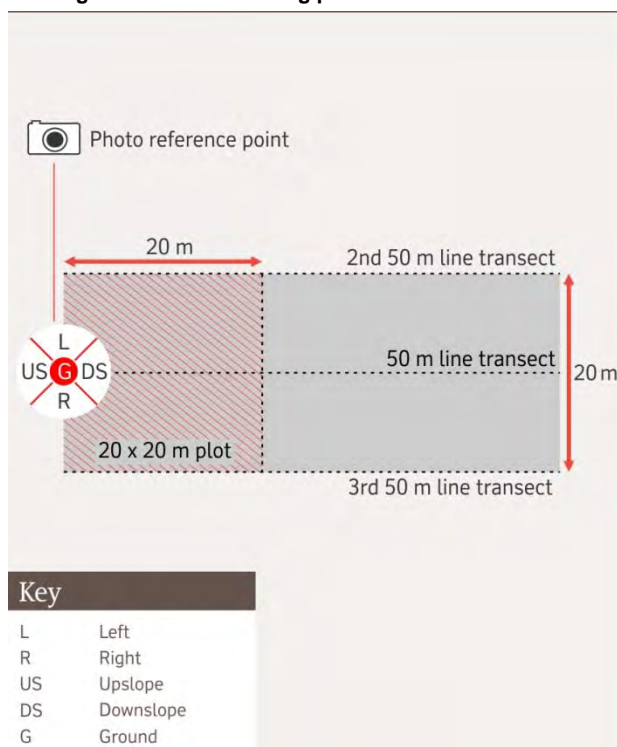


Photo Reference Points

Photo reference points 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 on 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/fruitlet species); and
- changes in identified threatening processes (e.g. weed infestations, erosion).

- At each photo reference point, a minimum of five photos are 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 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

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 started in winter/spring 2014 to collect baseline data and subsequent monitoring will occur in 2018 and 2020 (Table 21). 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.

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 Southern BA, nine bird monitoring plots are established according to the following distribution and their locations are shown on Figure 5:

- 5 plots in woodland (MZ1 and MZ3); and
- 4 plots in grassland (MZ2 and MZ4).

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.

Analysis of the baseline data will assess the difference in fauna assemblages and habitat condition between grasslands and woodlands across the BA. 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 reference woodland. This is expected to be a medium to long-term upward trend that will reflect the regeneration of grassland areas to 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 reference condition.

5.4 Management Monitoring

5.4.1 Rapid Condition Assessment

The RCA technique is used as a preliminary assessment of woodland condition within the BA. **Appendix A** provides details on the RCA methodology, the location of the plots is shown in Figure 5.

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.

5.4.3 Survival Assessment

To assess the survival of planted tubestock and observe regeneration a 50m line transect will be used and 2m x 2m quadrats will be placed every 10m along the transect. One transect will be established to assess every 10ha of re-establishment.

Along the 50m transect, the number of dead and living tubestock will be recorded. Within the 2m x 2m quadrats at every 10m the following is to be recorded:

- number of native plants regenerating;
- number of weed species; and
- record any erosion.

The starting point and end point of each transect is to be recorded by GPS.

6 Risk assessment

Table 22 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 22 Risk Assessment and Corrective Action 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 DoEE 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 23 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>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.</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; 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; f) measures to provide fire management regimes appropriate for the MNES; g) measures to manage the MNES in accordance with the recommendations of the approved recovery plan for the migratory and threatened species; h) monitoring measures including ecological surveys to measure the establishment and ongoing success of the revegetation based on a 	<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>Section 4 Conservation Management Actions</p> <p>Section 4 Conservation Management Actions</p> <p>Section 5 Monitoring</p>

Approval Condition	EPBC 2009/5081	Reference
	comparison with high quality habitat for the MNES;	
	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	Section 4 Conservation Management Actions Section 6 Risk assessment
	j) identify persons responsible and arrangements for implementing the REP and for reporting on performance.	Section 1.3.2 Key Stakeholders and Roles
	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 24 Compliance with relevant conditions of NSW SSD-6464

Approval Condition

Development Consent SSD-6464, Schedule 3

Reference

28

Retirement of Offsets

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.

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 :

(a) acquiring or retiring credits under the Biobanking Scheme in the TSC Act;

(b) making payments into an offset fund that has been developed by the NSW Government; or

(c) providing supplementary measures.

The credits reported in this document and the BioBanking Assessment Report will be retired to meet this condition.

