



Biodiversity Management Plan

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1 Introduction

1.1 Background

Liddell Coal Operations (LCO) is an established mining operation located approximately 25 kilometres north-west of Singleton in the Hunter Valley of New South Wales (refer to **Figure 1**). The LCO site is divided by the boundary between the Singleton and Muswellbrook local government areas (LGAs) and is located in the Parish of Liddell, in the County of Durham.

LCO is operated and managed by Liddell Coal Operations Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore Coal), on behalf of a joint venture between Glencore Coal (67.5 percent (%)) and Mitsui Matsushima Australia (32.5%).

LCO received approval for the extension of Liddell Open Cut coal mining operations under the State Environmental Planning and Assessment Act 1979 (EPA Act) on 1 December 2014 (DA 3015-11-01 Modification 5) and under the Commonwealth Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) on 24 December 2014 (EPBC Approval 2013/6908).

The State and Commonwealth approvals for this modification both require preparation of a Biodiversity Management Plan (BMP) to guide ongoing management of the LCO site to maintain and enhance biodiversity values, particularly those relating to threatened species.

This document has been prepared to satisfy the State and Commonwealth conditions of approval relating to the BMP, and its requirements apply to LCO operational lands (hereafter referred to as the BMP Area). **Figure 2** identifies the BMP Area, which falls within the LCO Approved DA Boundary, however excludes the existing biodiversity offset areas (BOAs) (being Bowmans Creek Riparian Corridor, Mitchell Hills South and Mountain Block (with the exception of a 14.8 hectare area of Mountain Block as described in greater detail in **Section 3.4**)). The management of these biodiversity offset areas is documented within a separate Biodiversity Offset Management Plan (BOMP). This document details the strategies for the second three year period since commencement of the action.

1.2 Objectives

The objectives of this BMP are to provide direction for the short to long term management and enhancement of the biodiversity values of the BMP Area, as well as to provide a detailed description of the measures to be implemented to achieve this over the next three years (as per the State requirements). Beyond this three years, the BMP will be reviewed on a regular basis in relation to progress, actions completed, forward planning of remaining actions and any alterations/additions resulting from the adaptive management process and additionally in accordance with Schedule 5 Condition 10 of DA 3015-11-01 (see **Section 8**). The tasks within this BMP will be implemented for the life of mine (as approved until 2028).

The specific requirements of the BMP are to:

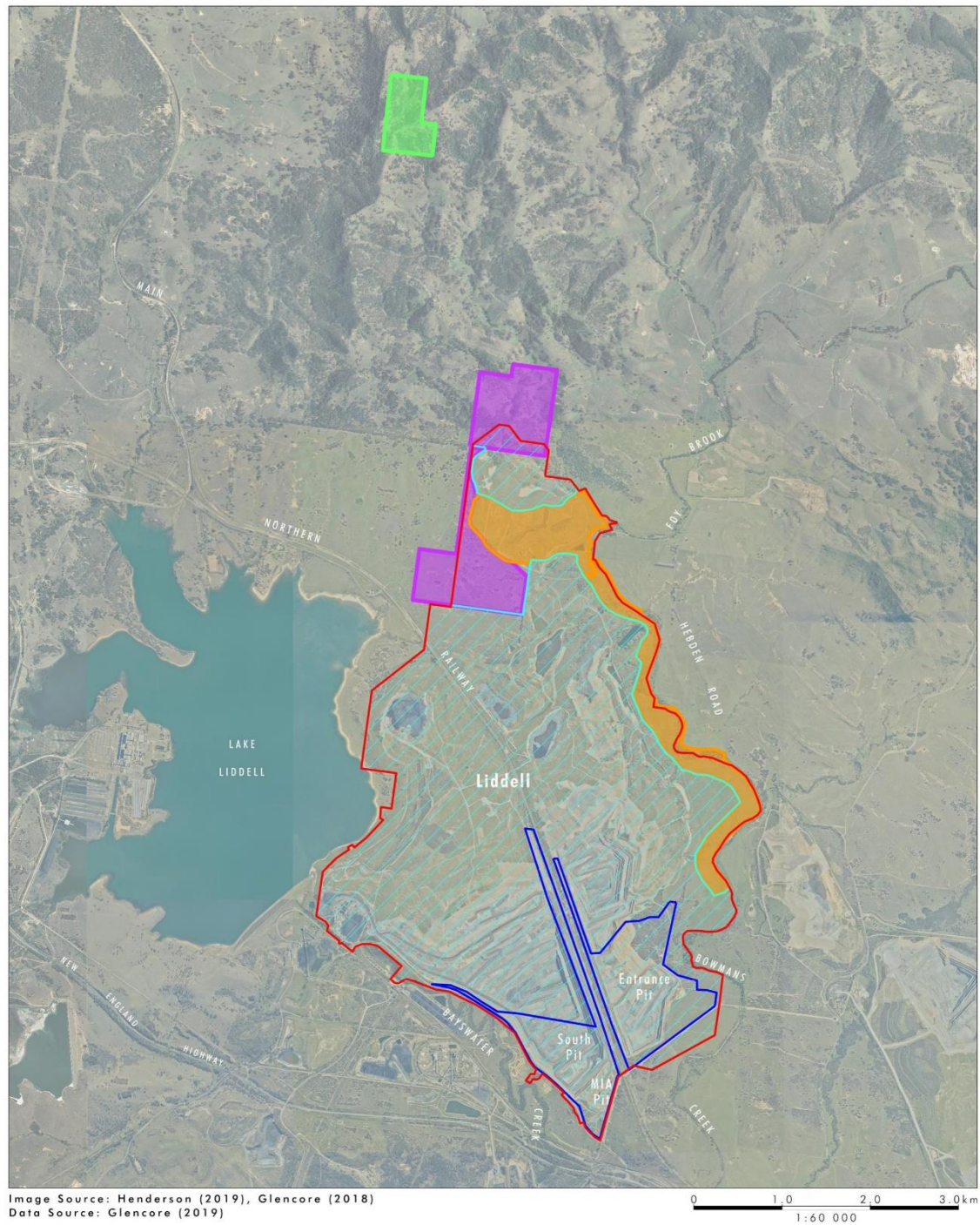
- Identify and describe the land that will be managed in accordance with this BMP;
- Provide clear and concise management measures for the BMP Area to adhere to the State and Commonwealth approval conditions (**Section 1.3**) and to minimise the impacts of key threats;
- Provide a working schedule for the implementation of activities required in the BMP; and
- Describe monitoring, performance evaluation and reporting procedures that are informative, practical and achievable.



Locality Map

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Figure 1 Locality Map



Legend

- ▬ Liddell Coal Operations Approved DA Boundary
- ▬ Approved Modification Area
- ▬ Mountain Block Offset Area (State/Commonwealth Offset)
- ▬ Bowman's Creek Riparian Corridor Offset Area (State/Commonwealth Offset)
- ▬ Mitchell Hills South Offset Area (Commonwealth Offset)
- ▬ Biodiversity Management Plan Area

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**Liddell Coal Operations
Biodiversity Offset Areas**

Figure 2 Biodiversity Offset Areas

1.3 Commitments and Statutory Requirements

This BMP has been prepared to address the relevant components of conditions 2, 3 and 4 of the Commonwealth EPBC Act project approval 2013/6908 and Condition 29 the EPA Act approval DA 3015-11-01 Modification 7. The details of these conditions and reference to where they are addressed in this BMP are provided in **Table 1**.

Condition	Relevant Section of BMP
EPBC Act Project Approval 2013/6908	
2. To protect threatened species, the approval holder must prepare and submit a Biodiversity Management Plan to the Minister for approval prior to commencement of the action. This Plan must contain detail of the following mitigation measures:	
a) Fencing and access control;	Section 4.1
b) Weed control;	Section 4.12
c) Feral animal control;	Section 4.13
d) Bushfire management;	Section 4.17
e) Habitat enhancement measures;	Section 4.15
f) Tree-felling procedure;	Section 4.8
g) Indirect impact mitigation measures; and	Section 4.18
h) Adaptive management.	Section 8.0
3. The approval holder must not commence the action until the Biodiversity Management Plan required under Condition 2 has been approved by the Minister. The approved Plan must be implemented.	
4. The Biodiversity Management Plan required under condition 2, must include the following information, which must be specific, measurable, realistic and time-bound in relation to each measure listed in condition 2;	
a) environmental objectives;	Section 1.2
b) performance criteria;	Section 6.0
c) methodology;	Section 4.0
d) duration and frequency of actions to be implemented;	Section 4.0
e) monitoring and reporting of the effectiveness of the measures;	Section 5.0
f) corrective actions;	Section 7.0

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g) criteria for triggering corrective actions, should performance criteria not be met; and	Section 7.0
h) responsibility for implementation.	Section 1.4
Schedule 3 Condition 28. Prior to the construction of Dam 13B, the Applicant must undertake habitat enhancement measures to Dam 3 to increase habitat for water birds to the satisfaction of OEH and the Secretary. The Applicant must in addition establish a dam in the Mountain Block Area to provide habitat for waterbird species to the satisfaction of OEH and the Secretary. Where achievable, the habitat enhancement measures for each dam must include: a) a maximum water depth of 5 metres over at least half the surface area; b) gently sloping banks (apart from the dam wall) of less than 10 degrees; c) areas of shallow back water around the dams; d) appropriate levels of vegetation; and e) appropriate fencing and signposting.	Section 4.14
Schedule 3 Condition 29. The Applicant must prepare and implement a detailed Biodiversity Management Plan for the site to the satisfaction of the Secretary. This plan must:	
a) be prepared in consultation with OEH and be submitted to the Secretary for approval by the end of May 2015, unless otherwise agreed by the Secretary;	Appendix C
b) describe how the implementation of the offset strategy would be integrated with the overall rehabilitation of the site (see below);	Biodiversity Offset Management Plan
c) include:	
i. a description of the short, medium and long term measures that would be implemented to:	
• implement the offset strategy; and	Biodiversity Offset Management Plan
• manage the remnant vegetation and habitat on the site in the offset areas;	Biodiversity Offset Management Plan
ii. detailed performance and completion criteria for the implementation of the offset strategy;	Section 6.0
iii. a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for;	Section 6.0

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implementing revegetation and regeneration with the disturbance areas and offset areas, including establishment of canopy, sub-canopy (if relevant), understorey and ground strata;	Section 4.11
protecting vegetation and soil outside the disturbance areas;	Section 4.10
rehabilitating creeks and drainage lines that occur on the site;	Section 4.5
managing salinity;	Section 4.4
conserving and reusing topsoil;	Section 4.3
undertaking pre-clearance surveys;	Section 4.8
managing impacts on fauna;	Section 4.8 Section 4.15
collecting and propagating seed;	Section 4.7
salvaging and reusing material from the site for habitat enhancement;	Section 4.8 Section 4.15
salvaging, transplanting and/or propagating threatened flora in accordance with the Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al., 2004);	Section 4.9
controlling weeds and feral pests including investigating alternate technologies to reduce poisoning of non-target species	Section 4.12 Section 4.13
managing grazing and agriculture;	Section 4.16
controlling access;	Section 4.1
bushfire management;	Section 4.17
habitat enhancement works;	Section 4.15
seasonal monitoring of in-stream and riparian ecological condition;	Section 5.0
survey of stygofauna in Bowmans Creek alluvial aquifer (prior to predicted drawdown); and	Section 5.0
monitoring of stygofauna populations every 6 months following the occurrence of the predicted drawdown;	Section 5.0
iv. a seasonally-based program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;	Section 5.0

v. a description of the potential risks to successful revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and	Section 7.0
vi. details of who would be responsible for monitoring, reviewing and implementing the plan.	Section 1.4

Table 1 Project Approval Conditions Relevant to BMP

The BMP follows (where appropriate) the Hunter Valley Coal Mines: Best Practice Guidelines for Biodiversity Offset Management Plans (Department of Planning and Infrastructure 2014).

1.4 Roles and Responsibility

Responsibility for the implementation of the BMP lies with LCO, with input from external specialists and contractors as required. **Table 2** lists the key roles and responsibilities of specific LCO positions concerning the implementation of the BMP.

Role	Accountabilities for this Role
Operations Manager	Sufficient time and resources are allocated to allow for the implementation of biodiversity management and monitoring strategies as outlined in the BMP.
Environment & Community Manager	Allocate sufficient resources and time for the implementation of the BMP programs. The results of the BMP monitoring programs and research trials are utilised to refine closure criteria as well as to evaluate the effectiveness of biodiversity management practices to facilitate continual improvement. Periodically review progress against performance indicators and completion criteria. Internal and external reporting requirements are met, including necessary revisions of the BMP. All relevant records are effectively maintained. Authorisation of clearing activities in accordance with the BMP through the Ground Disturbance Permit process.
Environment & Community Coordinator and Officer	Coordinate day to day implementation of the BMP, including design and implementation of biodiversity management activities and as delegated by the Environment and Community Manager; Coordinate monitoring activities as per the BMP and Glencore standards; Coordinate reporting requirements relating to rehabilitation in the Annual Review (AR) and Mining Operations Plan (Rehabilitation Management Plan (RMP)). Complete inspections of clearing activities in accordance with the BMP through the Ground Disturbance Process.
All Persons	Undertake activities directly in accordance with the requirements of the BMP, as directed by the Environment and Community Manager, Environment and Community Coordinator and Officers. Any potential or actual issues, including environmental incidents, are reported to their immediate supervisor.

Table 2 BMP Roles and Responsibilities

1.5 Authority Consultation

In accordance with Schedule 3 Condition 29 (a) the BMP has been developed in consultation with The NSW Office of Environment and Heritage. Correspondence relating to this is contained in **Appendix C**.

The BMP has also been reviewed and approved by the Department of Environment (the Australian Government Department administering the EPBC Act) on the 14 May 2015. Correspondence relating to this is contained in Appendix D.

2 Environmental Context

A detailed description of the baseline biodiversity conditions of LCO is provided in the following key documents:

- Ecological Assessment – Liddell Coal Operations Extension Project (Umwelt 2013a);
- Liddell Coal Operations Mine Extension Project: Fauna Survey, Final Report (Eco Logical Australia (ELA) 2013a);
- Liddell Coal Mine Modification 5 - Aquatic Ecology and Groundwater Dependent Ecosystem Assessment (ELA 2013b)
- Liddell Coal Flora and Fauna Management Plan (Umwelt 2003); and
- Ecological Assessment – Liddell Coal Operations DA305-11-01 Modification 7 (Umwelt 2018).

The following sections provide a summary of the characteristics and biodiversity values of the BMP Area.

2.1 Location and Land Use

2.1.1 Location

LCO is located close to the northern border of the Sydney Basin Bioregion (OEH 2011), where it joins the boundary of the NSW North Coast Bioregion. The Sydney Basin Bioregion lies on the central east coast of NSW, covers an area of 3,624,008 hectares (OEH 2011) and is characterised by a temperate climate.

The LCO is within the Hunter subregion which is characterised by rolling hills, wide valleys, with the meandering Hunter River system on a wide floodplain. A diverse range of flora and fauna assemblages are likely to occur in the local area, with a mixture of coastal and inland influences. Due to the proximity to the NSW North Coast Bioregion, the LCO also displays environmental characteristics of this bioregion.

2.1.2 Land Tenure

The BMP Area is contained within lands owned by Liddell Coal Operations Pty Limited. LCO is operated and managed by Liddell Coal Operations Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore), on behalf of a joint venture between Glencore (67.5 per cent) and Mitsui Matsushima Australia (32.5 per cent).

2.1.3 Land Use History

The BMP Area has been under continuous mining operation since the 1950's. Prior to this, the land was primarily subject to agriculture (predominantly grazing) and its associated clearing has resulted in a heavily modified and fragmented landscape.

Mining has been conducted in the area since the early part of the century. Records indicate underground mining commenced in 1923 at Oaks Colliery with early workings exploiting shallow coal on the eastern limb of the Bayswater syncline near Lake Liddell.

The area surrounding LCO is heavily dominated by numerous mining and power generating activities. Surrounding current mining operations include Ravensworth Operations to the south, Ravensworth Underground Mine and the Ravensworth Central Coal Processing facility to the south west, and the Mt Owen Complex (incorporating Mt Owen, Ravensworth East and Glendell mining operations) to the east. The remaining land within the vicinity of LCO is characterised by traditional agricultural activities, mostly comprising low intensity grazing.

None of the vegetation communities recorded in the BMP Area (as per Umwelt 2013a) can be currently considered 'old growth' vegetation. Old growth refers to any vegetation that was present at the time of European arrival in Australia that still remains in essentially similar condition. The extant vegetation in the BMP Area is predominately 'regrowth' vegetation, that is, it has been previously cleared of forest and woodland vegetation and its present extent is based entirely on natural regeneration. Regrowth is, ecologically, any native vegetation that has been cleared and has regrown since that time.

2.1.4 Land Security

The requirements of this BMP apply to all LCO operational lands (being the BMP Area). These lands are all under the ownership and/or control of Liddell Coal Operations Pty Limited.

3 Baseline Environmental Conditions

3.1 Climatic Information

Table 3 below provides the relevant average climactic conditions for the area collated from the St Heliers Weather Station (Muswellbrook) (BOM 2019) and the LCO onsite meteorological station to provide local historic climate. This data can be utilised to determine appropriate seasons for rehabilitation and revegetation works.

Rainfall (mm)			Temperature (°C)					
	St Heliers	LCO	Singleton			LCO		
	Mean	Mean	Mean	Highest Monthly Mean	Lowest Monthly Mean	Mean	Mean High	Mean Low
January	60.0	90.0	32.1	36.0	28.9	32.8	32.8	19.4
February	60.7	47.5	30.7	34.8	26.4	31.0	31.0	18.2
March	62.8	100.3	28.3	30.3	26.1	28.4	28.4	17.3
April	35.6	18.9	24.9	27.5	22.5	25.3	25.3	14.4
May	41.8	27.0	21.6	23.3	19.9	21.6	21.6	11.1
June	51.9	43.8	18.1	19.7	16.2	17.7	17.7	9.4
July	37.1	19.4	18.0	19.9	16.5	18.1	18.1	8.0
August	40.3	36.5	19.9	22.1	17.7	19.6	19.6	8.5
September	44.2	35.0	23.5	26.6	21.5	23.2	23.2	10.9
October	44.9	34.4	26.3	29.3	23.1	27.1	27.1	13.2
November	74.3	74.6	28.8	32.1	26.3	28.9	28.9	15.6
December	64.0	79.7	30.3	34.8	25.2	31.4	31.4	17.8

Table 3 Climatic Data

Rainfall observations were taken from Muswellbrook (St Heliers Weather Station) (1992 to 2019) and Temperature Observations were from Singleton STP (2002 to 2019) (BOM 2019)

3.2 Physiography, Geology and Soils

LCO is situated centrally on the Hunter Valley floor, within the 22,000 km² Hunter catchment which is drained by the Hunter and Goulburn Rivers and their tributaries. The BMP Area is situated approximately 100 kilometres from the coast and 140 kilometres from the western extremity of the Hunter catchment at the Great Dividing Range.

The central Hunter Valley is characterised by relatively gentle undulating hills, broad river valleys and floodplains. To the south are the dissected sandstone plateaux of Wollemi and Yengo National Parks, while to the north the foothills of the Barrington Tops and Mount Royal Range adjoin the Hunter Valley floor, which is bounded by the Hunter Thrust System (Peake 2006). To the east and west extend the highly eroded Permian lowlands of the floor of the Hunter Valley.

The central Hunter Valley lies at the intersection of the north-eastern margin of the Sydney Basin and the south-eastern margin of the New England Fold Belt. The Sydney Basin extends from the South Coast of NSW well into the central Queensland Coast (Hawley & Brunton 1995), and it mostly consists of a thick Permian-Triassic rock succession formed during early Permian rifting, and contains large reserves of coal.

The central Hunter Valley is primarily underlain by four major geological periods: Carboniferous; Permian; Triassic and Quaternary. To a lesser extent it is also underlain by Jurassic and Tertiary periods. Carboniferous rocks mostly underlie the areas in the north-east of the region and are a combination of erosion resistant marine, volcanic, conglomerate, and limestone sediments; these typically form steep-sided hills and valleys. Permian rocks make up the majority of the region and mostly consist of the moderately erosion resistant Singleton Coal Measures, conglomerate, sandstone, shale, tuff, and some lava beds which typically form low, undulating hills. The Triassic rock is mostly located in areas in the north-west, west, and south of the central Hunter Valley and consists of highly erosion resistant sandstone which tends to form infertile, rugged country. Quaternary sediments are mostly identified along and in proximity to the major rivers and creeks of the central Hunter Valley.

Within the Sydney Basin, LCO is located in the Hunter Coalfield. The coal-bearing sedimentary rocks within LCO include the Foybrook Formation, with the Vane Subgroup of the Whittingham Coal Measures, which form the lower part of the Singleton Supergroup.

Soil landscapes present in the BMP Area are the Liddell (ld), Hunter (hu) and Rosevale soil landscapes. The Liddell soil landscape dominates the area, with a smaller amount of the Hunter soil landscape occurring in the east and a small extent of the Rosevale soil landscape occurs across the north.

3.3 Biodiversity Values

The following section provides detail on the biodiversity values recorded within the BMP Area. It is noted that these results are gained primarily from the Ecological Assessment – Liddell Coal Operations Extension Project (Umwelt 2013a) and Liddell Coal Operations Mine Extension Project: Fauna Survey, Final Report (Eco Logical Australia (ELA) 2013a). These both covered the Approved Modification Area only (see **Figure 2**). Outside of the Approved Modification Area and three approved biodiversity offset areas, there is very little remnant vegetation (and thus biodiversity value) within the BMP Area.

3.3.1 Vegetation Community Mapping

Since commencement of operations within the Modification 5 Extension area in 2015, authorised clearing has occurred in accordance with the development consent and BMP.

Table 4 below summarises the vegetation communities mapped within the BMP Area during the 2013 Ecological Assessment (Umwelt (2013a), as well as the current presence of BMP Area vegetation communities (following approved clearing and subsequent rehabilitation works).

The initial vegetation mapping followed consideration of the field data collected by ELA in 2011 and the conduct of verification surveys by Umwelt in 2012. This table also includes vegetation mapping from Peake (2006) and Umwelt

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(2001) for areas outside of the BMP Area. The current vegetation communities of the BMP Area as of the end of 2018 are depicted in *Figure 3*.

Community	PCT	Status	Extent in Biodiversity Management Plan Area (hectares) (2015) ¹	Extent in BMP Area (hectares) (end 2018) ²
Central Hunter Ironbark Forest	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	EEC (BC Act) CEEC (EPBC Act)	5	2.61
Central Hunter Box – Ironbark Woodland	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	EEC (BC Act) CEEC (EPBC Act)	31	35.48
Central Hunter Box – Ironbark Woodland (Rough-barked Apple dominated)	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	EEC (BC Act) CEEC (EPBC Act)	1	-
Central Hunter Box – Ironbark Woodland (Regrowth)	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter (Regrowth)	EEC (BC Act) CEEC (EPBC Act)	34	9.58
Central Hunter Box – Ironbark Derived Native Grassland	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter DNG	Small areas fringing remnant vegetation likely consistent with CEEC (EPBC Act)	65	24.48
Narrow-leaved Ironbark – Spotted Gum Woodland	1602 -Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	EEC (BC Act)	-	3.10
Narrow-leaved Ironbark – Spotted Gum Woodland DNG	1602 -Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter DNG	-	-	3.14
Central Hunter Swamp Oak Forest	1731 – Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	-	7	2.31

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Central Hunter Bulloak Forest	1692 – Bull Oak Grassy Woodland of the Central Hunter Valley	-	66	0.39
Central Hunter Bulloak Forest Regeneration	1692 – Bull Oak Grassy Woodland of the Central Hunter Valley (Regrowth)	-	-	19.55
Grey Myrtle – Kangaroo Vine Dry Rainforest and Rusty Fig Dry Rainforest	1614 - Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig open forest on ranges of the Upper Hunter	-	-	5.23
Hunter Valley River Oak Forest	485 - River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	-	1.4	1.41
Rehabilitated Grassland	-	-	197	717.70
Rehabilitated Native Woodland	-	-	-	137.64
Rehabilitated Pasture	-	-	-	50.73
Rehabilitation	-	-	-	14.08
Dam	-	-	-	0.06
Disturbed Land	-	-	68	200.71
Total			475	1,228.19

Table 4 Vegetation Communities of the BMP Area

Note: All values have been rounded up to the nearest two decimal places. All values subject to minor mapping/GIS-based variation.

¹ Numbers did not include rehabilitation works that had been completed

² Numbers include rehabilitation

BC : *Biodiversity Conservation Act 2016*

CEEC : critically endangered ecological community

DNG: derived native grassland

EEC: endangered ecological community

EPBC: *Environment Protection Biodiversity Conservation Act 1999*

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The first four vegetation communities (or variants thereof) conform to the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions endangered ecological community (EEC) listing under the Biodiversity Conservation Act 2016 (BC Act). Although it was not listed at the time of assessment, it is likely that these vegetation communities are also consistent with the Central Hunter Valley Eucalypt Forest and Woodland critically endangered ecological community (CEEC) (listed under the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) during 2015).

The Narrow-leaved Ironbark – Spotted Gum Woodland is consistent with Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (listed under the BC Act).

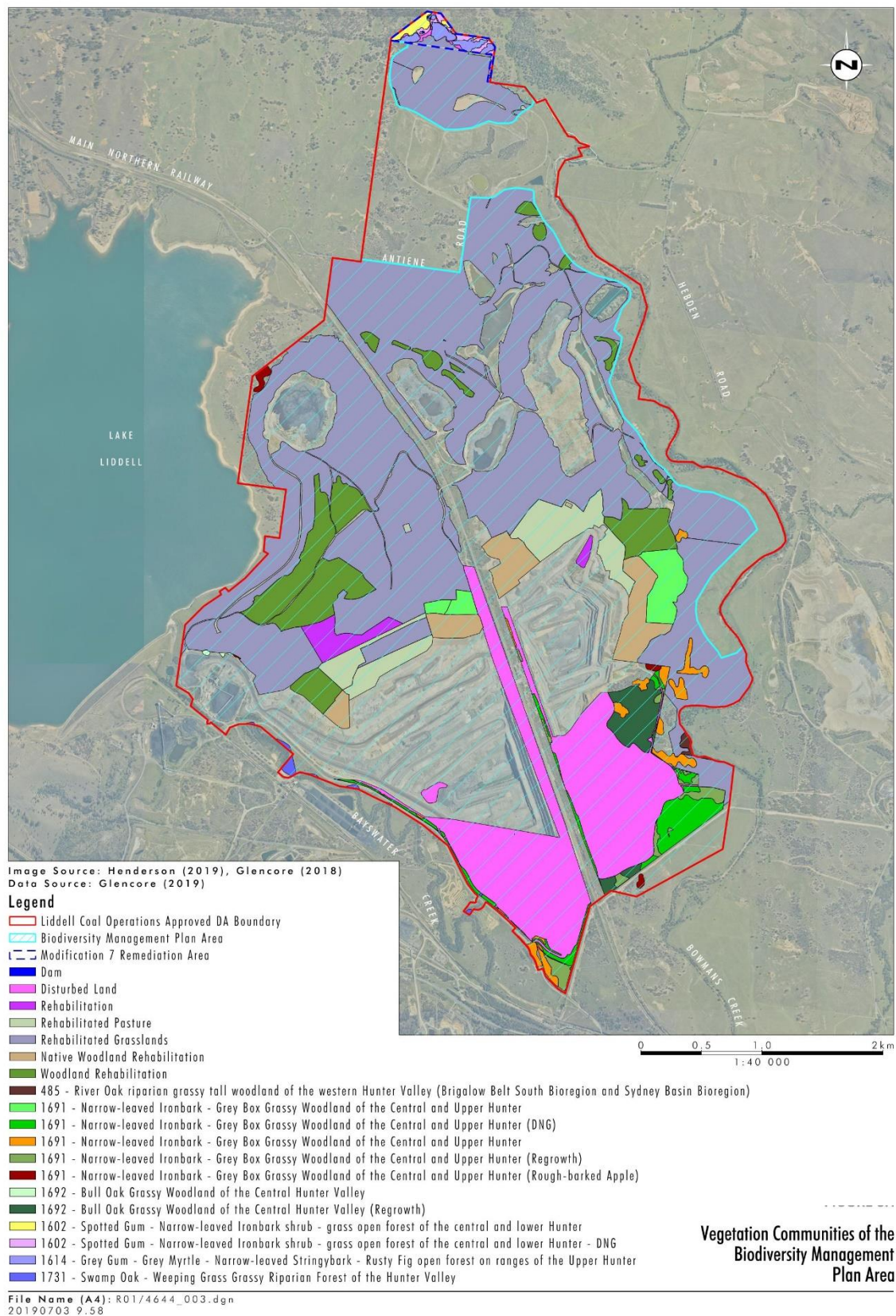


Figure 3 Vegetation Communities of the BMP Area

3.3.2 Fauna Habitats and Species

The broad fauna habitat types of grassland, riparian, woodland/forest and aquatic habitat found within LCO are representative of the habitat types occurring broadly across the Hunter Valley floor. All habitats in the region have been extensively cleared or modified for agriculture, largely for cattle grazing, and mining. Communities occurring on floodplains and more fertile soils on the Hunter Valley floor have been most extensively cleared (Peake 2006). Because of the widespread clearing of habitats in the region, those remaining contain important refuges for a number of fauna species.

Woodland and forests of the central Hunter Valley floor are characterised by a dry environment with little or no standing water. Habitat is provided by a moderately open canopy and a sclerophyllous understorey that ranges from very dense to sparse, while the ground cover is generally sparse and dominated by grasses and forbs.

Alluvial forests generally provide denser vegetation cover than woodland and forest habitats. The relatively larger sizes of eucalypt trees supported by the alluvial soils often also provide larger-sized hollows than those found on surrounding, drier slopes and ridges. The alluvial sites also provide ephemeral standing and moving water, with small wetlands and farm dams occurring in some areas. Aquatic habitat provided by farm dams and ephemeral creek lines and drainage lines are common across the undulating landscape surrounding the BMP Area.

Grassland habitats are dominated by a range of native and naturalised perennial grasses and forbs. The health and integrity of the vegetation largely corresponds with the grazing history, particularly grazing intensity with many grassland habitats formed as a result of the clearing of woodland well over 100 years ago. The grass and forb dominated groundcover includes log and stump cover that provides habitat for grassland mammals (small and large), birds and terrestrial reptile species. The highly scattered trees throughout the grassland provided nesting, roosting and perching habitat for bird species, roosting habitat for some micro-bat species and shade for larger grazing mammal species.

Connectivity between vegetation remnants within LCO with adjoining vegetated areas is poor. The remnant vegetation within the LCO is sparse and consists of variably sized patches surrounded by grasslands and cleared land. The main linkages are along creeklines, particularly those of Bowmans Creek to the east and of Bayswater Creek to the south; however this linkage is very narrow.

The areas surrounding LCO generally comprise fragmented valley floor woodlands and riparian forests, with native and exotic grasslands derived from previous clearing of woodland and forests.

3.3.3 Threatened and Migratory Species

The following threatened and migratory species (see **Table 5** below) have been recorded within the BMP Area as part of various ongoing surveys including impact assessment and monitoring works.

Common Name	Scientific Name	Status	
		BC	EPBC
Threatened Flora			
Tiger orchid	<i>Cymbidium canaliculatum</i>	EP	-
Threatened Fauna			
Blue-billed duck	<i>Oxyura australis</i>	V	-
Brown treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-
Brush-tailed phascogale	<i>Phascogale tapoatafa tapoatafa</i>	V	-
Eastern bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	V	-

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Eastern cave bat	<i>Vespadelus troughtoni</i>	V	-
Eastern false pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	-
Eastern freetail bat	<i>Mormopterus norfolkensis</i>	V	-
Eastern grass owl	<i>Tyto longimembris</i>	V	-
Greater broad-nosed bat	<i>Scoteanax rueppellii</i>	V	-
Grey-crowned babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V	-
Hooded robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	V	-
Large-eared pied bat	<i>Chalinolobus dwyeri</i>	V	V
Little bentwing-bat	<i>Miniopterus australis</i>	V	-
Little eagle	<i>Hieraaetus morphnoides</i>	V	-
Australian painted snipe	<i>Rostratula benghalensis australis</i>	E	E, M
Southern myotis	<i>Myotis macropus</i>	V	-
Speckled warbler	<i>Chthonicola sagittata</i>	V	-
Spotted harrier	<i>Circus assimilis</i>	V	-
Spotted-tailed quoll (south-east mainland population)	<i>Dasyurus maculatus maculatus</i>	V	E
White-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	V	M
Yellow-bellied sheath-tailed bat	<i>Saccolaimus flaviventris</i>	V	-
Migratory Species			
Rainbow bee-eater	<i>Merops ornatus</i>		M
Great egret	<i>Ardea alba</i>		M
Cattle egret	<i>Ardea ibis</i>		M
White-throated needletail	<i>Hirundapus caudacutus</i>		M
Satin flycatcher	<i>Myiagra cyanoleuca</i>		M

Table 5 Threatened and Migratory Species recorded within BMP Area

E	endangered
EP	endangered population
EPBC	Environment Protection and Biodiversity Conservation Act 1999
M	Migratory
BC	Biodiversity Conservation Act 2016
V	vulnerable

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In addition to species listed in **Table 5**, four species were identified as key biodiversity offset drivers for the Modification 5 project, despite not having been recorded within the BMP Area. These were included based on their legislative significance, and presence of potential habitat within the Approved Modification Area:

- regent honeyeater (*Anthochaera phrygia*) – critically endangered (BC Act and EPBC Act);
- swift parrot (*Lathamus discolor*) – endang (BC Act) and critically endangered EPBC Act);
- large-eared pied bat (*Chalinolobus dwyeri*) – vulnerable (BC and EPBC Act); and
- green and golden bell frog (*Litoria aurea*) – endangered (BC Act) and vulnerable (EPBC Act).

3.3.4 Introduced Species

The introduced fauna species identified in **Table 6** have been identified within the BMP Area.

Common Name	Scientific name
fox	<i>Vulpes vulpes</i>
pig	<i>Sus scrofa</i>
dog/dingo	<i>Canis familiaris</i>
rabbit	<i>Oryctolagus cuniculus</i>
hare	<i>Lepus capensis</i>
common starling	<i>Sturnus vulgaris</i>
common myna	<i>Sturnus tristis</i>
fallow deer	<i>Dama dama</i>
black rat	<i>Rattus rattus</i>

Table 6 Introduced Fauna Species Recorded within BMP Area

In addition to these species, the feral cat (*Felis catus*) is highly likely to be present, albeit not recorded.

The introduced flora species provided in **Table 7** have been identified within the BMP Area and have legislative status as listed under the Biosecurity Act 2015 or environmental weeds or as key threatening processes (KTPs).

Common Name	Scientific name	Legislative Status
African boxthorn	<i>Lycium ferocissimum</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty
African olive	<i>Olea europaea</i> subsp. <i>cuspidata</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty Specific Regional recommendation measures for Hunter Region
		Invasion of native communities by this species is listed as a KTP under the TSC Act
Blackberry	<i>Rubus fruticosus</i>	<i>Biosecurity Act 2015:</i>

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		General Biosecurity Duty Specific Regional recommendation measures for Hunter Region
Castor Oil Plant	<i>Ricinus communis</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty
Coolatai grass	<i>Hyparrhenia hirta</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty Specific Regional recommendation measures for Hunter Region
Galenia	<i>Galenia pubescens</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty
Mother of millions	<i>Bryophyllum delagoense</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty Specific Regional recommendation measures for Hunter Region
	<i>Bryophyllum daigremontianum</i>	
Pampas grass	<i>Cortaderia selloana</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty Specific Regional recommendation measures for Hunter Region
Prickly pear	<i>Opuntia stricta</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty Prohibition on dealings Class 4 noxious weed
Creeping pear	<i>Opuntia humifusa</i>	
St John's Wort	<i>Hypericum perforatum</i>	<i>Biosecurity Act 2015:</i> General Biosecurity Duty

Table 7 Introduced Flora Species with Legislative Status Recorded within BMP Area

KTP key threatening process

While not having any specific legislative status, the golden wreath wattle (*Acacia saligna*) is likely to be highly problematic to rehabilitated areas if not appropriately managed.

3.4 Modification 7 Remediation Area

On 12 February 2019, Development Application (DA) 305-11-01 Modification 7 was approved. Modification 7 was for the minor amendment of the DA boundary to incorporate a portion of the Mountain Block BOA to facilitate required remediation and rehabilitation works. The location of the Modification 7 boundary is provided on Figure 3.1.

The approved works are required in order to remediate extensive erosion, correct landform stability issues, and assist in achieving positive biodiversity outcomes within the BOA. These activities are required for the improvement of biodiversity values within the Mountain Block BOA in the medium to long term.

The Modification 7 Area is being managed under the provisions of the BMP until it has been fully stabilised and revegetated, following which management and monitoring obligations will be transferred back to the BOMP.

The Modification 7 Area contains the vegetation communities specified in **Table 8** (separated out from **Table 4**).

Plant Community Type	Status	Area (hectares)	
		Modification 7 Area	Extent Proposed for Disturbance
1602 – Spotted Gum - Narrow-leaved Ironbark Shrub – Grass Open Forest of the Central and Lower Hunter	Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC	3.10	<0.01
1602 – Spotted Gum - Narrow-leaved Ironbark Shrub – Grass Open Forest of the Central and Lower Hunter - DNG	-	3.20	0.26
1614 – Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig Open Forest on Ranges of the Upper Hunter	-	5.32	0.71
Disturbed Land	-	3.13	2.50
Water Bodies	-	0.06	0.03
Total		14.81	3.50

Table 8 Vegetation Communities of the Modification 7 Area (including those proposed to be disturbed)

Note: All values have been rounded up to the nearest two decimal places. All values subject to minor mapping/GIS-based variation.

4 Management and Enhancement Strategies

The following biodiversity management and enhancement strategies will be undertaken across the BMP Area, as required. The majority of these strategies are also relevant to the management of the LCO BOAs; however measures that specifically relate to offset management are addressed within a separate BOMP

The following strategies have been developed for the BMP Area to ensure that the various conditions of the State and Commonwealth approvals (**Table 1**) are met. The management actions committed to as part of the BMP will prove of benefit to all native flora and fauna species within the BMP area. Appendix A identifies how the management actions will specifically benefit the target MNES for this area (being the spotted-tailed quoll, regent

honeyeater and swift parrot). Inspections targeting the below management and enhancement measures in BMP areas are completed on a bi-monthly basis and are used to ensure corrective measures are implemented as identified.

4.1 Fencing, Signage and Access Control

Within the BMP area, retained vegetation and waterways (outside of the Approved Modification Area) and rehabilitation/regeneration areas across the BMP Area will be appropriately protected from human-induced impacts such as damage from vehicles or trampling, increased rubbish dumping, unplanned grazing and alteration to normal fauna behaviour patterns due to human presence. Fencing will be used (where needed), to exclude grazing from elements of the BMP area where grazing is undesirable i.e. woodland rehabilitation areas, pasture rehabilitation <3yrs old, and riparian zones.

Fencing and access control will be used to protect existing vegetation from accidental disturbance and will clearly demarcate areas of vegetation to be retained and protected. In areas where fencing is deemed as being unsuitable, appropriate signage will be used in its place. Signage will exclude access (where appropriate), instruct vehicles to remain on formed tracks only, or highlight sensitive ecological areas to be avoided.

Any new fencing used within the BMP Area will use no barbed wire on the upper strands, and as little barbed wire generally as possible. This will ensure as minimal impact on native species as possible. The minimal usage of barbed wire from fencing will minimise potential injury or death of fauna species, particularly macropods and gliding or flying mammals and threatened micro-bats. Fencing design will also consider the use of as few wire strands as practical to reduce potential for fauna entanglement.

In addition, any new fencing will use plain wire on the bottom strand and this strand will be of a height that allows faunal passage underneath. It is noted however, that this design will need to ensure that cattle cannot push underneath the bottom strand and thus gain access to the BMP Area or adjoining offset areas.

LCO will conduct an inspections of the BMP area to assess its condition and identify areas where new fencing is needed or repairs needed for existing fencing. Existing fencing that is deemed as unnecessary will be gradually removed (prioritising barbed wire fences), to allow free movement of native fauna within areas of remnant vegetation.

In addition, in onsite areas where road-based traffic is passing through or in proximity to known spotted-tailed quoll habitat, LCO will install signs to make drivers aware of potential activity.

4.2 Access Track Maintenance

Where practical, access to work areas will be confined to existing tracks. Prior to the construction of new access tracks / roads within the BMP (including any works requiring additional ground disturbance), due diligence ecological inspections will be undertaken by a suitably qualified ecologist to search for threatened flora species, endangered populations and important habitat for threatened fauna species, such as hollow-bearing trees and dams. Any ground disturbance will be carried out under the Ground Disturbance Permit process. Should these be identified, LCO will implement measures to minimise impacts on these features, including the redesign of the layout of access tracks/roads. The measures to be undertaken to minimise impacts on these features include:

- designing the access tracks for the minimisation of environmental impacts including
- minimising the length and width of the track;
- undertaking pre-clearance surveys (through the GDP process) in the proposed areas for track construction to determine constraints to track construction;
- where clearance of habitat trees is required, undertaking clearing activities in accordance with site procedures including the LCO Tree Felling Procedure; and

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- topsoil stripped for the construction and maintenance of tracks will be stockpiled onsite for reuse in other areas onsite.

In accordance with the Rural Fires Act 1997, in the event of a declared bushfire emergency, all efforts will be made to reduce and/or eliminate the fire hazard/risk. This may include the construction of emergency access tracks/roads to enable firefighting personnel access to the fire front and/or the construction of fire breaks without undertaking a due diligence assessment prior to clearing activities.

Erosion and sediment control structures as outlined in Section 4.5 will, where necessary, be established in conjunction with any tracks constructed through the BMP Area. Construction of erosion and sediment control structures will also be considered in the maintenance of access tracks.

4.3 Topsoil Management

Incorrect handling and storage of topsoil (proposed for re-use) has the potential to spread weed species and pathogens. As such, topsoil handling protocols are to be implemented to manage the potential for a reduction in ecological value as a result of inappropriately stored and managed topsoil. Where topsoil is available, the following measures will be adopted to protect its quality and enhance rehabilitation outcomes where practical:

- where deemed a potential threat to future rehabilitation success, weed infested areas will be sprayed prior to topsoil stripping. Particularly weedy areas may require multiple spraying events prior to stripping, to minimise the impacts of weeds on stockpiles and eventually in rehabilitation areas. Noxious weeds requiring management are identified with recommendations made during pre-clearance inspections of clearing areas prior to topsoil being stripped;
- Depth of stripping will be determined in accordance with the soils distribution plan (as per LCO Land Clearing and Topsoil Stripping Procedure)
- where possible, topsoil will be stripped when moist to help maintain soil structure and to reduce dust generation;
- topsoil will be stockpiled separately to subsoil, where appropriate;
- topsoil stockpiles are to be located away from mining, traffic areas and watercourses;
- level or gently sloping areas will be selected as stockpiles sites to minimise erosion and potential soil loss;
- where appropriate, sediment controls will be installed at the base of stockpiles to prevent soil loss;
- stockpiles will be generally less than three metres high and will be set out in windrows to maximise surface exposure and biological activity. They will be shaped to gently rounded mounds;
- stockpiled soils will be subject to erosion control measures to prevent stockpile erosion and ensure topsoil retain seed stock and nutrients;
- stockpiled topsoil will be used as soon as practicable to minimise loss of seed stock;
- stockpiles to be kept longer than three months will be sown with a suitable pasture or cover crop to minimise soil erosion and invasion of weed species;
- weed growth will be monitored and subsequently controlled if necessary;
- prior to re-spreading, weed growth will be sprayed or scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas;
- stockpiles will be appropriately demarcated with signage to identify the area and minimise the potential for unauthorised use or disturbance; and
- where available topsoil will be spread over rehabilitation areas prior to commencement of seeding and planting works.