Table 9: Ecosystem credit requirements

Vegetation Community	Code (BVT)	Biometric Vegetation Type	Area (ha)	Endangered Ecological Community (EEC)	*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	0.67	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:

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

Note:

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

30 Direct Land-Based Offsets

Within 3 years of the date of commencement of the development under this consent, the Applicant

This Plan will form part of

Approval Condition	Development Consent SSD-6464, Schedule 3	Reference																
	<p>shall secure offset areas listed in Table 12 under an in perpetuity conservation mechanism such as entering into a biobank agreement, in accordance with the relevant provisions of the TSC Act. The direct land-based offsets may be used as offsets for any approval required under the EPBC Act for this development.</p> <p><i>Table 12: Direct Land-based Offsets</i></p> <table><tr><th>Offset Area</th><th>Minimum Size (hectares)</th></tr><tr><td>Northern Biodiversity Area</td><td>303</td></tr><tr><td>Southern Biodiversity Area</td><td>705</td></tr><tr><td>Goulburn River Biodiversity Area</td><td>1,063</td></tr><tr><td>Bowditch Biodiversity Area</td><td>520</td></tr><tr><td>Putty Road Biodiversity Area</td><td>94</td></tr><tr><td>2003 Warkworth Sands Woodland Area</td><td>155.8</td></tr><tr><td>North Rothbury Biodiversity Area (Hanwood Estate)</td><td>40</td></tr></table> <p><i>Note: To identify the areas referred to in Table 12 see the applicable figures in Appendix 4.</i></p>	Offset Area	Minimum Size (hectares)	Northern Biodiversity Area	303	Southern Biodiversity Area	705	Goulburn River Biodiversity Area	1,063	Bowditch Biodiversity Area	520	Putty Road Biodiversity Area	94	2003 Warkworth Sands Woodland Area	155.8	North Rothbury Biodiversity Area (Hanwood Estate)	40	the conservation agreement.
Offset Area	Minimum Size (hectares)																	
Northern Biodiversity Area	303																	
Southern Biodiversity Area	705																	
Goulburn River Biodiversity Area	1,063																	
Bowditch Biodiversity Area	520																	
Putty Road Biodiversity Area	94																	
2003 Warkworth Sands Woodland Area	155.8																	
North Rothbury Biodiversity Area (Hanwood Estate)	40																	
36	<p>Biodiversity Management Plan</p> <p>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:</p> <p>(a) be prepared in consultation with OEH and submitted to the Secretary for approval prior to the commencement of any development under this consent;</p> <p>(b) describe the short, medium, and long term measures that would be implemented to:</p> <ul style="list-style-type: none">• 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; <p>(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);</p> <p>(d) include a detailed description of the measures that would be implemented over the next 3 years for:</p> <ul style="list-style-type: none">• 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 revegetation measures;• controlling weeds and feral pests;• controlling erosion;• managing grazing and agriculture on site;• controlling access; and• bushfire management; <p>(e) include a seasonally-based programme 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>	<p>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.</p> <p>Condition (e) see Section 5</p> <p>Condition(f) see Section 6</p> <p>Condition (g) see Section1.3.2.</p>																
38	<p>Wollombi Brook Aboriginal Cultural Heritage Conservation Area</p> <p>The Applicant shall prepare a conservation management plan for the Wollombi Brook Aboriginal Cultural Heritage Conservation Area to the satisfaction of the Secretary, and carry out the development in accordance with this plan. This Plan must:</p> <p>(a) be prepared in consultation with OEH and Aboriginal stakeholders, and submitted to the Secretary for approval prior to carrying out any development to the west of Wallaby Scrub Road under this consent unless otherwise agreed by the Secretary;</p> <p>(b) describe the measures that would be implemented to provide for the protection, conservation and enhancement of Aboriginal heritage values in the area;</p> <p>(c) include a programme/procedures for:</p> <ul style="list-style-type: none">• protection and management of Aboriginal sites, including protocols for the establishment of strictly controlled non-access zones and protocols around culturally sensitive areas;• maintaining and managing access to the area by the relevant Aboriginal stakeholders, including establishment of areas for active Aboriginal cultural heritage and landscape management; and• ongoing consultation and involvement of the relevant Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage in the area;	Section 2.2.																

Approval Condition	Development Consent SSD-6464, Schedule 3	Reference
	(d) investigate the potential for collaborative management of the Aboriginal heritage values of the land within the Southern Biodiversity Area and the adjoining Wambo-owned land adjacent to the conservation area, in consultation with the owner of the Wambo mine; and (e) include an action plan for the implementation of the plan, including the establishment and role of the Wollombi Brook Aboriginal Cultural Heritage Conservation Area management committee in overseeing implementation of the plan.	