The source, stockpile location and final in-situ location for all topsoil stockpiles is maintained within a topsoil register.

4.4 Erosion, Sedimentation and Salinity

LCO currently completes erosion and sediment control works in accordance with the LCO Erosion and Sediment Control Plan (LCO 2018, included within the LCO Water Management Plan). These works prevent loss of valuable topsoil and sedimentation of local waterways.

Owing to the moderate cover of vegetation across non-operational areas of LCO, erosion is not currently a significant management issue. Inspections of areas of erosion concern should be included in routine inspection surveys, targeting riparian areas and sites with limited vegetation cover (particularly newly rehabilitated sites).

If an area of significant erosion concern is identified, appropriate short term erosion and sediment controls will be implemented and longer term stabilisation actions such as vegetation establishment will be investigated.

The revegetation process has the potential to create erosion issues through the removal of ground covering vegetation and disturbing the soil profile. Minimising the area of exposed soil and ripping along contours will limit the amount of erosion in revegetation areas. All revegetation areas and watercourses will be monitored for evidence of erosion and corrective actions (e.g. remedial earthworks, groundcover planting, and soil amelioration) will be implemented where required.

Erosion and sediment mitigation will be put in place by LCO prior to any construction activities, as well as for any topsoil and subsoil stockpiles and for areas of erosion concern identified. Controls will be developed in accordance with relevant guidelines for erosion and sediment control, including:

- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 1 (Landcom, 2004); and
- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 2E Mines and Quarries (Landcom, 2008).

Measures to be put in place will include, but not necessarily be limited to:

- catch drains to capture run-off from disturbed areas and direct runoff into sediment dams;
- clean water diversion banks and drains;
- sediment dams; and
- silt fences, hay bales or other sediment control structures.

The following general erosion and sediment management measures will additionally be implemented:

- rehabilitated final landform designs will be of appropriate slope and have appropriate drainage structures;
- the extent of disturbed areas present at any one time will be stabilised by progressive rehabilitation as soon as practicable;
- cover crops will be utilised to provide quick re-establishment of ground cover over reshaped emplacement areas for protection against wind and water erosion;
- construction of drainage controls such as table drains at roadsides and on hardstand areas will be undertaken;
- erosion and sediment controls that are not performing adequately will be repaired or redesigned.

The measures related to land rehabilitation are detailed further in the LCO Mining Operations Plan.

Dryland salinity has not been identified as an issue of concern at LCO to date. Any evidence suggesting this is an issue within the BMP Area will be documented and the appropriate management and remediation strategies implemented.

4.5 Creek and Drainage Line Protection

Creekline protection and rehabilitation works will be undertaken within the Bowmans Creek Riparian Corridor. These works, including performance indicators and completion criteria will be described in greater detail within the BOMP. Works that will be undertaken within the Bowmans Creek Riparian Corridor will include:

- fencing to prevent access by humans and livestock;
- rehabilitation and revegetation works;
- active bank stabilisation works (as required);
- bushfire protection; and
- regular monitoring for biodiversity management and erosion issues.

Each of these actions will ensure that the biodiversity and environmental values (including water quality) are protected and enhanced.

Drainage values will be protected by way of regular inspections for erosion and will identify areas requiring reparation works. Reparation works should include, but not necessarily be limited to native vegetation plantings. Any remediation of areas of erosion should be subject to follow-up monitoring inspections as well as follow-up remediation as necessary.

4.6 Pathogen Management

The three key pathogens of relevance to the BMP Area include the root rot fungus (*Phytophthora cinnamomi*), myrtle rust (*Pucciniales*) and chytridiomycosis (infection by amphibian chytrid fungus). Each of these is listed as a key threatening process (KTP) under the Biodiversity Conservation Act 2016 (BC Act). Infection of frogs by amphibian chytrid and dieback caused by the root-rot fungus *Phytophthora cinnamomi* are also KTPs under the EPBC Act.

None of these pathogens are known to occur nor has monitoring or other survey identified reasonable potential for these to be present in the BMP Area. If reasonable potential for the presence of these pathogens is identified, the potential should be further investigated by way of targeted sampling/survey to determine if they are present.

The following information (including precautionary measures to minimise potential for their occurrence) should be considered in addressing this issue.

4.6.1 *Phytophthora cinnamomi*

Phytophthora cinnamomi is a soil fungus that attacks the root (and sometimes stem) systems of plants, destroying the ability of the plant to uptake water and nutrients (Commonwealth of Australia 2001). 'Infection of native plants by *Phytophthora cinnamomi*' is listed as a KTP under the TSC Act and 'Dieback caused by the root-rot fungus *Phytophthora cinnamomi*' is also listed as a KTP under the EPBC Act.

Although not recorded within the BMP Area, this pathogen has the potential to be spread onsite as a result of soil movement during earthworks or on infected vehicles. As a precautionary measure, vehicles and machinery should be washed before entering the LCO.

If any areas are reasonably suspected to be infected with this pathogen (areas of unexplained vegetation death, for example), a targeted sampling, diagnosis and management strategy will be designed to address impacts and further spread.

4.6.2 Myrtle Rust

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae is a KTP under the EPBC Act. This fungi which attacks young growth causing plants to become stunted, distorted or necrotic, consequently impacting the viability of the host plant (NSW Scientific Committee 2011).

Although not recorded within the BMP Area, this fungi has the potential to be spread onsite as a result of introduction of infected plant material from offsite or through inappropriate onsite tree-clearing procedures of infected plants.

Particular attention will be paid to the potential presence of this pathogen during monitoring works (it is recognisable on the leaves of Myrtaceae species), as well as during pre-clearance surveys. This will enable occurrences to be managed in order to reduce potential spread. If myrtle rust is identified as being present it will require immediate control using an appropriate fungicide.

If any areas of vegetation are reasonably suspected to be infected with this fungus, a targeted sampling, diagnosis and management strategy will be designed to address impacts and further spread.

4.6.3 Chytridiomycosis

Infection of frogs by amphibian chytrid causing the disease chytridiomycosis is listed as a KTP under the BC Act and the EPBC Act. This fungus is an infectious disease affecting amphibians globally and is caused by the amphibian chytrid fungus *Batrachochytrium dendrobatidis*. It is highly virulent and known to cause anything from erratic deaths of amphibian populations to 100 per cent mortality in other populations (Threatened Species Scientific Committee 2002 and NSW Scientific Committee 2003).

Although not known to occur within the BMP Area, this fungus has the potential to be spread onsite as a result of inappropriate amphibian handling and the transfer of infected amphibians and water containing the fungus between catchments.

Key to the prevention of spread of this pathogen is an appropriate amphibian handling strategy during ecological surveys. Handling amphibians should be avoided during ecological surveys and clearing works (where possible). If unavoidable, amphibians are only to be handled in accordance with Hygiene Protocol for the Control of Disease in Frogs (DECC 2008).

4.7 Seed Collection

A seed collection and handling program aimed at maximising the viability and diversity of local seed in the revegetation mix will be implemented as part of the rehabilitation program. Where able, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tubestock for planting. However, where adverse seasonal conditions (i.e. drought) or other factors may affect the availability of local provenance seed (such as lack of remnant vegetation as a seed source), supplementation with non-local provenance seed may be required.

The existing native vegetation within the Approved Modification Area provides a valuable but limited source of endemic seed sources to be used in revegetation/rehabilitation works. Viable seed resources will be identified by suitably qualified personnel during the pre-clearing phase and (where practical), will be harvested prior to the felling of non-habitat trees. Seeds will be harvested by suitably qualified personnel and stored in accordance with ANPC guidelines.

Harvested seeds should have the following information documented:

- time of year harvested;

- scientific name;
- location of source; and
- details on habitat harvested from.

4.8 Vegetation Clearing

The pre-clearing and tree felling procedure currently implemented at LCO is robust, and aimed at reducing impact to hollow-dependent native species from clearing activities as much as possible. This procedure has been subject to continued refinement and improvement in order to enable works to occur in a manner that creates as little impact to native flora and fauna species as possible.

Most recently, this process has been updated (as part of adaptive management processes and in response to commitments from the LCO Extension Project) to add specific objectives, performance criteria, methodology and reporting requirements to place particular emphasis on the spotted-tailed quoll (in particular). This process will continue to be reviewed and updated as part of an adaptive management process, including positive feedback from the monitoring and reporting for this process and as further ecological data arises.

Prior to any vegetation clearing works, there will be pre-clearing surveys undertaken (with emphasis on the presence of spotted-tailed quoll), followed by implementation of a detailed habitat tree felling strategy as provided below.

4.8.1 Timing of Tree Felling

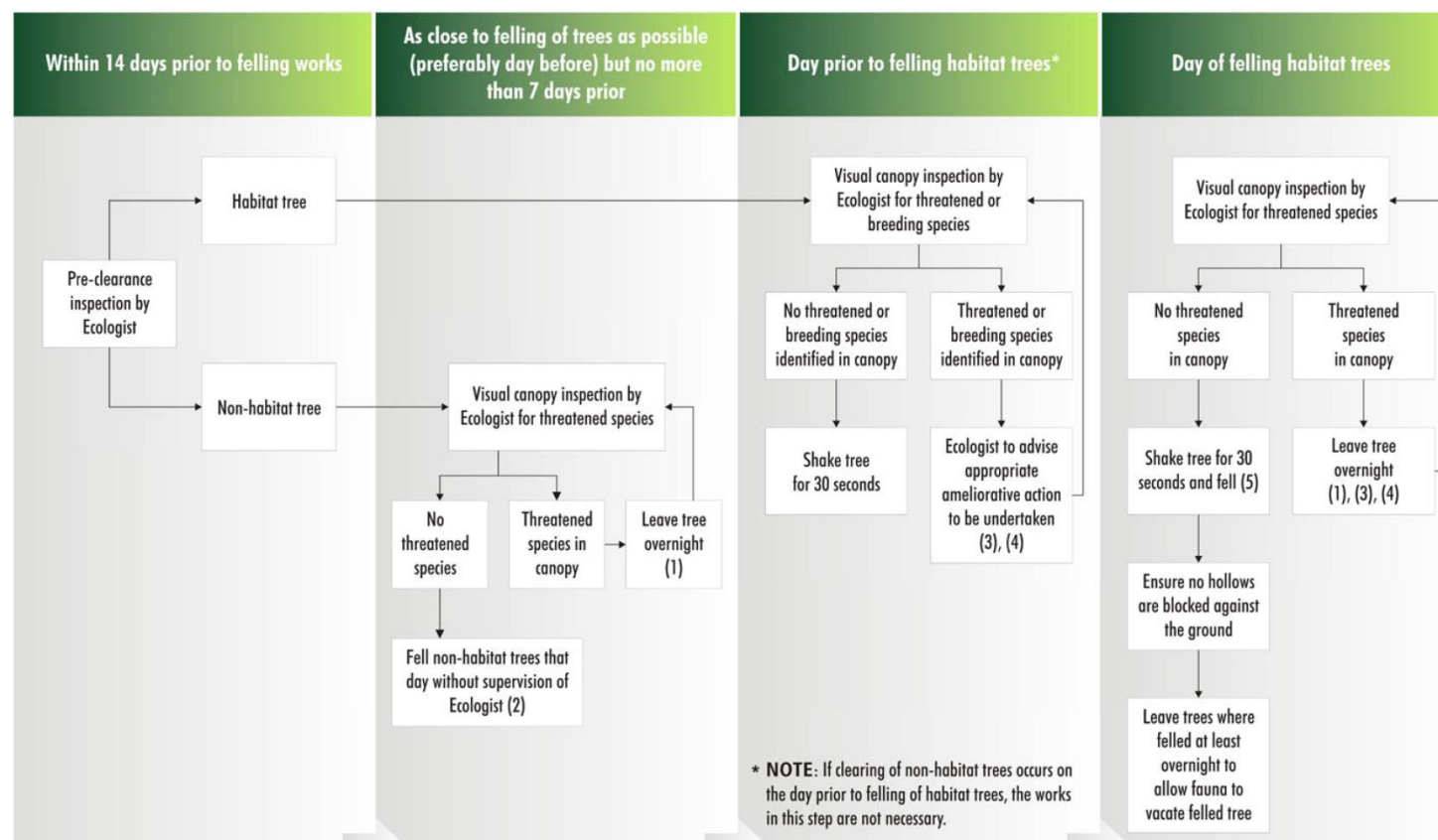
There are no months of the year in which hollow/den/nesting threatened fauna species are unlikely to be potentially breeding, or using hollows/dens/nests for prolonged periods of time. However, the following are the times when impacts on threatened species are most likely to occur based on breeding cycles, therefore clearing should be preferentially be undertaken outside of these periods where possible:

- spotted-tailed quoll (*Dasyurus maculatus maculatus*) – give birth between late July and mid-August
- brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) – give birth between June and August
- eastern freetail-bat (*Mormopterus norfolkensis*) – give birth between November to early December
- eastern falsistrelle (*Falsistrellus tasmaniensis*) – give birth in December
- yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*) – give birth between December to March
- greater broad-nosed bat (*Scoteanax rueppellii*) – give birth in January
- speckled warbler (*Chthonicola sagittata*) – lays eggs between August and January
- grey-crowned babbler (*Pomatostomus temporalis temporalis*) – lays eggs between July and February
- brown treecreeper (*Climacteris picumnus victoriae*) – lays eggs between June to February
- hooded robin (*Melanodryas cucullata cucullata*) – lays eggs between July and November.

In circumstances where clearing may need to occur during the above periods, dependent upon habitat features identified during pre clearing activities extra scrutiny will be placed on tree-felling operations (i.e. if potential rock/boulder dens are identified for spotted-tailed quolls, clearing may need to be postponed until breeding/raising of young is likely to have been completed). The pre-clearing and tree felling processes are documented in the sections below. These are also depicted in **Figure 4.1**. The supervision of all habitat tree felling works is to be completed by a suitably qualified and experienced person. If an unanticipated ecological issue is encountered, further advice is to be sought on the most appropriate measures to ensure minimal impact on fauna species, particularly threatened species. Prior to the commencement of felling activities, a local veterinarian and/or qualified wildlife carer will be identified and their contact details kept on hand, in the case that their assistance is

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needed for injured wildlife. All personnel who are involved in the capture/handling/housing and/or transport of native fauna species (injured or uninjured) must be appropriately licensed under the requirements of the NSW Animal Ethics Committee.



Footnotes:

1. In the event that an animal remains within the canopy the next day or following several days the animal may be captured and removed by a licensed and experienced wildlife handler.
2. Non-habitat trees which are not felled during the day of the canopy inspection will require another canopy inspection the following day to ensure that no fauna have moved into the trees to be felled overnight.
3. In the event that an animal repeatedly remains within the tree, it may be necessary to reduce the habitat quality of the tree by removing branches away from the hollow and/or shaking the tree daily. The ecologist may develop other procedures for discouraging the continual use of the tree.
4. If threatened birds are recorded nesting, the felling of the tree must be suspended for a period determined by the ecologist to allow nestlings to fledge. If non-threatened birds are recorded nesting, efforts must be made to reduce the impact of tree-felling on these species. Orphaned young will be taken to wildlife carers.
5. Should an animal be detected within the tree during shaking, the ecologist is to advise on the most appropriate methods to be undertaken to prevent harm to the animal. It may be necessary to leave the tree overnight and/or reduce the habitat quality of the tree by removing branches away from the hollow. Repeated bouts of shaking the tree may be sufficient to encourage the animal to vacate the tree. Alternatively, should the animal remain in a hollow, the ecologist may decide to have the tree felled, as gently as possible, with the animal inside the hollow.

Figure 4.1

4.8.2 Pre-Clearing Process

Pre-clearing surveys are carried out when woody native vegetation (including areas of shrubs and ground cover and trees within grasslands) are required to be cleared. As part of this process, a qualified and experienced ecologist is required to search the area proposed for clearing for the key purpose of minimising the impact of clearing on native flora, fauna and habitat features. The pre-clearing survey is to occur no more than two weeks prior to the felling works, to ensure that temporary habitat features (such as bird nests) are not constructed between the pre-clearing survey and the felling works; unless as agreed to by a qualified Ecologist. In some circumstances, minor extensions to this two-week timeframe may be afforded by the Ecologist if the timeframe extension is outside of key nesting times of locally threatened birds (i.e. this two-week timeframe is recommended in the event that native species move into a previously-surveyed area and there is no potential for new hollows to develop over such a short timeframes) and if the habitats present are confirmed to be of low quality. If this two week timeframe is exceeded, a secondary pre-clearing inspection is to be carried out to ensure no new habitat features have been constructed in this period. This secondary inspection can be carried out by suitably qualified LCO Environment and Community personnel in consultation with the Ecologist. This timeframe extension, if required, must include justification and be provided in written form and not comprise verbal feedback.

The following steps are to be completed as part of the pre-clearing process:

- Area to be cleared is designated visibly in the field;
- An Ecologist or suitably qualified person is to identify and mark all habitat trees (being those containing hollows, cracks, splits, spouts, large amounts of decorticated bark, active bird nests and possum dreys) using spray paint and flagging tape;
- Searches for and marking of animal dens/burrows, with attention paid to determining if they are currently used. This may include visual inspection (for fresh diggings, scats or tracks (suggesting recent use) or overgrown vegetation and cobwebs (suggesting disuse)), use of hair sampling methods or remote cameras;
- Identification and marking of habitat features to be salvaged for later use. These may include fallen timber, hollow logs and boulders. These are to be marked with spray paint and flagging tape;
- Areas of open water or drainage lines are to be inspected for amphibian or other fauna activity;
- Searches for threatened flora and fauna species (or signs thereof), endangered populations and threatened ecological communities ahead of clearing;
- Searches for the presence of weed and vertebrate pest species that require management action;
- Assess and report suitable timber resources for salvage and reuse (such as for habitat augmentation or fencing timber); and
- Highlight specific times of the year when species may be using habitat features for breeding or roosting, and provide advice on mitigative measures if occupation is deemed likely. Mitigative measures may be recommended to provide additional consideration of potential threatened amphibian and micro-bat species (in particular). These may include additional pre-clearing surveys (such as nocturnal amphibian searches of waterbodies) or additional shaking of habitat trees prior to felling (to increase potential for micro-bats to vacate habitat trees prior to felling).

Particular attention will be paid to searches of potential spotted-tailed quoll habitats such as hollows, fallen timber/hollow logs, burrows and boulder piles. If such habitat is suspected to be being used by a spotted-tailed quoll and (where practical) further searches/surveys will be completed to ensure this species is not resident in the area to be cleared. This may include spotlighting, trapping, hair sampling or remote camera surveys.

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If previously unrecorded threatened species, endangered populations or EECs are identified during the pre-clearing process, the ecologist will provide advice to LCO relating to the significance of these records and a course of action will be negotiated and implemented.

The outcomes of these inspections are documented and provide the locations of significant features identified (including coordinates and mapping) and advice on any specific actions recommended to mitigate impacts. This may include recommended measures to discourage fauna usage of the area to be cleared, additional inspections of identified nests to assess breeding status, delaying of clearing of target trees or specific recommendations to clear trees in a particular manner.

4.8.3 Tree Felling Process

A robust tree felling procedure will be implemented to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of habitat trees. As part of this process, particular attention will be paid to minimising potential for injury to the spotted-tailed quoll.

The following sections document the steps required to be completed as part of the tree felling process.

4.8.3.1 Prior to Felling Habitat Trees

- Completion of actions recommended from the pre-clearing surveys, including (but not limited to) salvage of identified habitat features, additional surveys to determine threatened fauna usage of the area (if required), identification of active dens or burrows, any actions required to discourage fauna occupation and weed or feral fauna management requirements;
- Removal of non-habitat trees/vegetation as close to the habitat tree felling date as possible (less than one week) in order to create disturbance to discourage fauna usage of the habitat trees; and
- Shaking of habitat trees (with heavy machinery) for 30 seconds or as appropriate to encourage fauna to abandon trees.

4.8.3.2 On Day of Felling of Habitat Trees

- Complete a visual inspection of the area to be cleared for fauna species and nests that may have become active since pre-clearing surveys;
- Shake the habitat tree (with heavy machinery) for at least 30 seconds or as appropriate prior to felling to encourage fauna to abandon the tree;
- Lower the habitat tree as gently as possible with heavy machinery, noting in some situations (i.e. steep slopes) manual felling by chainsaw may be appropriate;
- Inspect all hollows in felled trees for remaining or injured fauna;
- Capture of any displaced or injured fauna. Unharmed fauna is to be released into nearby secure habitats on the same day. Injured fauna are to be triaged immediately, humanely euthanized if required, or taken to a veterinarian or wildlife carer for further attention if required;
- Felled trees are to be rolled where appropriate so that the number of hollows blocked against the ground is minimised;
- Felled trees are to remain in place at least overnight to allow any remaining fauna to escape; and
- Salvage of suitable hollows for use as compensatory habitat, where practicable.

If, at any time, the spotted-tailed quoll (or other threatened species) is identified in the area to be cleared, felling activities will cease until all recommendations from the ecologist or suitably qualified person to remove this species from the area (thus from potential harm) have been completed.

Following all felling activities, a report will be provided by the supervising ecologist or experienced person. This will document the process followed, any fauna recorded and their fate. The report is also to include any recommendations for improvement of the process. These will be fed into the adaptive management system and included in future clearing works.

4.9 Translocation Works

The only threatened flora species recorded within the Approved Modification Area is the tiger orchid (*Cymbidium canaliculatum*). This species is listed as an endangered population in the Hunter catchment. A single tiger orchid was recorded within the Approved Modification Area during surveys for the Ecological Assessment (Umwelt 2013a). The tiger orchid identified during the assessment was translocated from the modification area to the Mountain Block BOA in March 2018 under the supervision a suitably qualified and experienced Ecologist and has been subjected to monitoring as required in accordance with Section 5.8. Any other tiger orchids identified during the pre-clearing process are proposed to be translocated into the secure BOAs. A suitable recipient site with comparable habitat and environmental conditions will be identified prior to enacting any translocation works.

The following salvage and translocation procedure has been developed from similar works occurring for this species elsewhere in the Hunter Valley, and from continued feedback and improvement recommendations. It has also considered the procedures and recommendations within Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al., 2004).

4.9.1 Expertise Required

All tiger orchid (*Cymbidium canaliculatum*) salvage and translocation works must be supervised by appropriately qualified and experienced personnel, to be engaged by LCO. This requires either an ecologist with suitable species-based expertise and/or a horticulturalist (or similar) with experience in salvage and translocation of epiphytic species.

4.9.2 Identification of Recipient Sites and Trees

Prior to salvage occurring, appropriate recipient sites will be identified for the translocation of tiger orchids. Details of recipient sites will be recorded and should be located in areas with environmental conditions as close to host locations as possible. If possible, recipient sites should be in proximity to existing tiger orchid records, as these will act as control sites for future monitoring works (detailed in Section 4.8).

It has been assumed that the recipient site will occur within the Bowmans Creek Riparian Corridor Offset Area, Mountain Block Offset Area or the Mitchell Hills Offset Area (see **Figure 2**). Rehabilitated vegetation is not considered to be appropriate as a recipient location until it is of sufficient age to support epiphytic species and to have developed similar environmental conditions as in the host site.

Factors that will be taken into consideration and documented for the purposes of selecting appropriate recipient sites will include:

- suitable due diligence inspections for cultural heritage and ecological values to ensure translocation will not impact other significant values;
- security and fencing of the recipient sites;
- accessibility of the site (i.e. proximity to vehicular tracks for ease of translocation);
- vegetation community; and
- aspect.

Where recipient trees are identified, locations will be way pointed with a hand-held GPS, and demarcated with flagging tape.

4.9.3 Salvage Procedure

The salvage and translocation of tiger orchids should be undertaken outside of the peak growing period (i.e. not in spring) to ensure minimal distress is caused to the plant.

All salvage activities where other qualified personnel (such as arborists and excavator drivers) are involved will take into consideration the safety of all personnel and the limitations of machinery and equipment.

This procedure will be refined upon visual inspection of both the host and recipient trees; however will consist of activities indicated below:

- the tiger orchid is identified from pre-clearance survey records;
- each tiger orchid is assigned a unique identifying number, and detailed records of the donor site condition are taken;
- assess the need to secure the tiger orchid in place within the host tree, prior to salvage;
- tiger orchids should be salvaged prior to felling of the host tree. Where the tiger orchid is located too high in the tree to make this possible, and when felling can be completed in a manner assured not to harm the tiger orchid, the tree can be carefully lowered with the tiger orchid in situ. This must, however be agreed to by the supervising ecologist prior to occurring;
- any clearing of non-habitat vegetation surrounding the tiger orchid must ensure no damage to the host tree or tiger orchid;
- carefully remove the tree (or part thereof) containing the tiger orchid with a chainsaw, without disturbing the tiger orchid (or its roots), and ensuring maximum rootstock is retained. Note that rootstock can extend some length into the tree, so careful examination and retention of as much of this as possible is recommended; and
- prior to removal, the salvaged portion of the tree (containing the tiger orchid), will be secured so that the salvaged portion of the tree does not fall and damage the tiger orchid.

Details of the salvage procedure undertaken will be documented.

4.9.4 Salvage and Translocation Techniques

Two techniques have been identified for use as part of the translocation process; being manual translocation and mechanically assisted translocation. Both of these is discussed in further detail below; however will be dependent on information collected on the host tiger orchid tree collected during the initial inspection. In the case of the known individual in the Approved Modification Area, it is likely that its small size will be amenable to manual translocation.

There are several situations where these processes may be modified. These include when the tiger orchid is suffering from severe stress as a result of changes in growing conditions i.e. death of host tree or clearing around host tree; when the host tree poses safety risk to operators to be felled with the orchid intact; or when host tree is unlikely to remain intact throughout the felling and translocation process.

4.9.4.1 Manual Salvage and Translocation

This approach is most suited to situations where tiger orchids are very small and attached to small sections of hard wood, thus can be easily salvaged and transported without the use of heavy machinery. Manual translocation involves removing the specimen from the host tree by hand and using a light vehicle, on existing tracks, to transport the specimen to the recipient site.

A qualified arborist or experienced chainsaw operator may be required to salvage the branch or section of branch containing the tiger orchid from the tree and lower it safely to the ground.

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Salvaged tiger orchids are then manually attached to recipient trees using wire, hessian or brackets. If tiger orchids are being salvaged/established at heights greater than 1.8 metres, suitably qualified personnel with Working at Heights Training will be required to undertake works.

Ground disturbance is not likely to occur as a result of the manual translocation process.

4.9.4.2 Mechanically Assisted Salvage and Translocation

Mechanical assisted salvage and translocation will be applied where tiger orchids require mechanical equipment to assist the translocation process. These tiger orchids can be large or small, however they are generally attached in a way or position that requires a large section of the host tree to be translocated.

Mechanical assisted salvage and translocation involves removing the specimen from the original site using heavy machinery. The exact type of machine used will be discussed based on assessment of the host tree and the equipment that LCO has available. The preference is for a rubber tread loader with a fork lift attachment or similar. This piece of machinery is preferred to minimise soil disturbance in the translocation process.

The tiger orchid and surrounding parts of the host tree (as marked by supervising ecologist) is to be carefully removed from host tree and gently lowered to the ground by a qualified arborist (or similar). The tiger orchid is then secured for translocation. The tiger orchid is moved to the recipient site and carefully positioned securely against, or adjacent to the recipient tree.

4.9.5 Translocation Procedure for Tiger Orchid

The salvaged tiger orchids should be transported directly to the recipient site without delay, and attached to identified recipient trees. Salvaged tiger orchids must be translocated to appropriate areas and host trees with similar conditions to those of the original host location.

The specific translocation techniques used will depend on the size and nature of the salvaged tiger orchid. On initiation of translocation activities, the suitability of the procedure will need to be considered, and refined according to the needs of each individual case, if necessary. The procedure will need to incorporate those techniques that are found to be most successful from previous experience, and include any relevant but unforeseen requirements suiting the individual situation.

The method to attach the salvaged tiger orchid to the recipient tree should follow the advice of the supervising ecologist, as some tiger orchids will be too large to translocate into a recipient tree without causing damage to both. In some cases, supporting the salvaged tiger orchid against an existing tree may be an acceptable option. In such cases, the tiger orchid must be greater than 1.5 metres off the ground or as appropriate with considerations regarding potential grazing impacts.

Translocated tiger orchids will be subject to monitoring as indicated in Section 5.8.

No other threatened flora species are anticipated to occur at LCO, however in the event that they are identified during the pre-clearing procedure, LCO will liaise with suitably qualified personnel regarding appropriate strategies for their salvage/translocation or propagation.

4.10 Remnant Vegetation and Habitat Management

While only very small amounts of remnant vegetation are present within the BMP Area, these will be managed during the life of the project to maintain their ecological values and promote biodiversity values. Strategies to achieve this include management of grazing impacts, weeds, feral animal control, erosion and sediment control and encouragement of natural regeneration.

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Prior to commencement of any mining activities within the Approved Modification Area, infrastructure needs and other areas of disturbance (such as stockpile locations) will be clearly identified on the ground to prevent accidental impact outside of these areas.

Annual inspections of remnant woodland areas will be undertaken by suitably qualified persons to identify any weed or feral animal issues, identify any areas affected by erosion and to assess the extent of natural regeneration occurring. Actions will be taken to address any issues identified.

The need for bushfire management controls in these areas will be assessed by LCO to manage fuel loads and threat of unplanned bushfire and documented within LCO Bushfire Management Plan. Where required and practical, infrequent burns of moderate intensity may be undertaken within remnant vegetation areas to manage fuel loads and allow native species to set seed in consultation with the local Rural Fire Service.

4.11 Rehabilitation Works

A post-mining land use plan has been prepared to provide an indication of post-mining landform, rehabilitation focus, habitat enhancement and corridor linkages required for the BMP Area. As part of this plan, previously-mined areas will be rehabilitated progressively and as soon as is practicable to mitigate time during which fauna is displaced as well as assisting in the prevention of erosion and assist in bank stabilisation.

This plan also includes planning for the construction of ecological corridors within the post-mining Approved Modification Area and broader BMP Area, to improve the current poor levels of vegetated connectivity within the BMP Area, and to adjoin remnant vegetation in the local area. Details on the LCO rehabilitation plan are provided in the rehabilitation strategy (Umwelt 2013a) and Mining Operations Plan (MOP). The MOP has been prepared to meet the requirements of the Rehabilitation Management Plan required under Schedule 3, Condition 39 of DA 305-11-01. From these documents, a summary of relevant rehabilitation actions relating to the management of biodiversity values have been provided below.

Rehabilitation works within the BMP Area will be undertaken in accordance with the approved final landform plan and will comprise rehabilitation of native woodland corridors between areas of established rehabilitation and remnant vegetation (particularly biodiversity offset areas) on adjacent areas of land. These native woodland corridors will replace areas of woodland vegetation removed during the life of the mine and will facilitate fauna movement between the vegetation remnants and rehabilitation areas.

This plan will integrate with the planned revegetation/rehabilitation of the biodiversity offset areas, particularly the substantial works proposed within the Bowmans Creek Riparian Corridor, which will provide vegetated connectivity to the Mountain Block BOA to the north. All works within the BOAs will be completed with the specific purpose of enhancing existing habitat, and providing additional habitat for the spotted-tailed quoll. Further detail on all works relating to these BOAs is provided in the BOMP.

Native woodland vegetation will be rehabilitated to a standard that is consistent with that of local examples of Central Hunter Grey Box-Ironbark Woodland and will comprise at least 731 hectares of the final BMP Area landscape, as defined in the MOP. Rehabilitated grassland vegetation will be established and maintained with pockets of native vegetation to support sustainable agricultural activities; refer to the MOP for detail.

Rehabilitation works within the BMP Area will be completed in accordance with the Synoptic Plan (DRE, 1999), and as such will integrate the following specific control measures:

- post-mined and other disturbed areas will be rehabilitated to be consistent with extant vegetation communities;
- use of native species of suitable local provenance (wherever possible) in rehabilitation works and areas targeted for native woodland, and planning for the linkage and integration of rehabilitation areas with existing

vegetated areas to improve ecological function and provide appropriate fauna habitat. Flora species used in rehabilitation works should be consistent with native flora species that have previously been identified at LCO. A recommended planting list for all revegetation and rehabilitation works is provided in Appendix B. This list identifies a broad suite of species commensurate with the target vegetation communities, as per Peake (2006), the relevant TEC Scientific Determinations and from the Greater Hunter Vegetation Mapping Classification Unit (Sivertsen 2012). These are intended to provide a broad community-based species list from which to source appropriate species for planting, as opposed to being a full list of species which must be present in the post-revegetation communities;

- rehabilitation and habitat enhancement works will be subject to monitoring as indicated in Section 5.0;
- habitat features salvaged from areas disturbed will be used to enhance habitat of rehabilitation areas;
- fencing and access to rehabilitated areas will be restricted and controlled;
- weed control and feral animal control in accordance with existing practices;
- emplacement and monitoring of appropriate erosion and sediment controls to ensure minimal impact on aquatic habitats and adjacent remnant vegetation;
- ecological monitoring programs of success of rehabilitation; and
- adaptive management (as provided in Section 7.0) to include new management strategies as new threats and opportunities of rehabilitation are identified.

Final rehabilitated woodland vegetation will comprise relevant strata (groundcover, midstory, sub-canopy and canopy) and will be self-sustaining.

The specific remediation and rehabilitation requirements of the Modification 7 Area are outlined in a discrete section (Section 4.19).

4.11.1 Post-Mining Land Use Design Objectives

The primary post mining land use goal for the BMP Area is to establish a mix of grasslands capable of supporting future sustainable grazing, and native vegetation corridors constructed in the final landform to enhance habitat connectivity. Native woodland corridors will consist of native trees, shrubs and groundcover. The rehabilitation strategy aims to emulate the objective of establishing pasture suitable for grazing, enhance local and regional ecological linkages and provide for sustainable land use options. The proposed rehabilitation strategy (*Figure 4*) has been developed in consideration of a number of factors including site opportunities and constraints, ecological and rural land use values and existing strategic land use objectives. In particular, the strategy considers the integration of rehabilitation with the strategies developed for surrounding operations within the Greater Ravensworth Area.

The principal rehabilitation objectives for the BMP Area (as per the Mining Operations Plan) are to:

- rehabilitate all disturbance areas to be safe, stable and non-polluting;
- ensure public safety;
- minimise the adverse socio-economic effects associated with mine closure;
- decommission and remove all surface infrastructure, unless the DRE agrees otherwise;

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- design final landforms to incorporate micro-relief and integrate with surrounding natural landforms; Micro-relief by definition relates to only slight/small irregularities in the final land surface causing minor variations in elevation.
- restore or maintain land capability generally as described in the EA;
- construct landforms that drain to the natural environment (excluding final voids);
- minimise visual impact of the final landforms as far as reasonable and feasible;
- minimise to the greatest extent practicable:
 - the size and depth of the final voids;
 - the drainage catchment of the final voids;
- restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprising:
 - 731 hectares of Central Hunter Box-Ironbark Woodland;
 - Habitat for threatened flora and fauna species including habitat connectivity for the Spotted-tailed Quoll; and
- Maintain, establish and/or restore grassland areas with pockets of native revegetation to support sustainable agricultural activities, as shown conceptually in Appendix 3 of DA 305-11-01.

From a biodiversity perspective, the objectives for the BMP Area include:

- to provide opportunities for future agricultural activities such as sustainable grazing;
- to contribute to effective native corridors through the area which promote fauna movements between Ravensworth Operations, Mount Owen Complex, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area;
- to maintain and provide additional suitable habitat for the spotted-tailed quoll, particularly along the Bowmans Creek Riparian Corridor, and to increase landscape linkages to facilitate the movement of this species along Bowmans Creek to the offset areas to the north. This will provide benefit to numerous other threatened species recorded in the area, particularly threatened woodland birds and micro-bats.

Considering the above, the key assumptions that relate to the proposed post-mining land use and rehabilitation strategy for the BMP Area and broader LCO holdings are outlined below:

- habitat enhancement works will be undertaken for the spotted-tailed quoll along the existing Bowmans Creek Riparian Corridor (planned works being approximately 200 metres wide along the majority of its length). This will include a mixture of tree plantings and habitat structures such as log piles (such as that containing the known female den site) constructed adjacent to the creekline. It will be the intention to link this area with native vegetation corridors established on rehabilitated mine land to facilitate movement of the spotted-tailed quoll and other fauna species to other remnant native vegetation area in the region such as the Hillcrest Offset Area managed by Glencore Coal's Ravensworth Operations. Management actions within this Offset Area (to date) have included baseline ecological monitoring, detailed planning of required revegetation and vegetation reconstruction works and pest and weed control works;
- native woodland areas to be established across the slopes of overburden spoils and higher portions of the lowwalls associated with the final voids.. The location of these woodland areas has been designed to promote fauna movement through the BMP Area for linkages to Ravensworth Operations, Mount Owen Complex

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(including Ravensworth State Forest and its associated biodiversity offset areas), Lake Liddell and the Ravensworth Operations Hillcrest Offset Area;

- planting/seeding of native vegetation (canopy, mid-canopy and groundcover) on the highwall benches where safe and appropriate to improve long term visual amenity of void; the lower portions of the lowwalls will be established initially with exotic grassland species with the objective to stabilise these areas until they are submerged by surface and groundwater that is predicted to accumulate in the final voids;
- the proportion of native vegetation at Mountain Block has increased with the establishment of offset areas (refer to the LCO BOMP). The establishment of native vegetation in this area will provide a valuable linkage to the Ravensworth Operations Hillcrest Offset Area, Bowmans Creek Riparian Corridor and Mountain Block Offset; and flatter areas on site, including the tops of overburden areas and tailings dams to be established to open grassland with pockets of native vegetation. Depending on outcomes of final land use analysis to be completed as part of detailed closure planning process five years from closure, there is the potential that these flatter areas could be used for sustainable agricultural purposes such as grazing.

The post mining land use and final landform will be implemented as detailed in the Rehabilitation Management Plan (Mining Operations Plan).

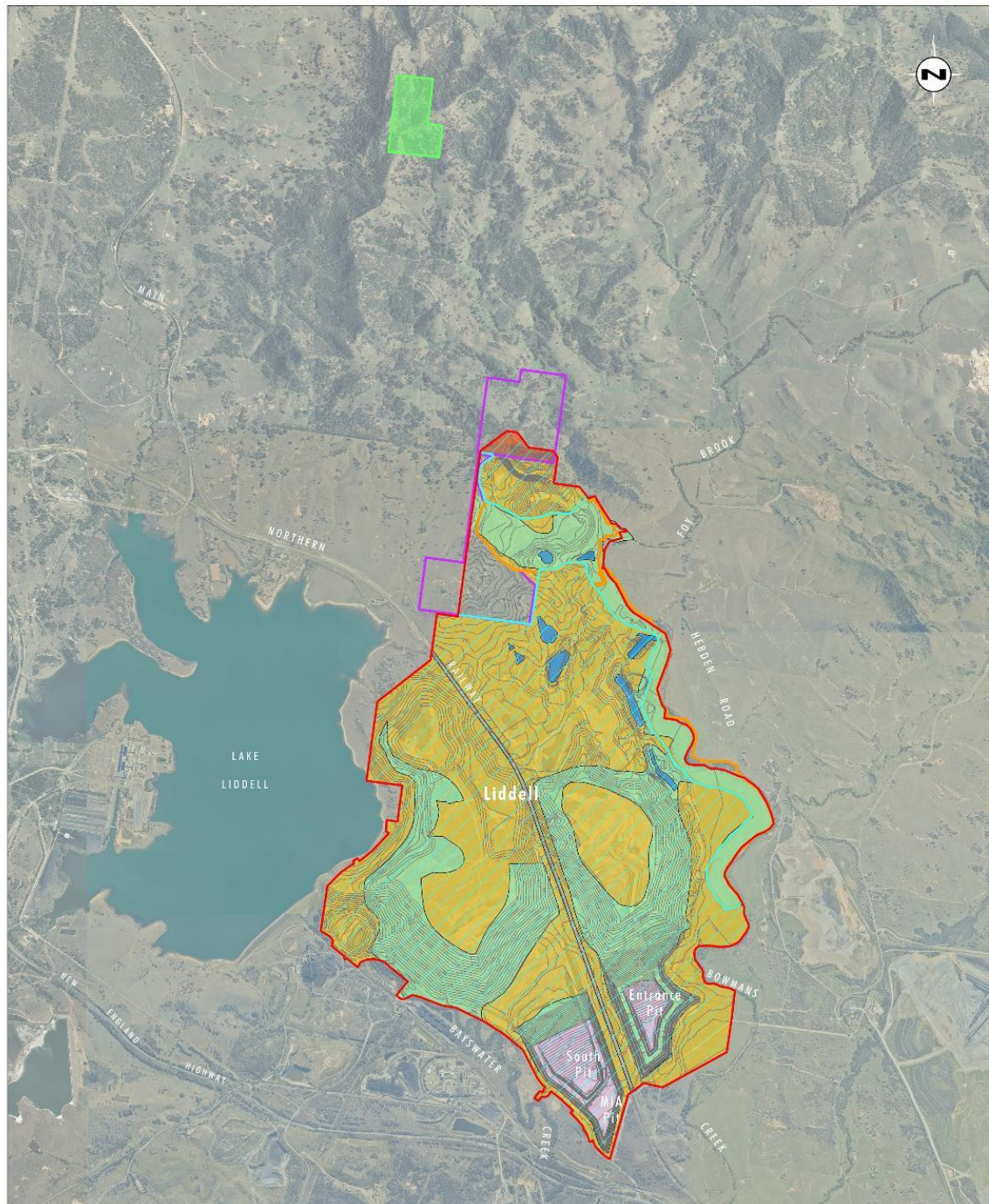


Image Source: Henderson (2019), Glencore (2018)
 Data Source: Glencore (2019), ELA (2012)
 Note: Contour Interval 5m

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Legend

- Liddell Coal Operations Approved DA Boundary
- Biodiversity Management Plan Area
- Mountain Block Offset Area
- Bowmans Creek Riparian Corridor Offset Area
- Mitchell Hills South Offset Area
- Domain 1 - Native Woodland
- Domain 2 - Grassland for Stabilisation
- Domain 3 - Open Grassland (potential grazing areas) with Pockets of Native Vegetation
- 1602 - Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter
- Dams

Liddell Coal
Proposed Post-Mining
Land Use Design

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Figure 4 Post Mining Land Use Design

4.11.2 Post-Mining Land Use Rehabilitation Strategy

Rehabilitation of post-mining areas will be completed as soon as practicable after shaped areas become available. The rehabilitation strategy will primarily involve the establishment of areas of grassland for potential future agricultural activities such as grazing. In addition, native vegetation corridors will be established to promote regional fauna movement. In addition to the rehabilitation of post-mining areas, restoration of the Bowmans Creek Riparian Corridor (on a mixture of previously-mined and non-mined disturbed land) and in the northwest portion of the site will be designed to augment habitat for the spotted-tailed quoll.