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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 - MTW Bird Monitoring Results: July 2011

The nine MTW sites surveyed in July 2011 were the same survey sites as those of Debus (2008), and the survey method was repeated. Each site was surveyed four times over almost consecutive days, and survey times at each site were rotated between early, mid or late morning, and mid or late afternoon. Birds were surveyed by habitat (area) search, using visual and aural cues, by a random meander through 4 ha around the survey point during 40 minutes (= 2x the standard 2-ha/20-minute search commonly used and recommended for bird surveys). In practice, tracks through the sites were used as much as possible to maximise the detectability of birds and the counting of individuals. Also, because bird foraging activity continued through the day in winter, counts continued until later in the morning and started earlier in the afternoon than in the autumn and spring surveys. For each site and replicate count, species and individuals were again counted in 10-minute intervals (taking care not to double-count individuals). Survey effort was 2.67 hrs (4 x 40 minutes) per site.

Weather conditions during the winter 2011 MTW survey (11–14 and 19–21 July) were mostly dry, but often cold and gusty in the first week, and cold, overcast, gusty and occasionally showery in the second week (counts were not conducted during rain). Mining operations had also approached more closely to site 1 (especially, where habitat clearing had intruded), and sites 3 and 4 (i.e. those sites east of Wallaby Scrub Road), meaning that there was machinery noise interference at these sites, and the 4-ha search area at sites 1 and 4 was adjusted slightly south and west to compensate.

Eight hundred and seventy individuals, of 74 species, were recorded on MTW - sixty-eight species on the survey plots, and six seen or heard off site during counts or while travelling between the sites. This is a similar number of species to autumn 2008 (76) and winter 2009 (71), although fewer species than spring 2008 (85), and 100 more individuals than in autumn or spring 2008. These differences can be explained by the winter absence of spring-summer migrant species, the winter influx of certain species (Eastern Spinebill, Yellow-faced Honeyeater and Golden Whistler), and the greater detectability of some species in spring (e.g. singing, breeding). The winter influx of honeyeaters included a new species for MTW, the White-cheeked Honeyeater, and was related to the winter flowering of Coast Banksia on the Warkworth Sands. Six other new species for the MTW monitoring plots may have been winter visitors to the area. Recorded species diversity at MTW in winter 2011 may have been slightly depressed by the weather conditions, and the habitat loss or disturbance and/or the noise interference resulting from encroachment of mining activity on sites 1, 3 and 4.

Table B1 provides the results from the 2005, 2008 and 2011 surveys.

Table B1 Results from MTW surveys completed from 2005 to 2011

Scientific Name	Common Name	Total No. birds Spring 2005	Total No. Species Spring 2005	Total No. birds Autumn 2008	Total No. Species Autumn 2008	Total No. birds Spring 2008	Total No. Species Spring 2008	Total No. birds Winter 2011	Total No. Species Winter 2011
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	OPP 1	OPP 1						
<i>Falco longipennis</i>	Australian Hobby	2	1	1	1				
<i>Alisterus scapularis</i>	Australian King Parrot			5	1			1	1
<i>Gymnorhina tibicen</i>	Australian Magpie	9	1	18	1	18	1	18	1
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					1	1		
<i>Corvus coronoides</i>	Australian Raven	13	1	14	1	18	1	32	1
<i>Chenonetta jubata</i>	Australian Wood Duck			2	1	4	1	5	1
<i>Vanellus tricolor</i>	Banded Lapwing	2	1						
<i>Geopelia humeralis</i>	Bar-shouldered Dove					2	1	1	1
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo			1	1				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	9	1	16	1	11	1	7	1
<i>Falco berigora</i>	Brown Falcon			2	1	1	1		
<i>Gerygone mouki</i>	Brown Gerygone							1	1
<i>Accipiter fasciatus</i>	Brown Goshawk	1	1			3	1		
<i>Acanthiza pusilla</i>	Brown Thornbill	8	1	4	1	4	1	4	1
<i>Climacteris picumnus</i>	Brown Treecreeper	1	1	1	1	3	1	1	1
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			12	1	14	1	58	1
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	1	1	39	1	37	1	39	1
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	7	1			8	1		
<i>Coracina tenuirostris</i>	Cicadabird						1		
<i>Acrocephalus stentoreus</i>	Clamorous Reed-Warbler						1		
<i>Phaps chalcoptera</i>	Common Bronzewing	5	1	1	1	3	1	3	1
<i>Eudynamys scolopacea</i>	Common Koel					6	1		
<i>Ocyphaps lophotes</i>	Crested Pigeon	2	1	1	1	8	1	1	1
<i>Falcunculus frontatus</i>	Crested Shrike-tit							1	1
<i>Platycercus elegans</i>	Crimson Rosella							2	1
<i>Stagonopleura guttata</i>	Diamond Firetail					1	1	1	1
<i>Eurystomus orientalis</i>	Dollarbird					3	1		
<i>Taeniopygia bichenovii</i>	Double-barred Finch	4	1	9	1	5	1	2	1
<i>Gallinula tenebrosa</i>	Dusky Moorhen	OPP 1	OPP 1						