Rehabilitation activities should be generally undertaken in spring and autumn to maximise potential for success of young plants. Revegetation activities will primarily consist of sowing and direct seedling of native tree species; however a range of other techniques may be utilised where appropriate.

4.11.2.1 Native Woodland Establishment

Rehabilitated woodland areas will be created to contain a flora species assemblage characteristic of the dominant vegetation communities within the approved modification area. Revegetation of the post-mining landscape, including native woodland areas will focus on establishing vegetation that is predominantly consistent with the Central Hunter Box – Ironbark Woodland vegetation community.

To a lesser extent, revegetation activities should also target the establishment of vegetation that is predominantly consistent with the following vegetation communities adjacent to Bowmans Creek:

- Central Hunter Box – Ironbark Woodland (Rough-barked Apple dominated); and
- Hunter Valley River Oak Forest.

In regards to rehabilitation of areas adjacent to Bayswater Creek, revegetation activities should target the establishment of vegetation that is predominantly consistent with the Central Hunter Swamp Oak Forest vegetation community.

Seed collection and handling aimed at maximising the viability and diversity of local seed in the revegetation mix will be implemented as part of the rehabilitation program. Where able, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tubestock for planting. However, where adverse seasonal conditions (i.e. drought) or other factors may affect the availability of local provenance seed (such as lack of remnant vegetation as a seed source), supplementation with non-local provenance seed may be required.

Revegetation will primarily involve direct seeding of native species along with a suitable cover crop or other organic material (e.g. mulch, brush matting or organic growth medium) as required to prevent soil loss and add biomass to the profile. A range of other techniques including the planting of tubestock may also be utilised where appropriate over isolated areas associated with steep slopes.

4.11.2.2 Establishment of Sustainable Agricultural Areas

Areas that may be established as open grassland or for potential viable and sustainable agricultural use have been identified in the flatter portions of the conceptual final landform as shown in Appendix 3 of DA 305-11-01. Revegetation may involve the use of both native and suitable exotic pasture species for the establishment of grasslands in these areas with pockets of native vegetation, which may ultimately be utilised as shelter for livestock.

In regards to the establishment of future grazing areas, revegetation techniques will be consistent with local agricultural practices and are likely to involve sowing with grasses and legumes appropriate to the district and recognised as suitable for grazing. A similar mix may also be used in areas such as steeper slopes to prevent scouring and subsequent soil loss.

4.11.2.3 Corridor Habitat Enhancement

In regards to restoration of the riparian corridor along Bowmans Creek, revegetation activities should target the establishment of a riparian strip that is predominantly consistent with the Hunter Valley River Oak Forest vegetation community. Outside of the riparian strip, the remainder of this corridor should focus on restoration of the Central Hunter Box – Ironbark Woodland (Rough-barked Apple dominated), to complete the corridor. In relation to the non-mined land situated on the northwest portion of the site, restoration of native woodland areas should focus on establishing vegetation that is predominantly consistent with the Central Hunter Box – Ironbark Woodland vegetation community. Establishment of this riparian corridor is detailed in the LCO BOMP.

These native vegetation communities are all likely to provide suitable habitat for the spotted-tailed quoll. Measures such as the establishment of log piles/boulder piles for potential denning habitat will also be undertaken to further enhance the habitat for this species. It is noted that the known breeding den located along Bowmans Creek is within one such constructed timber pile.

Prior to the commencement of restoration activities in these areas, mapping of baseline ecological condition will be undertaken in order to confirm the scope of ecological management works required. The details of the scope of works will be developed in consideration of the following principles:

- all planting or seeding within revegetation areas will be designed with structural and floristic diversity suitable to meet the benchmark vegetation community targets;
- where practicable, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tubestock for planting;
- revegetation areas will be subject to a formal care and maintenance program that will be developed to include the control of weeds, replacement of failed plantings, bushfire protection etc.;
- revegetation areas will be subject to formal monitoring program (success/failure, as well as floristic monitoring) that will be developed to include a feedback loop to achieve continual improvement in the methodology and results.

Table 9 shows the revegetation objectives as per Schedule 3 Condition 37 of DA 305-11-01. Revegetation areas will be completed over the life of the Project. The rehabilitation program implemented will be continually reviewed over the life of the Project with the aim of achieving an effective, sustainable rehabilitation outcome. These indicative areas may therefore change as an outcome of this detailed rehabilitation program. The rehabilitation vegetation to be established is detailed as the final landform plan included in the Rehabilitation Management Plan (Mining Operations Plan).

Feature	Objective
Revegetation	• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprising: ○ At least 731 hectares of Central Hunter Box-Ironbark Woodland ○ Habitat for threatened flora and fauna species including habitat connectivity for the Spotted-tailed Quoll • Maintain, establish and/or restore grassland areas with pockets of native vegetation to support sustainable agricultural activities, as shown conceptually in Appendix 3 of DA 305-11-01.

Table 9 Revegetation Objectives

Note: All values have been rounded up to the nearest whole number. All values subject to minor mapping/GIS-based variation.

185 hectares of vegetation is to be achieved within the Bowmans Creek Riparian Corridor for Spotted-tailed Quoll Habitat with portions of the corridor being non-mined areas and mined areas.

Within each target vegetation community, the density of plantings will be varied to create a variegated landscape to increase the value of rehabilitation for local fauna species. The range of densities for each vegetation community will remain within the documented natural variation levels of each vegetation community.

4.11.3 Rehabilitation Care and Maintenance

Based on the outcomes of the rehabilitation monitoring program as outlined above, care and maintenance activities will be implemented until rehabilitation is shown to meet the acceptable completion criteria. The scope of the care and maintenance program may include weed and feral animal control, fertilising, re-seeding or planting (where required) and erosion and sediment control works. It is envisaged that works will be continued as required until it can be demonstrated that the rehabilitation area has satisfied the closure criteria.

4.12 Weed Control

The presence of weed species has the potential to be a major hindrance to rehabilitation and regeneration activities and the potential to enhance edge effects on remnant vegetation within the BMP Area. In addition to this, the presence of weed species has the potential to significantly decrease the value of vegetation to native species, particularly threatened species. LCO commit to completion of formal weed inspections of the BMP area every two months to collate diversity and abundance of noxious weed species. The implementation of control methods will be defined from the outcomes of this inspection, including timing, duration and the most appropriate methods to be employed. The outcomes of this inspection will feed into the ongoing review and response process outlined in Section 8.

Weed control will be conducted in accordance with current LCO management practices, which require:

- regular site inspections to identify areas of weed infestation and type of weed species.
- development and implementation of a control plan applicable to the circumstances, which may include manual removal, spot spraying, boom spraying, aerial spraying or biological control. These will be undertaken in target areas identified during site inspections and prioritise:
- treatment of entire infestations where possible;
- re-treatment of recurring infestations at regular intervals;
- annual monitoring of key weed infestations;
- annual monitoring for new infestations; and
- mapping of key weed infestations following monitoring to track progress and focus control activities where necessary.
- prompt rehabilitation of land post disturbance;
- early establishment and maintenance of vigorous grasses and native trees particularly during rehabilitation of overburden dumps; and
- regular maintenance of topsoil stockpiles to control weed infestation.

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Galenia (*Galenia pubescens*) occurs in areas throughout the BMP Area and LCO will continue to target this species for control in areas where it is known to occur. LCO will also implement measures to prevent it from establishing in new regeneration or rehabilitation areas.

In addition to galenia, LCO will continue to place particular effort towards the control of African olive (*Olea europaea* subsp. *cuspidata*) and *Acacia saligna* where they are identified.

As part of ongoing task coordination, LCO will ensure that machinery movements throughout the BMP area do not prove a major source of weed spread or infestation. If it is identified that vehicle movements are spreading infestations, LCO will implement the above controls as appropriate as well as utilising formed tracks where possible to mitigate the spread.

In conjunction with active monitoring, tracking and control; LCO implement preventative measures to reduce the spread and therefore infestation of invasive species across the site. Vehicle movements have been identified as having particular potential to spread invasive weed species for which LCO implement the vehicle hygiene practices to manage. Vehicle hygiene practices include avoidance of vehicles or equipment trafficking on any vegetation. Where avoidance is not possible, the vegetation, works and potential for spread of weeds are assessed and appropriate controls, such as vehicle wash-down, are implemented.

In recognition of key species with particular potential to impact LCO and Greater Ravensworth sites, a number of strategies to target these undesired species including the Coolatai and African Lovegrass Strategy and Rhodes Grass Management Strategy.

If a substantial increase in the density of any known weed species, or the occurrence of a previously unrecorded weed species, is discovered, LCO will seek advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna. Where weeds have been controlled, suitable native or pasture species will be sown to prevent weed regrowth.

4.13 Feral Animal Control

Introduced fauna species such as foxes, rabbits, pigs, dogs and feral cats could increase within the BMP Area as a result of alteration to existing land uses. Foxes, feral cats and wild dogs represent a substantial threat to the ongoing persistence of the spotted-tailed quoll in the LCO holdings, as well as the broader Foy Brook area. Targeted and intensive control of such predators will be a key factor in mitigating current impacts on this species in the local area.

LCO currently implements feral animal control measures, including a combination of targeted shooting, trapping and baiting practices. Remote cameras are also used to collect information on presence/abundance of these species across the BMP area. These measures are generally implemented on a reactive basis, when monitoring or opportunistic sightings identify species requiring control.

Currently, baiting practices involve 1080 baits buried in mounds as well as free baiting (non-poisoned baits) in areas around known spotted-tailed quoll habitat. Bait mounds in areas of potential spotted-tailed quoll habitat are monitored by remote cameras to gather data on which species are accessing and taking the baits. This assists in gathering data on potential impacts to non-target species such as the spotted-tailed quoll. Thus far, this process has recorded spotted-tailed quolls investigating bait mounds on at least four occasions, however not taking any baits. The cameras also assist in attributing the tracks and digging signs at the mounds to particular species.

These measures serve to control most feral animal species relevant to the BMP area, particularly foxes, feral dogs, feral cats, rabbits and pigs. The current frequency of these measures is responsive to monitoring results, opportunistic sightings and abundance.

LCO commit to completion of formal feral animal inspections of the BMP area every two months to formally collate sighting (including diggings, tracks, burrows etc) and abundance records (opportunistic and from monitoring). The

implementation of control methods will be defined from the outcomes of this inspection, including target species, timing, duration and the most appropriate methods to be employed. The outcomes of this inspection will feed into the ongoing review and response process outlined in Section 8.

The feral animal control measures used are tailored based on the outcomes of this data. New feral animal control measures (particularly baiting techniques) are regularly considered, however will be included in the feral animal inspections every two months.

Regular monitoring of revegetation and regeneration areas will be undertaken to determine the impact of feral animals, particularly on vegetation establishment. Feral animal control works will be undertaken periodically to ensure the suppression of feral animals, and will consider potential ecological impacts.

Current management practices for feral animals within the LCO holdings will be reconsidered with a specific focus on the protection of the spotted-tailed quoll population in this area. Particular focus will be paid to additional research towards feral animal control measures (particularly foxes, cats and wild dogs) that have minimal direct or indirect negative impact on the spotted-tailed quoll.

Vertebrate pest control will use best practice methods, and include follow-up monitoring and control as required. If monitoring shows a substantial increase in the density of any known feral fauna species, or the occurrence of a previously unrecorded feral fauna species is discovered, LCO will seek expert advice on appropriate management and control options.

If monitoring shows a substantial increase in the density of any known feral fauna species, or the occurrence of a previously unrecorded feral fauna species, is discovered, LCO will seek expert advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna.

4.14 Blue-Billed Duck Management

During fauna monitoring surveys undertaken at LCO during 2005, 2006 and 2007, several individual blue-billed ducks (*Oxyurua australis*) (listed under the TSC Act) were identified at Dam 7 and Dam 13 within the BMP Area. These dams have both subsequently been removed as part of ongoing mining activities. To ameliorate potential adverse impacts to this species, LCO is providing compensatory specific habitat material at Dam 3 and at two purpose-built dams known as the Triangle Dams. Whilst not triggered, the two Triangle Dams have been constructed as ecological preferential alternatives to the Mountain Block Dam identified in Condition 28 of DA 305-11-01 to satisfy the intent.

Condition 28 of DA 3015-11-01 Modification 7 (see **Table 1**) defines the requirements for the habitat enhancement, ongoing management and monitoring requirements for these three dams in order to provided habitat for this species.

A Blue Billed Duck Management Strategy (Umwelt 2008) was prepared to address these requirements and these strategies have been reflected below. The requirements of the Blue Billed Duck Management Strategy (Umwelt 2008) have been superseded by this BMP.

Habitat enhancement measures for the existing Dam 3 and two Triangle Dams will continue to focus on creating habitat for the blue-billed duck, incorporating features that were present in the previous Dam 7 and Dam 13. Enhancement and management measures for blue-billed duck habitat at these dams will be completed in a manner consistent with Condition 28 of DA 3015-11-01 Mod 7 and will include the following (as per Umwelt (2008)):

- where achievable, the dams will be modified to have a maximum depth of five metres over at least half of the surface area. This depth will allow for vegetation-free areas to be maintained over a significant portion of the centre of each of the dams, providing foraging habitat for the ducks. This depth will also allow for significant seasonal fluctuations in water level. Where practical, it is important that the water depth remains relatively

shallow (<1.5 metres) for a distance of at least 3 metres from the water's edge to allow dense thickets of emergent vegetation to be established around the entire circumference of each dam;

- the growth of healthy macro-invertebrate populations within each of the dams will be encouraged by the provision of suitable microhabitat and environmental conditions. Where practical, the provision of supplementary habitat features, including a substrate of pebbles, rocks, logs and organic detritus will be encouraged to promote growth of Macro invertebrate numbers. Where possible the achievement of suitable water quality levels will be targeted;
- additional control of feral animals will be undertaken on an as needed basis in the vicinity of the dams to reduce the risk of predation of adult ducks, nestlings and eggs by foxes, wild dogs and feral cats;
- plantings of terrestrial and aquatic vegetation species favoured by blue-billed ducks will be undertaken at each of the dams. These species will include (where possible) cumbungi (*Typha orientalis*), water milfoil (*Myriophyllum* spp.), duckweed (*Lemna* spp.), spike rush (*Eleocharis dietrichiana*), tall spike rush (*Eleocharis sphacelata*), tall sedge (*Carex appressa*), and club rush (*Bulboschoenus caldwellii*).
 - These species were selected based on **Appendix A** in Schneider 2007 ("Where land meets water resource kit: a guide to riparian management in the Hunter Valley", Hunter Central Rivers CMA). These species will be planted as densely as is practicable at each of the dams. Where required, revegetation will be undertaken using tube stock to provide immediate stabilisation of the banks. Tube stock used for revegetation will be of local provenance unless it is not possible to source such material or if growing conditions are not appropriate for a particular species. Where a particular species is not available, additional plants from those listed above will be planted; and
 - to maximise the density and age of the vegetation within and on the fringes of each of the dams (and therefore the foraging habitat for the ducks), the vegetation will be protected from burning or grazing at all times.

Monitoring will also be undertaken to record success of the blue-billed duck management actions, these monitoring actions are covered in greater detail in Section 5.3.4.1.

4.15 Habitat Enhancement

The loss of fauna habitat from the Approved Modification Area will result in increased pressure on surrounding vegetation for displaced fauna competing for foraging resources, shelter and nesting/roosting habitats. The following section describes mitigation of habitat loss through habitat enhancement of remnant vegetation, revegetation and areas of rehabilitation within the BMP Area. It is noted that substantial habitat enhancement works will be completed within the biodiversity offset areas, and that these will place particular emphasis on enhancing habitat for the Spotted-tailed Quoll. Those works will be detailed within the BOMP being prepared for the Bowmans Creek Riparian Corridor, Mountain Block and Mitchell Hills South BOAs.

Habitat enhancement will be undertaken within the rehabilitation and revegetation of the BMP Area and will focus on the protection and provision of specific habitat features for target threatened species (particularly for woodland-dependent species and the Spotted-tailed Quoll and the blue-billed duck). The aim of doing so will be to increase the specific habitat features required by target threatened species and their prey (as necessary), thereby improving the quality of the habitat so it is able to support greater numbers of those species. Specific habitat features are those that can be a limiting factor to population thresholds and can include for example habitat features such as tree hollows, complex ground strata and specific foraging resources.

4.15.1 Nest Boxes

Hollow-bearing trees are critical to the survival of several threatened species known to occur in the BMP Area. While only occurring in relatively low numbers in the approved modification area, the presence of a number of recorded threatened hollow-dependent species in this area highlights the importance of this scarce resource in the

landscape. The availability of suitable hollows within a landscape is a recognised limiting factor to the survival of hollow-dependent species. In particular, the loss of suitable hollows is a major factor contributing to the listing of many threatened species under the State and Commonwealth threatened species legislation.

To address the loss of hollows from clearing activities, the following will be undertaken:

- accurate recording of hollows lost (including size ranges) during the pre-clearing process;
- staged mitigation of hollow loss by placing nest boxes in surrounding secure vegetation of the biodiversity offset areas; and
- placement of nest boxes within the post-mining rehabilitation areas as vegetation reaches suitable maturity.

Nest boxes will be placed in the post-mining areas once the rehabilitation reaches suitable maturity. Alternatively, nest boxes can be bolted to poles within rehabilitation areas, to expedite the return of hollow-dependent species to these areas. A range of hollow size classes will be provided, thus increasing the quality of habitat for target threatened species. The number and types of nest boxes to be established in rehabilitation areas will be determined during pre-clearing inspections. Each tree hollow suitable for use by fauna species that is removed for mining will be replaced with a nest box in rehabilitation areas. Nest boxes will be monitored and maintained within rehabilitation and offset areas to monitor usage by hollow-dependent species.

The timing of the nest box installation works will be progressive, based on the progress of the clearing works within the approved modification area. This will ensure the nest box program can be informed by the pre-clearing process, ensuring comparable number and sizes of nest boxes are installed in the biodiversity offset areas and rehabilitation areas. Replacement of hollows lost (with nest boxes) will occur within six months of each discrete clearing event, to ensure that seasonal breeding opportunities are not lost.

4.15.2 Habitat Feature Salvage

The salvage and relocation of hollow logs, fallen timber and boulders will be undertaken to augment habitat complexity. Habitat features such as boulders, hollow logs and hollow-bearing trees will be identified during pre-clearing surveys, and salvaged as part of the clearing process, where suitable and feasible to do so. Salvaged features will then be stockpiled for use in rehabilitated areas to increase the value and complexity of rehabilitation areas, thus making them more suitable for native fauna colonisation (particularly that of threatened species).

Habitat augmentation will focus on the provision of specific habitat features for key threatened species which require specific habitat features (other than tree hollows) to provide adequate foraging, roosting or breeding habitat. Examples of specific habitat features include, but are not limited to:

- hollow logs, fallen timber and boulders to provide shelter and foraging habitat which may be used by the Spotted-tailed Quoll for denning and latrines; and
- fallen timber and stumps to provide perch sites which may be used by the hooded robin (*Melanodryas cucullata cucullata*) and brown treecreeper (*Climacteris picumnus victoriae*).

When habitat features are being relocated, care should be taken not to damage the native vegetation at the location it is being relocated to.

The salvage process will be an ongoing one (as with nest box installation), as it relies on the progress of the clearing within the approved modification area. In a similar manner, the deployment of stockpiled habitat features will be dependent on the progress of rehabilitation/regeneration works. This will be completed progressively, once rehabilitation/regeneration works are completed within discrete areas.

4.15.3 Planting of Specific Foraging Resources

To ensure a variety of different fauna species are encouraged to colonise rehabilitation areas, a variety of plant foraging resource species, particularly flowering resources that will attract nectarivorous species, as well as insects that will attract insectivorous species will be planted. Species planted should target those that will be removed from the Approved Modification Area, including (but not limited to):

- bulloak (*Allocasuarina luehmannii*);
- swamp oak (*Casuarina glauca*);
- broom bitter pea (*Daviesia genistifolia*);
- *Acacia falcata*;
- hickory wattle (*Acacia implexa*); and
- cooba (*Acacia salicina*).

The timing of these works will be as per the rehabilitation schedule provided in the approved LCO MOP (Rehabilitation Management Plan). This timing will be responsive to the progress of rehabilitation planning and the program within this document.

4.15.4 Dam Reconstruction

Dams will be constructed in the post-mining landform to facilitate the re-colonisation of woodland fauna communities. Dams generally provide a source of standing water in the landscape and associated fauna species such as frogs and invertebrates will constitute suitable prey for many additional fauna species such as reptiles. Increasing the habitat complexity and range of micro-habitats occurring in the post-mining landscape will result in the increased utilisation of the rehabilitation by a much wider range of fauna species thereby meeting the objective of the re-establishment of fauna habitats and threatened species habitats in the post-mining land form.

Establishment of dams with shallow edges and fringing vegetation is likely to provide foraging habitat for threatened species such as the southern myotis (*Myotis macropus*), which is known to occur at LCO.

Dams will also take into consideration provision of habitat dams for the blue-billed duck, which has previously been identified at LCO (see Section 4.14 above).

4.15.5 Spotted-tailed Quoll Habitat Enhancement

Given the known presence of a Spotted-tailed Quoll population, the following habitat enhancement measures will be undertaken that are specific to assisting the persistence of this species in the BMP Area, and broader local area:

- salvage of hollow-bearing trees (and non-hollow bearing trees if sufficient resources are lacking), hollow logs and stumps felled during construction works and placement as log piles within areas of rehabilitation (particularly along drainage lines). This will increase the amount of potential foraging and denning habitat for this species throughout the post-mining landscape. It is notable that the current breeding den is located in such a log pile;
- salvage and placement of large rocks and boulders into piles as further potential denning habitat.

4.16 Grazing Management

LCO has historically practiced grazing activities within select parts of the BMP Area. Grazing will continue in areas of rehabilitation. A Trial was commenced in December 2012 and completed in 2018 under the advice of a local agronomist. The Trial assessed and compared performance of a rehabilitation grazing site against an adjoining un-mined (natural) grazing site across a range of soil, pasture and livestock parameters.

The trial utilised beef cattle of similar breed and age to reduce variation between cattle and the cattle are placed randomly in rehabilitation paddocks and natural (un-mined) paddocks. The trial involved monitoring of soils, water, pastures and livestock performance across both the rehabilitation and natural pastures. The following key outcomes/findings informing rehabilitation practices and outlined below;

- Growth rates of cattle grazing pastures sown on land rehabilitated after mining have been above (trials 1, 3 & 4) or equal (Trial 2) cattle grazing adjacent natural pastures on undisturbed land.
- The stocking rates have been maintained at the high end of district average to ensure pastures are subject to the kind of grazing pressure common in the area.
- Trace element levels were satisfactory in both rehabilitated and undisturbed soils and blood test of the cattle showed no contamination of cattle with heavy metals or excess minerals.
- Feed quality was a major factor in the increased performance of the cattle grazing rehabilitated pastures compared to unmined pastures
- Groundcover levels has been maintained above 70% across the sits during the studies.
- The pasture species sown on rehabilitated land comprises mostly tropical grasses (dominated by Rhodes Grass). The unmined pastures area a diverse mix of native and exotic species.

Within the term of this Plan, any grazing across other parts of the BMP area, will be restricted to improved pasture areas within mine rehabilitation >3 years age, where practicable, to assist with the management of fuel loads and enhance pasture diversity. Grazing will be managed in accordance with the following general grazing management principles:

- manage stocking rates and monitor grazing areas to ensure that overgrazing does not occur;
- stock will be rotated between fenced paddocks within mine rehabilitation based on pasture availability (height) and recovery of pastures following spelling to maintain sufficient groundcover (>70%) and allow grasses to regenerate;
- stock access to water bodies will be limited to prevent bank erosion and excess water turbidity;
- prevent stock access into biodiversity offset areas and remnant native woodland areas by fencing; and
- vegetation planted in order to provide shade and shelter for livestock uses species of suitable local provenance and those compatible with nearby vegetation communities.

Regular inspection and maintenance of shared boundary fences with grazing areas will assist in minimising incidences of un-authorised stock access into remnant vegetation areas.

4.17 Bushfire Management

The vegetation that will be retained within the BMP Area will require appropriate bushfire management to protect life and property, while providing necessary protection to the significant ecological features identified. The LCO Bushfire Management Plan provides for the documentation of specific management strategies for LCO and maintained for adaptive management processes (see Section 8).

The Bushfire Management Plan considers:

- exclusion of planned bushfire from revegetation and regeneration areas to allow replanted and regenerating communities to mature to a stage where they are able to withstand bushfire and regenerate naturally following such an event (nominally at least 15 years, but dependent on the success of plant establishment and the vegetation community present);
- consideration of the sensitivities of threatened species and TECs to bushfire and appropriate bushfire planning and management in relation to known occurrences of these. This will include specific focus on appropriate bushfire planning for protecting habitat for the spotted-tailed quoll, which is known to be particularly sensitive to inappropriate fire regimes (Long and Nelson 2004);
- the use of ecologically appropriate fire regimes (be they related to burn frequency, duration or intensity), as these have the potential to impact negatively on significant ecological features;
- asset protection; and
- appropriate incorporation of all relevant ecological requirements in the Bushfire Management Plan.

4.18 Indirect Impact Mitigation

Indirect impacts identified from the EA (Umwelt 2013) that were considered to have potential to impact biodiversity were the those relating to dust, noise and groundwater impacts. Dust levels will be managed in accordance with the Air Quality Management and Monitoring Program, with mitigation measures including:

- engineering controls (e.g. enclosure of conveyors);
- source-specific control measures routinely implemented (e.g. road dust suppression); and
- contingency measures implemented during periods of high particulate matter concentrations or adverse meteorological conditions, such as modification or ceasing of operations.

Noise impacts on native fauna will be minimised by ensuring that noise generated does not exceed noise impact assessment criteria, using mitigation measures including but not limited to the following:

- engineering controls (e.g. enclosure of fixed plant);
- source specific control measures (e.g. sound suppressed equipment); and
- contingency measures implemented in response to noise monitoring riggers such as modification or ceasing of operations.

Impacts to groundwater will be minimised by:

- development and implementation of a Water Management Plan including:

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- groundwater monitoring program and assessment criteria, including trigger levels to investigate any potential adverse impacts above those predicted;
- measures to prevent, mitigate or offset groundwater leakage from the Bowmans Creek alluvium in excess of the drawdown predicted
- measures to mitigate any direct hydraulic connection between the open and Bowmans Creek alluvium if the potential for adverse impacts is detected; and
- trigger response plan, review and reporting procedures.

4.19 Remediation of Modification 7 Area

Remediation works that will be undertaken in the Modification 7 Area are detailed in LCO Environmental Assessment Modification 7 to DA 305-11-01 (Hansen Bailey 2018), which will include:

- Minor vegetation clearing;
- Earthworks to establish a less erodible landform and water drainage paths;
- Reshaping and stabilisation of steep slope areas;
- Soil amendment and preparation works;
- Establishment of erosion and sediment control structures;
- Subsequent vegetation re-establishment.

Details on these management activities will be undertaken in accordance with the MOP.

The revegetation activities will focus on the re-establishment of PCT 1602 Spotted Gum - Narrow-leaved Ironbark Shrub – Grass Open Forest, and PCT 1614 Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig Open Forest.

Until the Modification 7 Area is fully stabilised and revegetated, it will be subject to all general requirements of the BMP, including but not necessarily limited to:

- access control (as per Section 4.1 as well as detail of Umwelt 2018)
- pre-clearing and tree-felling procedures (Section 4.8)
- habitat feature salvage (as per as detail of Umwelt 2018)
- topsoil management (Section 4.3)
- erosion, sedimentation and salinity control (Section 4.4)
- creek and drainage line protection (Section 4.5)
- pathogen management (Section 4.6)
- weed and feral animal control (Section 4.12 and 4.13)
- bushfire management (Section 4.17)
- nest box replacement (at a 1:1 ratio for hollows lost)

- Planting of specific foraging resources (as per Umwelt 2018) and
- Monitoring during vegetation re-establishment (as per Umwelt 2018).

5 Monitoring Program

The sites provided in **Table 10** below are proposed to continue to be monitored as permanent monitoring locations. These sites will each be monitored at the frequencies and in the seasons identified in **Table 10**, below. It is intended that this monitoring will continue for the life of mine (being 2028) or until sites are deemed redundant. It is intended that the monitoring program is (essentially) split over two years, with monitoring of half of the sites occurring in alternate years. Monitoring works will include, floristic monitoring, photo monitoring, fauna monitoring, soil analysis, stygofauna monitoring, instream and riparian ecological condition monitoring.

Site Name	Descriptor	Monitoring Type	Monitoring Frequency	Monitoring Season
W01	Remnant Grey Box - Narrow-leaved Ironbark shrubby woodland	Flora, General Fauna, soil chemistry	Biennial – Year A	Spring/Summer
W02	Remnant Grey Ironbark – Spotted Gum – Grey Box Open Forest	Flora, General Fauna, soil chemistry	Biennial – Year B	Spring/Summer
W03	Remnant Grey Box – Narrow-leaved Ironbark Shrubby Woodland	Flora, General Fauna, soil chemistry	Biennial - Year A	Spring/Summer
R01	Remnant Riparian - River Oak Riparian Woodland	Flora, General Fauna, soil chemistry	Biennial – Year B	Spring/Summer
R02	Remnant Riparian - River Oak Riparian Woodland	Flora, General Fauna, soil chemistry	Biennial – Year A	Spring/Summer
WR01	Rehabilitation Woodland	Flora, General Fauna, soil chemistry	Biennial - Year A	Spring/Summer
WR02	Rehabilitation Woodland Rehabilitation	Flora, General Fauna, soil chemistry	Biennial – Year B	Spring/Summer
Mountain Block Dam	Dam	Waterbird Survey	Biennial - Year A	Spring/Summer
Dam 1	Dam	Waterbird Survey	Biennial – Year B	Spring/Summer
Dam 3	Dam	Waterbird Survey, Targeted Blue-billed Duck	Biennial - Year A	Spring/Summer
Triangle Dams	Dam	Waterbird Survey, Targeted Blue-billed Duck	Biennial – Year B	Spring/Summer
Nest boxes		Nest Box Monitoring	Half Year A Half Year B	Spring/Summer
ALV2	Alluvial site	Stygofauna Monitoring	Annual	Spring and Autumn

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ALV3	Alluvial site	Stygofauna Monitoring	Annual	Spring and Autumn
ALV4	Alluvial site	Stygofauna Monitoring	Annual	Spring and Autumn
ALV7	Alluvial site	Stygofauna Monitoring	Annual	Spring and Autumn
ALV9	Alluvial site	Stygofauna Monitoring	Annual	Spring and Autumn
Bowmans Upstream (BCK1)	Bowmans Creek	Instream and Riparian Ecological Condition Monitoring	Biennial - Year A	Spring and Autumn
BCK3	Bowmans Creek	Instream and Riparian Ecological Condition Monitoring	Biennial – Year B	Spring and Autumn
BCK5	Bowmans Creek	Instream and Riparian Ecological Condition Monitoring	Biennial - Year A	Spring and Autumn
Bayswater Upstream	Bayswater Creek	Instream and Riparian Ecological Condition Monitoring	Biennial – Year B	Spring and Autumn
Bayswater Downstream	Bayswater Creek	Instream and Riparian Ecological Condition Monitoring	Biennial - Year A	Spring and Autumn

Table 10 Permanent Monitoring Sites

Additional monitoring sites will be added to assess progressive rehabilitation as it establishes. Until rehabilitation is established, a rehabilitation monitoring program is conducted under the Mining Operations Plan (LIDOC-90533967-5095) to monitor the success of rehabilitation measures and ensure remedial actions are undertaken as necessary. In addition to this, further remnant reference site locations will need to be added to the monitoring program to supersede monitoring sites that are in the approved mining footprint pathway and as such will be removed. These monitoring locations should ideally be relocated to a vegetation community commensurate to that of the original monitoring site. Precise locations of future monitoring sites will be determined on an as-required basis.

5.1 Flora Monitoring

Floristic monitoring will be undertaken at each permanent flora monitoring site according to the frequency outline in **Table 10**. This monitoring will be completed in a manner consistent with Biodiversity Assessment Methodology (BAM) (OEH 2017) and will consist of a 50 metre transect, 50 metre by 20 metre plot, with a 20 metre by 20 metre sub-plot and five 1 metre by 1 metre sub-plots.

At each plot/transect, roughly 45 to 60 minutes will be spent searching for all vascular flora species present within the 20 x 20 m plot. Searches of each 20 x 20 m plot will be generally undertaken through parallel transects from one side of the plot to another. Most effort will be spent on examining the groundcover, which usually supports well over half of the species present, however the composition of any shrub, mid-storey, canopy and emergent layers will also be thoroughly examined.

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For each flora species recorded in the plot, the following data will be collected in accordance with Table 2 of the BAM (OEH 2017):

- Stratum/layer in which the species occurs
- Growth form
- Scientific name and common name
- Cover and
- Abundance.

The following attributes will be recorded at each floristic plot, in accordance with the BAM (OEH 2017) to determine the condition of the vegetation zone:

- Composition - native plant species richness by growth form (within the 20 x 20 m plot)
- Structure – estimate foliage cover of native and exotic species by growth form (within the 20 x 20 m plot)
- Function - (within the 20 x 50 m plot) including, number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five 1 x 1 m plots), number of trees with hollows and high threat exotic cover.

Data collected will be analysed in order to identify changes in floristic diversity and abundance over time. Analyses will also be completed to compare rehabilitation/regeneration sites to their suitable benchmark/analogue sites. This will assist in tracking the progression of rehabilitation/regeneration sites in relation to performance criteria.

5.2 Habitat Assessment

Habitat assessment will also be undertaken in each 50 metre by 20 metre plot. Habitat features recorded at each site will include:

- General vegetation health;
- Evidence of natural seedling recruitment;
- Occurrence and abundance of weed species;
- Structure and floristics of vegetation cover;
- Signs of disturbance (by stock, people or feral animals);
- Nature and extent of erosion;
- Evidence of fire;
- Characteristic of ground cover (e.g. leaf litter, rocks, logs and soil);
- Nectar or fruit resources and perch sites;
- Water resources; and
- Secondary evidence of fauna use such as scats, tree scratches or diggings.

5.3 Photo Monitoring

Photo monitoring will be undertaken at each permanent flora monitoring location facing left, centre and right at the start of the 50 metre transect.

5.4 Fauna Monitoring

Fauna monitoring will be undertaken at each of the permanent monitoring locations, according to the frequency outline in **Table 10**. Fauna monitoring to be undertaken at each site will consist of diurnal woodland bird surveys, targeted winter bird surveys (for the regent honeyeater and swift parrot), micro-bat surveys, diurnal herpetofauna surveys, spotlighting surveys, call playback surveys, baited remote camera surveys, spotted-tailed quoll surveys, waterbird surveys and hollow-dependent fauna surveys. At each of the seven permanent fauna monitoring sites, the following will be undertaken:

- minimum of 20 minutes diurnal bird survey (species-time approach);
- targeted winter bird surveys;
- four full night Anabat surveys;
- one person hour of diurnal herpetofauna surveys;
- one person hour of spotlighting surveys;
- one call-playback session; and
- baited remote camera traps to be deployed for two weeks (targeted to spotted-tailed quoll).

Each of these is described in greater detail below.

5.4.1 Diurnal Woodland Bird Surveys

Diurnal woodland bird surveys will consist of slow walking transects over an approximate 2 hectare area surrounding the site. These surveys will take place within the first four hours/ last four hours of sunlight and will be in accordance with the species-time curve approach (DEC 2004). Surveys will be undertaken for a minimum of 20 minutes; after which every new species that is recorded triggers a further 5 minutes of survey.

All bird species identified during this time will be recorded as well as detailed on whether the bird identified was within, outside or flying over the site.

5.4.2 Targeted Winter Bird Surveys

Targeted winter bird surveys will be undertaken at monitoring sites with appropriate feed tree species for the regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*). These surveys will consist of an initial call playback session followed by a slow walking transect.

Calls will be broadcast using a directional loud hailer and commence with a quiet listening period of approximately five minutes. Each species call will then be played for a minimum of four minutes followed by a listening period of two minutes before the beginning of the next species call.

The slow walking transect will then be undertaken in the same manner as that for the diurnal woodland bird surveys.

5.4.3 Micro-Bat Surveys

Micro-bat surveys will be undertaken with Anabat devices equipped with a ZCAIM recording device for each permanent monitoring location and will be placed along a flyway over a riparian body. Micro-bat surveys will comprise four full survey nights of Anabat surveys for each site. Anabats will be set to record all micro-bat calls prior to dusk until after dawn.

5.4.4 Diurnal Herpetofauna Surveys

Targeted diurnal searches will be conducted for reptile and amphibian species (herpetofauna) within an approximate 2 hectare area of each of the seven monitoring sites as well as at blue-billed duck monitoring sites. One person hour of diurnal herpetofauna surveys will be undertaken for each site. Searches will comprise a slow walking meander searching areas of likely habitat such as under rocks and logs, in bark at the base of trees, around water resources and in man-made features.

5.4.5 Spotlighting Surveys

Spotlighting will target nocturnal mammal, birds and herpetofauna. One person hour of spotlighting surveys will be conducted at each of the seven monitoring sites within an approximate 2 hectare area of each site. Spotlighting will consist of slow walking meanders undertaken after sunset.

5.4.6 Call Playback Surveys

Call playback sessions will be undertaken at each of the seven monitoring locations using a directional loud hailer. Calls will be broadcast for the powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*), grass owl (*Tyto longimembris*), koala (*Phascolarctos cinereus*) and squirrel glider (*Petaurus norfolcensis*).

Call playback sessions will commence with a quiet listening period of five minutes. Each call was played for a minimum of two minutes followed by a listening period of two minutes. If a response or unclear noise was heard the call was repeated.

5.4.7 Baited Remote Camera Traps (Including Spotted-tailed Quoll) Monitoring

Spotted-tailed quoll monitoring is to be undertaken at each monitoring site and at 23 further locations (i.e. a total of 30 sites) and will consist of baited motion sensing remote cameras. At each of the seven monitoring sites, single baited remote camera stations will be positioned in an area of high fauna activity. The camera will be set to record five photographs each time it is triggered.

The 23 additional baited camera stations will be established as permanent monitoring locations across the BMP area. Methods will be as per those at the seven monitoring sites. These sites will be situated in areas including but not limited to:

- remnant vegetation;
- rehabilitated/regenerated vegetation;
- areas of known spotted-tailed quoll activity;
- known spotted-tailed quoll denning locations; and
- established log and boulder piles.

All baited remote camera stations will be left in-situ for a two week period. Baited remote cameras will be downloaded and analysed at the completion of the two weeks.

5.4.8 Waterbird Monitoring

Dam 1, Dam 3 and the two Triangle Dams (upper and lower) will each be subject to monitoring targeting all bird species using the dams. Waterbird monitoring will involve observing the dam surface, shore and emergent vegetation habitats using a 60 x magnification spotting scope and 10 x 42 binoculars. Bird species identified were recorded, along with details on whether they were within, outside or flying over the dams. Any signs of breeding activity will also be recorded.

Each waterbird survey site will have two one person hour long surveys undertaken on two separate days. These surveys will be undertaken in late summer/early autumn each year to coincide with the breeding activity of the blue-billed duck.

5.4.8.1 Blue-billed Duck Monitoring

In addition to the standard waterbird surveys indicated above, targeted blue-billed duck surveys will be undertaken at Dam 3 and the two Triangle Dams. Blue-billed duck habitat enhancement monitoring will consist of transect monitoring, macro invertebrate sampling, blue-billed duck counts and water quality monitoring.

5.4.8.2 Transect-based Monitoring

Transect-based monitoring will comprise a traverse along a permanent 50 metre transect. While traversing this transect the diversity and density of all aquatic, emergent and terrestrial vegetation within 3 metre either side of the transect will be recorded on a standard pro-forma.

Cover abundance of each of these species will be documented in accordance with the Braun-Blanquet scale.

Information will also be recorded on the presence and extent of aquatic and terrestrial weeds, presence of feral fauna, presence/condition of blue-billed duck informational signage and presence of any unexplained flora/fauna death.

5.4.8.3 Macro Invertebrate Sampling

Macro invertebrate will be undertaken at each site from within near edge habitats and macrophytes. Samples will be collected over a distance of 10 metres within representative habitat using a standard AUSRIVAS kick net with 250 µm mesh.

Samples will then be live-sorted for a 40 minute minimum period at each collection point. If new taxa continue to be identified after 40 minutes, picking will continue for a further ten minutes and then cease if no further taxa are identified. If further taxa are identified during this extended ten minute survey a further ten minutes of sorting will be undertaken. Samples will not be sorted for longer than 60 minutes total.

Sorted specimens will be preserved in a 70 percent ethanol solution and sent to a laboratory for processing.

Macro invertebrates will be sorted to a family or subfamily level (depending on requirements of the AUSRIVAS model). These macro invertebrates were then used to assign a Stream Invertebrate Grade Number – Average Level (SIGNAL) score for water quality.

5.4.8.4 Blue-billed Duck Counts

For each dam, observation will be made of the dam surface, shore and emergent vegetation for an approximate half hour period. Observation will be made using a 60 x magnification scope and 10 x 42 binoculars.

All bird species identified during this time will be recorded; however if blue-billed ducks are identified, the number of individuals will be counted.

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5.4.8.5 Water Quality Monitoring

The following water quality measurements will be undertaken for each dam:

- dissolved oxygen;
- conductivity;
- pH;
- temperature;
- turbidity;
- total nitrogen;
- nitrates;
- total phosphorus; and
- alkalinity.

5.4.9 Nest Box Monitoring

All nest boxes installed within the BMP area are subject to monitoring for condition and content. This occurs biennially over alternate years (i.e. half of all nest boxes installed at LCO are monitored one year and the second half are monitored the subsequent year). Details recorded for nest box monitoring is as follows:

- Content, including:
 - Whether they are being used by target species;
 - Signs of presence such as nesting material or feathers;
 - Predator use;
 - presence of native fauna; and
 - presence of non-target species such as bees, wasps and introduced birds.
- Condition, including:
 - Collapsing joints;
 - Missing lids;
 - Bowing timber;
 - Perishing timber; and
 - Tree attachment.

Additional nest box monitoring surveys will be undertaken where new nest boxes are installed as habitat enhancement measures. These will be undertaken annually commencing the year after installation.

5.5 Soil Chemistry

Sites contained in **Table 10** will have soil samples taken and analysed for:

- pH
- Electrical Conductivity (EC)

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- Exchangeable sodium percentage (ESP)
- Cation exchange capacity (CEC)
- Macro Nutrients
- Trace Elements
- Emerson Aggregate test

Sampling should be conducted of the top 10-15cm of the soil profile or otherwise sampling depth should correspondance with the average depth of topsoil applied. Sampling should be used to determine soil conditions of reference sites and monitor the development of rehabilitation soils.

5.6 Rehabilitation Monitoring

Rehabilitation performance will be monitored to ensure that target vegetation is establishing and to determine the need for any maintenance and/or contingency measures. The details of this monitoring program are provided in the Mining Operations Plan. The objectives of the program are to:

- assess the long term stability and functioning of rehabilitation areas;
- assess rehabilitation performance against the closure criteria; and
- facilitate continuous improvement in rehabilitation practices.