Scientific Name	Common Name	Total No. birds Spring 2005	Total No. Species Spring 2005	Total No. birds Autumn 2008	Total No. Species Autumn 2008	Total No. birds Spring 2008	Total No. Species Spring 2008	Total No. birds Winter 2011	Total No. Species Winter 2011
<i>Artamus cyanopterus</i>	Dusky Woodswallow			18	1	5	1		
<i>Platycercus eximius</i>	Eastern Rosella	12	1	2	1	11	1	5	1
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	2	1			2	1	11	1
<i>Psophodes olivaceus</i>	Eastern Whipbird	6	1						
<i>Eopsaltria australis</i>	Eastern Yellow Robin			7	1	15	1	10	1
<i>Hirundo ariel</i>	Fairy Martin					17	1		
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	1	1					2	1
<i>Petroica phoenicea</i>	Flame Robin								
<i>Lichenostomus fuscus</i>	Fuscous Honeyeater								
<i>Eolophus roseicapillus</i>	Galah	2	1	2	1		1		
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo			1	1		1	4	1
<i>Pachycephala pectoralis</i>	Golden Whistler	20	1	3	1	1	1	15	1
<i>Phalacrocoax carbo</i>	Great Cormorant				1				
<i>Cracticus torquatus</i>	Grey Butcherbird	9	1	8	1	15	1	7	1
<i>Rhipidura fuliginosa</i>	Grey Fantail	14	1	7	1	5	1	22	1
<i>Accipiter novaehollandiae</i>	Grey Goshawk								
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	1	1	3	1	7	1	14	1
<i>Anas gracilis</i>	Grey Teal	1	1						
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	3	1	15	1	19	1	8	1
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	3	1			2	1		
<i>Microeca fascians</i>	Jacky Winter		1		1	3	1	3	1
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	14	1	10	1	11	1	12	1
<i>Myiagra rubecula</i>	Leaden Flycatcher			1	1				
<i>Meliphaga lewinii</i>	Lewin's Honeyeater	2	1					1	1
<i>Turnix velox</i>	Little Button-quail								
<i>Hieraaetus morphnoides</i>	Little Eagle			1	1				
<i>Philemon citreogularis</i>	Little Friarbird	1	1						
<i>Glossopsitta pusilla</i>	Little Lorikeet	1	1	14	1			4	1
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant				1				
<i>Grallina cyanoleuca</i>	Magpie-lark	5	1	6	1	8	1	4	1
<i>Vanellus miles</i>	Masked Lapwing	1	1			2	1		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	2	1	12	1	19	1	8	1