From these objectives, the key elements of this rehabilitation monitoring program include:

- Rehabilitation Records – detailed documentation of each rehabilitation campaign to allow later interpretation against performance criteria and to allow adaptive management and continual improvement based on feedback from monitoring;
- Rehabilitation Area Walkover Inspections – these annual inspections will involve assessment and recording of evidence of erosion, stability and functioning of erosion and sediment control measures, visual assessment of vegetation features and success. Evidence of faunal usage of rehabilitation areas and presence of weeds and pests. Rehabilitation will additionally be monitored to review the impacts of grazing by native herbivores and management strategies recommendations provided as required;
- Ecological Monitoring Program – as defined in Sections 5.1 to 5.4 above;
- Pasture Rehabilitation – including monitoring of sward composition, yields/carrying capacities and total management inputs.
- Native Ecosystem Development - as defined in Sections 5.1 to 5.4 above; and
- Geochemical Monitoring – soil samples are tested against a number of geochemical criteria to track its progress towards the characteristics of analogue sites.

5.7 Stygofauna Monitoring

Baseline stygofauna monitoring will be undertaken at two six month intervals prior to predicted drawdown occurring along Bowmans Creek and then every 6 months following the occurrence of predicted drawdown. This

monitoring will occur for a three-year minimum following the predicted drawdown occurring, after which point the requirement to continue monitoring will be evaluated.

Stygofauna monitoring will be undertaken at four locations (ALV2, ALV3, ALV4, ALV7 and ALV9). Stygofauna monitoring will utilise a weighted sampling net with 50µm mesh that will be lowered to the bottom of each bore. The net will then be raised and dropped over an approximate 50 cm distance three to five times to dislodge fauna. The net will then slowly be brought back to the surface.

Once nets are at the surface, contents will be rinsed into a 50µm mesh sieve. This process will be repeated six times for each site.

Sieve contents will then be washed into a sample jar containing ethanol, appropriately labelled and then sent to a laboratory for identification.

5.8 Instream and Riparian Ecological Condition Monitoring

Instream and riparian condition will be undertaken using the Riparian Channel and Environmental (RCE) inventory (Peterson 1992) which has been modified to suit Australian Conditions (Chessman et al. 1997). RCE will be undertaken at three locations along Bowmans Creek (Bowmans Creek Upstream, BCK3 and BCK 5) and two locations along Bayswater Creek (Bayswater Ck Upstream and Bayswater Creek Downstream).

This monitoring will take place biennially in order to document any changes to instream and riparian condition of Bowmans Creek and Bayswater Creek.

RCE will be monitored using a set of 13 descriptors, each with scores between 1 and 4. This will provide a total score for each site out of 52 that will be used to indicate the degree of modification as a result of human activity.

5.9 Tiger Orchid Monitoring

Any recipient trees containing translocated tiger orchids will be monitored on a regular basis to assess the health of the plants, and the success of the relocation efforts. This monitoring will occur on a six monthly basis for the first year following relocation, and annually thereafter. Monitoring will use semi-quantitative recording, including details on the following:

- observed health of plant;
- any observed flowering or breeding of the plant;
- appropriateness of translocation position in the landscape;
- need for repair or maintenance of host tree/branch;
- effectiveness of any previously recommended actions to protect/enhance the species; and
- photo monitoring.

The results of the monitoring will include any recommendations to improve the condition of tiger orchids to ensure the on-going health and viability. Results will be provided within the annual ecological monitoring reporting. Monitoring will continue for five years (or beyond), until such time that the translocated plants are stable and healthy and the translocation project is deemed successful.

Some examples of triggers that may indicate the need for remedial action may include (but not be limited to):

- browning or loss of foliage;

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- dis-attachment of tiger orchid roots from translocated section of its original host tree;
- dis-attachment of translocated section of host tree (including the tiger orchid) from the recipient tree;
- evidence of sunburn, windburn or other unsuitable environmental conditions of recipient tree;
- evidence of grazing or excessive insect attack;
- lack of obvious growth or flowering; and
- evidence of plant disease.

Remedial actions that could be considered to prolong specimen longevity, as deemed required by a suitably qualified person, include (but are not necessarily limited to) re-attachment, removal of plant into nursery situation to address health issues, propagation of plant to ensure chances of survival, potential relocation to a different aspect/location within the recipient tree or relocation to a different recipient tree.

If required, expert advice will be sought to determine the most appropriate remedial action.

5.9.1 Control Sites for Tiger Orchid

A naturally occurring (control) tiger orchids is located in the Mountain Block Offset Southern Paddock and will be monitored using the same criteria as for translocated tiger orchids for reference purposes. Observing naturally occurring tiger orchids in conjunction with translocated individuals will assist in determining if observed changes in the translocated tiger orchids are a result of natural environmental conditions or a result of the translocation process.

6 Performance and Completion Criteria

The performance indicators and completion criteria listed in **Table 11** below relate to the general management strategies as outlined in Section 4.0. Completion criteria are objective target levels or values assigned to a variety of indicators (i.e. slope, species diversity, groundcover etc.), which can be measured against to demonstrate progress and ultimate success of rehabilitation. As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful and the lease relinquishment process can proceed.

The management measures implemented are for the ongoing implementation of this BMP and can be used to assist in demonstrating how management actions are progressing towards achieving completion criteria.

The completion of and performance against each of these indicators/criterion needs to be assessed and documented in the AEMR, based on the outcomes of ecological monitoring and inspections across LCO for each year.

The performance indicators and completion criteria will be reviewed and revised throughout the Project life through consideration of the results of monitoring programs; any relevant research trials; and consideration of stakeholder feedback.

Action/Item	Management Measure Implementation			Performance Indicator / Completion Criteria	Responsibility
	Year 4 (Aug 2018 / Aug 2019)	Year 5 (Aug 2019 / Aug 2020)	Year 6 (Aug 2020 / Aug 2021)		
Fencing, Signage and Access Control					
Complete inspection of all fencing and signage of BMP Area to map locations, condition and identify need for new fencing or redundant fencing.				Inspection completed in Year 1 and actions completed in Year 3 of BMP.	LCO, fencing contractors.
Minimum twice yearly inspections of fences and signage to identify any works required Fencing and signage of relevant parts of BMP area should be as per Section 4.1	Inspections undertaken nominally in March and September. Damaged critical fences to be repaired within 1 week (temporary if needed), final repairs and non-critical repairs to be completed in 1 month.	Inspections undertaken nominally in March and September. Damaged critical fences to be repaired within 1 week (temporary if needed), final repairs and non-critical repairs to be completed in 1 month.	Inspections undertaken nominally in March and September. Damaged critical fences to be repaired within 1 week (temporary if needed), final repairs and non-critical repairs to be completed in 1 month.	All fences in functional condition. Riparian areas are adequately fenced/protected against damage from uncontrolled human or livestock access.	LCO, fencing contractors
Access Track Maintenance					
New access tracks (only constructed where necessary) are subject to due diligence assessments.	Complete due diligence assessments for new access tracks requiring new ground disturbance to minimise impact on biodiversity, where possible.	Complete due diligence assessments for new access tracks requiring new ground disturbance to minimise impact on biodiversity, where possible.	Complete due diligence assessments for new access tracks requiring new ground disturbance to minimise impact on biodiversity, where possible.	New access tracks requiring new ground disturbance are only constructed where necessary and are subject to due diligence inspections	LCO
Minimum twice a year BMP Area inspections to identify track conditions, any works	Inspections undertaken nominally in March and	Inspections undertaken nominally in March and	Inspections undertaken nominally in March and	Tracks maintained in good usable condition and unnecessary tracks	LCO

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required and any unnecessary tracks to be remediated	September. Action and repair track damage or remediation where applicable.	September. Action and repair track damage or remediation where applicable.	September. Action and repair track damage or remediation where applicable.	are remediated	
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Topsoil Management

Areas containing weeds that may pose a threat to rehabilitation are targeted using appropriate weed control methods prior to topsoil stripping. Methods may include, foliar spraying, basal bark spraying, cut and paint, slashing and other mechanical methods as deemed appropriate.	Pre-stripping weed control of topsoil is completed, as needed.	Pre-stripping weed control of topsoil is completed, as needed.	Pre-stripping weed control of topsoil is completed, as needed.	Weed control is completed prior to topsoil stripping (where required) to minimise future potential impact to rehabilitation success.	LCO, weed management contractors
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Creek and Drainage Line Protection

Fencing/protection of LCO controlled side of riparian corridor (as part of Offset Management Plan).	Refer to fencing action items above in table.	Refer to fencing action items above in table.	Refer to fencing action items above in table.	Riparian areas are adequately fenced/protected against damage from uncontrolled human or livestock access.	LCO
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Pathogen Management

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If reasonable potential for pathogens is identified in the BMP Area, appropriate pathogen monitoring and management protocols are developed and implemented.	If reasonable potential is identified, pathogens are considered in design and implementation of monitoring works. If identified (or potential identified), management actions for specific pathogens are developed and implemented.	If reasonable potential is identified, pathogens are considered in design and implementation of monitoring works. If identified (or potential identified), management actions for specific pathogens are developed and implemented.	If reasonable potential is identified, pathogens are considered in design and implementation of monitoring works. If identified (or potential identified), management actions for specific pathogens are developed and implemented.	Methods to identify potential pathogens are considered in monitoring program design (if reasonable potential of pathogen presence is identified onsite). Signs of pathogen presence (or potential presence) are immediately reported. If suspected to be onsite, detailed management actions are developed and implemented. There is no onsite infestation of Phytophthora cinnamomi, Myrtle rust or Chytridiomycosis.	LCO, pathogen expert
Seed Collection					
Where suitable remnant vegetation is available, implementation of seed collection and handling program for use in revegetation/rehabilitation works.	Pre-clearing surveys identify potential seed sources. Seeds are collected, stored and handled according to appropriate program. Collected seed resources are used in revegetation/rehabilitation works.	Pre-clearing surveys identify potential seed sources. Seeds are collected, stored and handled according to appropriate program. Collected seed resources are used in revegetation/rehabilitation works.	Pre-clearing surveys identify potential seed sources. Seeds are collected, stored and handled according to appropriate program. Collected seed resources are used in revegetation/rehabilitation works.	Rehabilitation/revegetation works use seeds collected onsite, thus maintaining as much genetic similarity (local provenance) as possible.	LCO, seed collection contractors
Vegetation Clearing					
Detailed pre-clearing procedure is to be	Pre-clearing process is to be implemented as part of GDP	Pre-clearing process is to be implemented as part of GDP	Pre-clearing process is to be implemented as part of GDP	Pre-clearing process has been	LCO, ecological

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implemented when clearing areas of woody native vegetation (including shrub, groundcover and isolated trees in grasslands).	process. Outcomes of pre-clearing process are recorded and recommendations are implemented.	process. Outcomes of pre-clearing process are recorded and recommendations are implemented.	process. Outcomes of pre-clearing process are recorded and recommendations are implemented.	followed. Recommendations from pre-clearing process have been implemented, prior to tree felling if necessary. Outcomes of pre-clearing procedure are recorded and readily accessible.	consultant
Detailed tree felling process is to be implemented when clearing areas of woody native vegetation (including shrub, groundcover and isolated trees in grasslands).	Tree felling process is to be implemented as part of the GDP process. Outcomes of tree-felling process are recorded and recommendations are implemented.	Tree felling process is to be implemented as part of the GDP process. Outcomes of tree-felling process are recorded and recommendations are implemented.	Tree felling process is to be implemented as part of the GDP process. Outcomes of tree-felling process are recorded and recommendations are implemented.	Tree felling process has been followed when required. Recommendations from tree felling process have been implemented.	LCO, ecological consultant

Translocation Works

Translocation of tiger orchids or other threatened flora species (if encountered during pre-clearing process) to biodiversity offset areas.	Tiger orchids identified during pre-clearing process are salvaged during the tree felling process and are translocated into biodiversity offset areas. Any translocated individuals are subject to regular monitoring and maintenance works, if required. Reporting of translocation works and monitoring works is maintained.	Tiger orchids identified during pre-clearing process are salvaged during the tree felling process and are translocated into biodiversity offset areas. Any translocated individuals are subject to regular monitoring and maintenance works, if required. Reporting of translocation works and monitoring works is maintained.	Tiger orchids identified during pre-clearing process are salvaged during the tree felling process and are translocated into biodiversity offset areas. Any translocated individuals are subject to regular monitoring and maintenance works, if required. Reporting of translocation works and monitoring works is maintained.	Tiger orchids (or other threatened flora species if encountered) are salvaged from Approved Modification Area and translocated into biodiversity offset areas. Detailed records are kept on the process, including regular monitoring and maintenance works as required. No completion criterion is proposed regarding condition due to uncertainty of plant response.	LCO, ecological consultant, orchid translocation expert
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Remnant Vegetation and Habitat Management

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Remnant vegetation is to be protected from accidental impact.	Areas to be disturbed will be clearly defined in the field to prevent accidental impact to remnant vegetation.	Areas to be disturbed will be clearly defined in the field to prevent accidental impact to remnant vegetation.	Areas to be disturbed will be clearly defined in the field to prevent accidental impact to remnant vegetation.	No areas of remnant vegetation are impacted unnecessarily.	LCO
Remnant vegetation is protected from disturbance.	Remnant vegetation will be fenced or sign-posted as necessary to protect from disturbance. Annual inspections are completed to assess condition of fences and signs, areas of erosion concern, weeds or feral animals requiring control. Management works will be conducted, as necessary.	Remnant vegetation will be fenced or sign-posted as necessary to protect from disturbance. Annual inspections are completed to assess condition of fences and signs, areas of erosion concern, weeds or feral animals requiring control. Management works will be conducted, as necessary.	Remnant vegetation will be fenced or sign-posted as necessary to protect from disturbance. Annual inspections are completed to assess condition of fences and signs, areas of erosion concern, weeds or feral animals requiring control. Management works will be conducted, as necessary.	Remnant vegetation is protected from disturbance such as accidental clearing, unauthorised access, erosion, weeds and feral animals.	LCO
Annual inspections undertaken by suitably qualified personnel to assess the extent of natural regeneration occurring.	Annual inspection undertaken by suitably qualified personnel to assess extent of natural regeneration occurring. Appropriate action is undertaken if regeneration is deemed as being inadequate.	Annual inspection undertaken by suitably qualified personnel to assess extent of natural regeneration occurring. Appropriate action is undertaken if regeneration is deemed as being inadequate.	Annual inspection undertaken by suitably qualified personnel to assess extent of natural regeneration occurring. Appropriate action is undertaken if regeneration is deemed as being inadequate.	Areas where natural recruitment is not occurring have been identified and assisted regeneration is occurring if considered appropriate.	LCO, ecological consultant, rehabilitation contractor
Rehabilitation Works					
Criteria for these works are included within the Mining Operations Plan (LCO 2018). This includes detailed criteria for rehabilitation success (survival, succession, vegetation structure and health).					
Weed Control					
Complete weed inspections of BMP area every two months to document diversity and abundance of noxious weed records. This	Inspections completed every two months, followed by implementation of required control methods, as required.	Inspections completed every two months, followed by implementation of required control methods, as required.	Inspections completed every two months, followed by implementation of required control methods, as required.	Regular inspections are undertaken for weed inspections and outcomes documented.	LCO, weed management contractors,

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will then inform ongoing control actions (as needed), including timing, frequency, target species and methods to be used.					
Weed inspections of remnant and rehabilitation areas	Annual inspections are undertaken of remnant vegetation to identify areas of weed infestation Weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Annual inspections are undertaken of remnant vegetation to identify areas of weed infestation Weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Annual inspections are undertaken of remnant vegetation to identify areas of weed infestation Weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Annual inspections are undertaken for weed inspections and outcomes documented. Weed densities in rehabilitation/regeneration areas are no worse than those in remnant vegetation (analogue) sites or as specified in the MOP. There are no significant weed infestations that are identified as a risk to rehabilitation or regeneration areas.	LCO, weed management contractors, ecological consultants
Feral Animal Control					
Complete feral animal inspections of BMP area every two months to document sighting and abundance records. This will then inform ongoing control actions (as needed), including timing, frequency, target species and methods to be used.	Inspections completed every two months, followed by implementation of required control methods, as required.	Inspections completed every two months, followed by implementation of required control methods, as required.	Inspections completed every two months, followed by implementation of required control methods, as required.	BMP area is inspected for feral animal diversity and abundance every two months. Control measures are implemented in response to outcomes of the inspections. Measures are being taken to control feral animals in the BMP area.	LCO, feral fauna management contractors, ecological consultants
Develop and implement an effective annual pest animal action plan which details adaptive control measures as required	Develop and implement pest animal action plan which details adaptive control measures as required	Develop and implement pest animal action plan which details adaptive control measures as required	Develop and implement pest animal action plan which details adaptive control measures as required	Strategies from action plans are implemented.	LCO, feral fauna management contractors, ecological consultants

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Develop a vertebrate pest control register to document when and where each control method is implemented.	Update and maintain vertebrate pest control register.	Update and maintain vertebrate pest control register.	Update and maintain vertebrate pest control register.	Pest animal control register is maintained and up to date.	LCO
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Blue-billed Duck Management

Complete habitat enhancement, maintenance and monitoring works (as required) for the blue-billed duck	Ongoing habitat enhancement and management works within Dam 3 and two Triangle Dams; requirement as identified during annual inspections. Monitoring works as required.	Ongoing habitat enhancement and management works within Dam 3 and two Triangle Dams requirement as identified during annual inspections. Monitoring works as required.	Ongoing habitat enhancement and management works within Dam 3 and two Triangle Dams requirement as identified during annual inspections. Monitoring works as required.	Monitoring shows appropriate habitat for the blue-billed duck is maintained is provided in Dam 3 and two Triangle Dams.	LCO, ecological consultants
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Habitat Enhancement

Salvage of habitat features (particularly for the spotted-tailed quoll) such as hollow-bearing trees, logs, stumps, large rocks and boulders.	Suitable habitat features identified during the pre-clearing process are salvaged. Salvaged features are either re-instated into areas with low levels of habitat features or stockpiled appropriately for later use. Timber or boulder piles will be constructed in riparian areas and areas of regeneration, revegetation and/or rehabilitation (as appropriate) to provide potential quoll denning habitat.	Suitable habitat features identified during the pre-clearing process are salvaged. Salvaged features are either re-instated into areas with low levels of habitat features or stockpiled appropriately for later use. Timber or boulder piles will be constructed in riparian areas and areas of regeneration, revegetation and/or rehabilitation (as appropriate) to provide potential quoll denning habitat.	Suitable habitat features identified during the pre-clearing process are salvaged. Salvaged features are either re-instated into areas with low levels of habitat features or stockpiled appropriately for later use. Timber or boulder piles will be constructed in riparian areas and areas of regeneration, revegetation and/or rehabilitation (as appropriate) to provide potential quoll denning habitat.	Appropriate habitat features have been salvaged. Salvaged habitat features are re-instated into areas of remnant vegetation lacking in habitat features or into rehabilitated vegetation. Appropriate spotted-tailed quoll habitat has been salvaged and placed into onsite rehabilitation areas. Habitat features that have been salvaged and are yet to be re-instated are in appropriate storage. Appropriate documentation is available of any habitat features salvaged.	LCO, clearing contractors, ecological consultants
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Nest boxes are providing habitat value for native fauna.	Biodiversity offset areas, areas of remnant vegetation and suitably established rehabilitated vegetation (not in disturbance areas) will be supplemented with nest boxes as required.	Continue staged installation of nest boxes. Established nest boxes are subject to annual inspection and maintenance.	Continue staged installation of nest boxes. Established nest boxes are subject to annual inspection and maintenance.	Nest boxes densities appropriate. Boxes are monitored and maintained.	LCO, ecological consultants
Salvaged–reinstated hollows	Salvaged and re-instated hollows are subject to annual monitoring in conjunction with nest boxes.	Salvaged and re-instated hollows are subject to annual monitoring in conjunction with nest boxes.	Salvaged and re-instated hollows are subject to annual monitoring in conjunction with nest boxes.	All salvaged re-instated hollows are monitored and maintained.	LCO, ecological consultants
Timing of nest box installation	Removed hollows will be replaced (with nest boxes) within six months of each discrete clearing event.	Removed hollows will be replaced (with nest boxes) within six months of each discrete clearing event.	Removed hollows will be replaced (with nest boxes) within six months of each discrete clearing event.	Seasonal breeding opportunities are not lost due to delay in nest box installation.	LCO, ecological consultants
Foraging specific plant resources	Rehabilitation and revegetation plantings undertaken include bulloak (Allocasuarina luehmannii), swamp oak (Casuarina glauca), broom bitter pea (Daviesia genistifolia), sickle wattle (Acacia falcata), hickory wattle (Acacia implexa) and cooba (Acacia salicina)	Rehabilitation and revegetation plantings undertaken include bulloak (Allocasuarina luehmannii), swamp oak (Casuarina glauca), broom bitter pea (Daviesia genistifolia), sickle wattle (Acacia falcata), hickory wattle (Acacia implexa) and cooba (Acacia salicina)	Rehabilitation and revegetation plantings undertaken include bulloak (Allocasuarina luehmannii), swamp oak (Casuarina glauca), broom bitter pea (Daviesia genistifolia), sickle wattle (Acacia falcata), hickory wattle (Acacia implexa) and cooba (Acacia salicina)	Rehabilitation areas include plant species that are specific foraging resources.	LCO, rehabilitation contractors, ecological consultants