Scientific Name	Common Name	Total No. birds Spring 2005	Total No. Species Spring 2005	Total No. birds Autumn 2008	Total No. Species Autumn 2008	Total No. birds Spring 2008	Total No. Species Spring 2008	Total No. birds Winter 2011	Total No. Species Winter 2011
<i>Falco cenchroides</i>	Nankeen Kestrel				1	2	1		
<i>Philemon corniculatus</i>	Noisy Friarbird	10	1	102	1	33	1	3	1
<i>Manorina melanocephala</i>	Noisy Miner	16	1	30	1	27	1	49	1
<i>Oriolus sagittatus</i>	Olive-backed Oriole	6	1	2	1	12	1		
<i>Aviceda subcristata</i>	Pacific Baza			1	1				
<i>Anas superciliosa</i>	Pacific Black Duck	OPP 1	OPP 1	2	1		1	2	1
<i>Turnix varia</i>	Painted Button-quail			2	1	3	1		
<i>Cuculus pallidus</i>	Pallid Cuckoo	3	1			4	1		
<i>Geopelia placida</i>	Peaceful Dove			2	1	3	1		
<i>Cracticus nigrogularis</i>	Pied Butcherbird			2	1	5	1	6	1
<i>Strepera graculina</i>	Pied Currawong	11	1	7	1	11	1	10	1
<i>Merops ornatus</i>	Rainbow Bee-eater	2	1	19	1	9	1		
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	1	1						
<i>Anthochaera carunculata</i>	Red Wattlebird	1	1					5	1
<i>Neochmia temporalis</i>	Red-browed Finch	1	1			3	1	22	1
<i>Petroica goodenovii</i>	Red-capped Robin			4	1	11	1	7	1
<i>Myiagra inquieta</i>	Restless Flycatcher	5	1						
<i>Petrocia rosea</i>	Rose Robin							9	1
<i>Rhipidura rufifrons</i>	Rufous Fantail			1	1	1	1		
<i>Cincloramphus mathewsi</i>	Rufous Songlark					4	1		
<i>Pachycephala rufiventris</i>	Rufous Whistler			20	1	18	1	1	1
<i>Todirhamphus sanctus</i>	Sacred Kingfisher	8	1	1	1	4	1		
<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater			16	1	5	1	4	1
<i>Petroica boodang</i>	Scarlet Robin							7	1
<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo					3	1		
<i>Zosterops lateralis</i>	Silvereye	7	1	19	1	19	1	14	1
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	2	1	27	1	19	1	32	1
<i>Pardalotus punctatus</i>	Spotted Pardalote	3	1	9	1	14	1	13	1
<i>Threskiornis spinicollis</i>	Straw-necked Ibis						1		
<i>Pardalotus striatus</i>	Striated Pardalote	6	1	10	1	10	1	5	1
<i>Acanthiza lineata</i>	Striated Thornbill	2	1						
<i>Plectrohyncha laneolata</i>	Striped Honeyeater			5	1	10	1	8	1

Scientific Name	Common Name	Total No. birds Spring 2005	Total No. Species Spring 2005	Total No. birds Autumn 2008	Total No. Species Autumn 2008	Total No. birds Spring 2008	Total No. Species Spring 2008	Total No. birds Winter 2011	Total No. Species Winter 2011
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo				1	1	1		
<i>Malurus cyaneus</i>	Superb Fairy-wren	2	1	17	1	24	1	29	1
<i>Podargus strigoides</i>	Tawny Frogmouth	1	1	1	1				
<i>Petrochelidon nigricans</i>	Tree Martin			4	1	7	1		
<i>Daphoenositta chrysoptera</i>	Varied Sittella		1	18	1	15	1	20	1
<i>Malurus lamberti</i>	Variegated Fairy-wren	3	1	6	1	7	1	29	1
<i>Aquila audax</i>	Wedge-tailed Eagle	OPP 1	OPP 1	4	1	11	1	6	1
<i>Smicromnis brevirostris</i>	Weebill	13	1	68	1	59	1	92	1
<i>Hirundo neoxena</i>	Welcome Swallow	1	1	12	1			4	1
<i>Gerygone fusca</i>	Western Gerygone			1	1	3	1		
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	OPP 1	OPP 1						
<i>Sericornis frontalis</i>	White-browed Scrubwren	OPP 1	OPP 1	1	1	2	1	1	1
<i>Phylidonyris niger</i>	White-cheeked Honeyeater							2	1
<i>Lichenostomus leucotis</i>	White-eared Honeyeater		1	8	1	8	1	16	1
<i>Egretta novaehollandiae</i>	White-faced Heron						1		
<i>Melithreptus lunatus</i>	White-naped Honeyeater		1						
<i>Ardea pacifica</i>	White-necked Heron					1	1	2	1
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	5	1	2	1	7	1	7	1
<i>Gerygone olivacea</i>	White-throated Gerygone	17	1	5	1	5	1		
<i>Hirundapus caudacutus</i>	White-throated Needletail			17	1				
<i>Cormobates leucophaeus</i>	White-throated Treecreeper	OPP 2	OPP 1	8	1	7	1	4	1
<i>Corcorax melanorhamphos</i>	White-winged Chough	17	1	36	1	40	1	86	1
<i>Lalage sueurii</i>	White-winged Thriller					5	1		
<i>Rhipidura leucophrys</i>	Willie Wagtail	7	1	3	1	8	1	3	1
<i>Leucosarcia picata</i>	Wonga Pigeon							1	1
<i>Acanthiza nana</i>	Yellow Thornbill	13	1	47	1	39	1	41	1
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater			9	1	14	1	40	1
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	1	1	4	1	4	1	11	1
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo	2	1						
Total		330	64	788	76	789	85	898	68

Appendix C - 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 C1.

- 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 C1 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