Grazing Management

Stock rotation	Cattle are grazed within improved pasture areas within mine rehabilitation >3years where practical Stocked will be managed to allow pasture recovery and	Cattle are grazed within improved pasture areas within mine rehabilitation >3years where practical. Stocked will be managed to allow pasture recovery and	Cattle are grazed within improved pasture areas within mine rehabilitation >3years where practical. Stocked will be managed to allow pasture recovery and	Refer to the RMP, pasture rehabilitation will be managed to achieve the RMP rehabilitation completion criteria.	LCO, cattle manager
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	maintain pasture availability and sufficient groundcover.	maintain pasture availability and sufficient groundcover.	maintain pasture availability and sufficient groundcover.		
Bushfire Management					
Bushfire Management Plan will be implemented.	Implementation of requirements of Bushfire Management Plan.	Implementation of requirements of Bushfire Management Plan.	Implementation of requirements of Bushfire Management Plan.	Bushfire risk is managed according to a Bushfire Management Plan which allows for appropriate protection of life and property, as well as identified significant ecological features.	LCO, bushfire consultants
Modification 7 Area					
Access control	Remediation area clearly defined and demarcated prior to any revegetation works commencing.	Demarcation is maintained for the duration of remediation activities.	Demarcation is maintained for the duration of remediation activities.	Demarcation was maintained for the duration of remediation activities and removed upon completion.	LCO
Pre-clearing	Vegetation is subject to appropriate pre-clearing surveys prior to clearing activities taking place.	Vegetation is subject to appropriate pre-clearing surveys prior to clearing activities taking place.	Vegetation is subject to appropriate pre-clearing surveys prior to clearing activities taking place.	All vegetation cleared was subject to pre-clearing surveys.	LCO, consulting ecologists
Tree-felling supervision	Habitat features identified during pre-clearing surveys are subject to appropriate supervision during their removal.	Habitat features identified during pre-clearing surveys are subject to appropriate supervision during their removal.	Habitat features identified during pre-clearing surveys are subject to appropriate supervision during their removal.	All habitat features identified were subject to appropriate supervision during their removal.	LCO, consulting ecologists
Tree-felling supervision	A running tally of hollows felled during tree felling is retained (along with sizes of hollows removed).	A running tally of hollows felled during tree felling is retained (along with sizes of hollows removed).	A running tally of hollows felled during tree felling is retained (along with sizes of hollows removed).	The number and type of hollows removed were used to inform nest-box installation activities.	LCO, consulting ecologists

Biodiversity Management

Habitat feature salvage	Habitat features identified as appropriate for salvage during pre-clearing surveys are: • Documented • Salvaged • Stockpiled • Documented • Re-instated as part of rehabilitation.	Habitat features identified as appropriate for salvage during pre-clearing surveys are: • Documented • Salvaged • Stockpiled • Documented Re-instated as part of rehabilitation.	Habitat features identified as appropriate for salvage during pre-clearing surveys are: • Documented • Salvaged • Stockpiled • Documented • Re-instated as part of rehabilitation.	All habitat features identified during pre-clearing surveyed were: • Documented • Salvaged • Stockpiled • Documented Re-instated as part of rehabilitation.	LCO, consulting ecologists
Nest box installation	When rehabilitation trees are an appropriate size, nest boxes are installed which replace hollows removed at a 1:1 ratio.	When rehabilitation trees are an appropriate size, nest boxes are installed which replace hollows removed at a 1:1 ratio.	When rehabilitation trees are an appropriate size, nest boxes are installed which replace hollows removed at a 1:1 ratio.	Nest boxes have replaced hollows removed at a ratio of 1:1.	LCO
Planting of foraging specific resources	If revegetation works commence during this year, foraging resources are planted which include those specified in Section 5.2.5 of the EA (Umwelt 2018).	If revegetation works commence during this year, foraging resources are planted which include those specified in Section 5.2.5 of the EA (Umwelt 2018).	If revegetation works commence during this year, foraging resources are planted which include those specified in Section 5.2.5 of the EA (Umwelt 2018).	Rehabilitated vegetation includes species listed in Section 5.2.5 of the EA (Umwelt 2018).	LCO
Vegetation is commensurate with target PCTs	If rehabilitation commences, species planted will be commensurate with species compositions required in relevant PCT benchmarks. Installation of habitat features will also include consideration of benchmark targets.	If rehabilitation commences, species planted will be commensurate with species compositions required in relevant PCT benchmarks. Installation of habitat features will also include consideration of benchmark targets.	If rehabilitation commences, species planted will be commensurate with species compositions required in relevant PCT benchmarks. Installation of habitat features will also include consideration of benchmark targets.	Rehabilitated vegetation contains a species composition and habitat features compatible with relevant PCT benchmark data.	LCO

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Monitoring	If required, monitoring is undertaken to determine: • Success of establishment of vegetation plantings • Success of rehabilitation establishment • Success of rehabilitation sustainability.	If required, monitoring is undertaken to determine: • Success of establishment of vegetation plantings • Success of rehabilitation establishment • Success of rehabilitation sustainability.	If required, monitoring is undertaken to determine: • Success of establishment of vegetation plantings • Success of rehabilitation establishment • Success of rehabilitation sustainability.	Maintenance and management of rehabilitation works was informed by progressive monitoring data.	LCO, consulting ecologists
Ecological Monitoring					
Undertake floristic, fauna, LFA, waterbird, nest box, stygofauna and instream/riparian monitoring program throughout LCO	Monitoring program completed and reported	Monitoring program completed and reported	Monitoring program completed and reported	Monitoring programs completed and results reported.	LCO, ecological consultants
Undertake annual inspections of LCO rehabilitation areas as per the MOP	Annual inspections completed	Annual inspections completed	Annual inspections completed	Annual inspections completed as per the MOP	LCO, ecological consultants
Native fauna presence in rehabilitation/regeneration areas	Fauna monitoring completed	Fauna monitoring completed	Fauna monitoring completed	Fauna monitoring confirms that native fauna species are recorded within rehabilitation/regeneration areas.	LCO, ecological consultants

Table 11 Years 4 to 6 Performance Indicators and Completion Criteria

7 Risk Management

There are a number of potential risks, or situations where performance indicators and completion criteria may not be achieved. A list of potential situations where biodiversity conservation objectives of this BMP may not be met is provided in **Table 12**, along with potential corrective actions. This list is adapted from Rawlings et al (2010).

Management Aspect	Key Element	Trigger	Corrective Action	Responsibility
General Management	Protection of Remnant Vegetation	Unauthorised stock access.	Identify access points and repair fences appropriately. Communicate with agricultural managers and adjacent landholders to emphasise areas where stock are not permitted.	LCO
	Weed Management	Regular noxious weed inspections identify an increase in abundance or new species are detected.	Adapt weed management actions and modify control strategies accordingly. Ensure that weed densities in rehabilitation/regeneration areas are no worse than those in remnant vegetation (analogue) sites. Ensure that there are no significant weed infestations that are identified as a risk to rehabilitation or regeneration areas.	LCO, weed management contractors
	Feral Fauna Management	Infestations of pest animals are increasing or new species detected.	Adapt pest management plan and modify strategies accordingly.	LCO, feral fauna management contractors
Vegetation Clearing	Protection of Remnant Vegetation	Vegetation outside of approved areas is subject to clearing.	Investigate whether areas were subject to appropriate demarcation. Rehabilitate areas immediately with compatible vegetation.	LCO

	Pathogen Management	Myrtle rust or Phytophthora cinnamomi identified or suspected to be present during pre-clearing surveys.	Commission suitably qualified personnel to undertake pathogen control works. Ensure any vehicles and equipment that may have come into contact with contaminated equipment is appropriately cleaned.	LCO, suitably qualified pathogen experts
	Fauna Injury/Fatality	Fauna fatality regularly occurring during tree-felling.	Investigate into what stage fauna fatalities are occurring and what the cause of death is. If possible, revise tree-felling protocols to reduce injury or fatality occurrences.	LCO, tree felling supervision contactors
Topsoil Management	Stockpile management	Topsoil stockpiles are weed infested.	Investigate what procedures were undertaken during soil stripping process to identify areas for improvement in future. Undertake weed spraying of stockpiles Consider compaction of stockpiles to prevent germination. Consider sowing of stockpile with a suitable sterile cover crop.	LCO
	Stockpile management	Topsoil subject to significant erosion.	Reshape sides of topsoil to be more gently sloping. Reduce heights of stockpiles. Sow infertile cover crop.	LCO
Tiger Orchid Translocation	Translocation methods	Attachment of tiger orchid to tree is failing.	Replace tiger orchid attachment to tree. Investigate a more appropriate mechanism of attachment.	LCO, suitably qualified orchid translocation supervision consultant
	Translocation success	Health of tiger orchid is failing.	Investigate causes of deterioration of orchid health.	LCO, suitably qualified orchid translocation supervision consultant

Revegetation Success	Species composition	No regeneration of plants, or indicator species missing.	Assess fencing and ensure there is no un-authorised stock access or native fauna (i.e. grazing kangaroos). Control exotic weeds and pest animals to reduce competition. If deemed necessary, instigate active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation.	LCO, rehabilitation contractors/consultants
	Native flora diversity	Low flora species diversity or species diversity not consistent with target community.	Targeted weed control. Instigate active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and auguring. Revegetate with high diversity patches. Assesses adequacy of soil present as an appropriate growth medium.	LCO, rehabilitation and ecological consultants
	Native fauna diversity	Fauna species diversity of rehabilitated areas is inconsistent with reference communities.	Control feral predators. Increase habitat features of target fauna species (i.e. nest boxes, specific foraging resources, log and rock piles etc).	LCO, feral fauna management contractors, ecological consultants
	Tree cover	Low or no tree cover.	Plant/direct seed trees at appropriate rate using minimal ground disturbance.	LCO, rehabilitation and ecological consultants
	Survivorship	Tree dieback (from insect pressure, herbicide drift, water stress).	Revegetate with dense shrubs to increase diversity and insectivorous birds. Avoid using defoliant near woodlands when windy.	LCO, rehabilitation and ecological consultants

			Increase patch size through revegetation. Do not fertilise and prevent fertiliser drift.	
	Weed management	Patches of exotic annual and perennial grasses occur.	Spot spray small clumps. Investigate suitability to undertake a spring burn. Monitor and maintain control.	LCO, weed management contractors
	Weed management	Exotic broadleaf weeds abundant or dominant.	Use bush regeneration principles to manage. Use broadleaf herbicides in accordance with best practice guidelines. Hand weed if appropriate.	LCO, weed management contractors
	Weed management	Tree and shrubs present but dense exotic ground cover.	Densely plant trees and shrubs to outcompete with the exotic ground covers. Spot spray small clumps or hand remove exotic ground covers around native ground covers.	LCO, weed management contractors
	Native flora diversity	Dense stands of colonising tree or shrub species dominate regeneration or revegetation areas.	Assess whether thinning is necessary. Leave if patches are small and plants are native. Thin manually if appropriate. Leave woody debris in-situ to enhance habitat value.	LCO, rehabilitation and ecological consultants
Habitat Enhancement	Habitat Enhancement	Scarcity of key habitat features present in relation to reference sites.	Add habitat features such as logs or branches. Increase the number of vegetation layers in the patch. Establish nesting boxes for target species.	LCO, ecological consultants
	Habitat salvage	Habitat features salvaged are damaged during	Investigate machinery and equipment currently being used to salvage and translocate habitat	LCO, ecological consultants

		salvage or during stockpiling.	features. Update protocols based on findings. Investigate adequacy of storage emplacement areas of features. Revise locations if necessary.	
Bushfire Management	Bushfire Management	Unplanned bushfire event occurs.	Review procedures in place and update Bushfire Management Plan based on findings. Monitor plant succession after bushfire event.	LCO, consultants bushfire

Table 12 Biodiversity Trigger, Action and Response Plan

8 Adaptive Management

8.1 Adaptive Management Process

Adaptive management of the BMP will be responsive to any new and relevant data that may arise through the monitoring described in Section 5.0, legislative change or any other studies completed at the site. This will enable a flexible approach to management commitments, allowing ongoing feedback and refinement of the BMP. Adaptive management will be a key mechanism to address the risks to the successful implementation of the BMP. Adaptive management steps include regular review of the BMP, including adaptation of performance indicators and completion criteria, recognising potential risks to the successful implementation of the BMP and having a frame work in place for corrective actions.

8.2 Review of BMP

As per the requirements of Schedule 5 Condition 10 of DA 3015-11-01 Mod 7, the BMP is to undergo an internal review and revision (if necessary) within 3 months of the submission of the Annual Review, an incident report, audit or modification to the conditions of consent. Where the BMP is revised, it must be submitted to the Secretary for approval within 2 months, unless an alternative timeframe is agreed.

Each review will seek opportunities to improve the management strategies and further develop and forecast the longer term performance indicators and completion criteria.

8.3 Re-Assessment of Targets and Performance Indicators

The performance indicators and completion criteria are preliminary and apply to the second three-year period of the BMP implementation. The targets and performance indicators will need to adapt and change as targets are met and new challenges arise. Each three years they will be assessed and redeveloped as appropriate in response to monitoring outcomes and the success or otherwise of the

management and improvement strategies. Modifications to the targets and performance indicators will be recorded in a revised BMP.

9 Reporting and Documentation Requirements

LCO will prepare an Annual Ecological Monitoring Report (AEMR) which will document the monitoring methods and results from the winter monitoring period through to the autumn monitoring period. The intent of this report will be to provide a comparison of the data collected with previous monitoring events and to provide (where necessary) ongoing management recommendations and ameliorative methods to ensure the biodiversity management within the BMP Area is subject to a positive feedback loop.

The outcomes of the AEMR will be incorporated into the LCO Annual Review, which will be submitted to DPIE, NSW Biodiversity Conservation Division (BCD) and NSW DRE for review. Monitoring data will be tabulated for simple presentation, with the relevant performance criteria in one column, and the results in the next column.

All other reporting will be undertaken in accordance with the requirements of the LCO Environmental Management Strategy.

The reporting requirements for the various management strategies of the BMP, including reporting frequency and timing, are identified in Table 13 below.

Report	Frequency	Requirements	Personnel
BMP Area inspection report	Every second month	Complete a BMP drive over and inspection, investigating aspects such as fence and gate condition, signage, access track condition, weeds, rubbish dumping, erosion and sedimentation, observations of stock and any other general observations	Competent site personnel
Biodiversity monitoring reporting	Annually	Consultant to compile and analyse results of flora and fauna monitoring completed each year and to compare against performance criteria for this strategy.	Prepared by consultant
LCO Annual Review	Annually	Summarise operational and environmental activities for the previous year including annual review requirements, review of compliance with MOP, PA, DoE and other approvals and description of non-compliance/exceedances, rehabilitation progress, comprehensive monitoring results and complaints information.	Prepared by consultant or competent site personnel

Table 13 BMP Reporting Requirements

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10 Document Information

10.1 Related Documents

Related documents, listed in **Table 14** below, are *documents* directly related to or referenced from within this document.

Number	Title
LIDOC-90533967-3755	Biodiversity Offset Management Plan
LIDOC-90533967-5095	2018-2020 Mining Operations Plan (Rehabilitation Management Plan)
LIDOC-90533967-3694	Water Management Plan
LIDOC-90533967-506	Land Clearing and Topsoil Stripping
LIDOC-90533967-3989	Pre-clearance Form
LIDOC-90533967-3944	Biodiversity Monitoring Inspection
LIDOC-90533967-797	Environmental Management Strategy
LIDOC-90533967-5406	Bushfire Management Plan
LIDOC-90533967-5409	Greater Ravensworth Coolatai Grass and African Lovegrass Strategy

Table 14 – Related documents

10.2 Reference Information

Reference information, listed in **Table 15** below, is *information* that is directly referred to for the development of this document.

Reference	Title
	Chessman B, C 1997. New Sensitivity Grades for Australian River Macroinvertebrates. Centre for natural Resources, Department of Sustainable Resources. Po Box 3720, Parramatta, NSW 2124.
	Commonwealth of Australia 2001. Threat Abatement Plan for Dieback Caused by the Root-rot Fungus <i>Phytophthora cinnamomi</i> .
	DMR 1999. <i>Synoptic Plan: Integrated landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW</i> .
	Department of Environment Conservation (DEC) 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft, November 2004.

Reference	Title
	Department of Planning and Infrastructure 2014. <i>Hunter Valley Coal Mines: Best Practice Guidelines for Biodiversity Offset Management Plans</i> .
	DECC 2008. <i>Hygiene Protocol for the Control of Disease in Frogs</i> . Information Circular Number 6. DECC (NSW), Sydney South.
	Eco Logical Australia (ELA) 2013a. Liddell Coal Operations Mine Extension Project: Fauna Survey, Final Report, February 2013. Prepared for Liddell Coal Operations Pty Ltd.
	Eco Logical Australia (ELA) 2013b. Liddell Coal Mine Modification 5 - Aquatic Ecology and Groundwater Dependent Ecosystem Assessment. April 2013. Prepared for Liddell Coal Operations Pty Ltd.
	Hansen Bailey 2018. Environmental Assessment – Modification 7 to DA 305-11-01. 6/127-129 John Street, Singleton, NSW 2330. Prepared on behalf of LCO
	Hawley, S.P. and Brunton, J.S, 1995. <i>Newcastle Coalfield. Notes to Accompany the Newcastle Coalfield Geology Map</i> . Department of Mineral Resources, Sydney.
	Landcom 2004. Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 1.
	Landcom 2008. Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 2E Mines and Quarries.
	Long, K. And Nelson, J. 2008. <i>National Recovery Plan for the Spotted-tailed Quoll <i>Dasyurus maculatus</i></i> . Department of Sustainability and Environment, Melbourne.
	NSW Scientific Committee 2003. Infection of frogs by amphibian chytrid causing the disease chytridiomycosis - key threatening process listing. Accessed February 2014 from: http://www.environment.nsw.gov.au/animals/AmphibianChytridKTPListing.htm .
	NSW Scientific Committee 2011. Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae - key threatening process listing. Accessed February 2014 from: http://www.environment.nsw.gov.au/determinations/exoticrustfungiFD.htm .
	Office of Environment and Heritage 2011. Sydney Basin Bioregion http://www.environment.nsw.gov.au/bioregions/SydneyBasinBioregion.htm [Accessed 26.04.11].
	Office of Environment and Heritage, 2014. <i>Biobanking Assessment Methodology</i> . Office of Environment and Heritage for the NSW Government, 59 Goulburn Street, Sydney NSW 2000.
	Office of Environment and Heritage (OEH) (2017) Biodiversity Assessment Method, August 2017

Reference	Title
	Peake, T. C. 2006. The Vegetation of the Central Hunter Valley, New South Wales. A Report on the Findings of the Hunter Remnant Vegetation Project. Final Draft Hunter – Central Rivers Catchment Management Authority, Paterson.
	Peterson, R. C. 1992. The RCE: a Riparian, Channel, and Environmental Inventory for small streams in the agricultural landscape. <i>Freshwater Biology</i> , 27: 295–306.
	Schneider, G. 2007. Where land meets water resource kit: a guide to riparian management in the Hunter Valley. Hunter Central Rivers Catchment Management Authority, Tocal, NSW.
	Sivertsen, D., Roff, A., Somerville, M., Thonell, J., and Denholm, B. 2011. Hunter Native Vegetation Mapping. Geodatabase Guide (Version 4.0, Internal Report for the Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia.
	SLR Consulting in Prep. Mining Operations Plan. Prepared for Liddell Coal Operations.
	Threatened Species Scientific Committee 2002. Infection of amphibians with chytrid fungus resulting in Chytridiomycosis. Accessed February 2014 from: http://www.environment.gov.au/node/14584 .
	Tongway, D. and Hindley, L. 2005. Landscape function analysis: procedures for monitoring and assessing landscapes with special reference to minesites and rangelands. CSIRO Sustainable Ecosystems, Canberra.
	Umwelt (Australia) Pty Limited 2001. Liddell Coal Environmental Impact Statement. Prepared on behalf of Liddell Coal Operations Pty Ltd.
	Umwelt (Australia) Pty Limited 2003. Liddell Coal Flora and Fauna Management Plan. Prepared on behalf of Liddell Coal Operations Pty Limited.
	Umwelt (Australia) Pty Limited 2006. Ecological Assessment of Proposed Modifications to Liddell Coal Operations. Prepared on behalf of Liddell Coal Operations Pty Limited.
	Umwelt (Australia) Pty Limited 2008. Blue Billed Duck Management Strategy. Umwelt (Australia) Pty Limited 2003. Liddell Coal Flora and Fauna Management Plan. Prepared on behalf of Liddell Coal Operations Pty Limited.
	Umwelt (Australia) Pty Limited 2011. <i>Bushfire Management Plan</i> . Prepared on behalf of Liddell Coal Operations Pty Limited.
	Umwelt (Australia) Pty Limited 2013a. <i>Ecological Assessment – Liddell Coal Operations Extension Project</i> . Prepared on behalf of Liddell Coal Operations Pty Limited.

Reference	Title
	Umwelt (Australia) Pty Limited 2013b. <i>Rehabilitation Strategy – Liddell Coal Operations Extension Project</i> . Prepared on behalf of Liddell Coal Operations Pty Limited
	Umwelt (Australia) Pty Limited 2018. Ecological Assessment – Liddell Coal Operations DA305-11-01 Modification 7
	Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M., and Rossetto M. 2004. Guidelines for the Translocation of threatened plants in Australia. Second Edition. Australian Network for Plant Conservation, Canberra

Table 15 – Reference information

10.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in *Table 16* below. Example detail shown below.

Version	Date	Change Details
1.0	March 2015	New document to meet conditions of consent for DA305-11-01 and EPBC Approval 2013/6908.
2.0	May 2015	Updates to document to address review comments from Dept. of Environment & NSW Office of Environment & Heritage.
3.0	18 May 2015	Addition of Section 1.5 Authority Consultation & associated Append C and D.
4.0	10 July 2015	Updates to document to address review comments from Dept. of Planning and Environment.
5.0	12 August 2015	Approval letter from Dept. of Planning and Environment appended. Updated doc owner to E&C Manager
6.0	23 June 2016	Update to Section 6 as per 2016 Independent Audit recommendation to include additional options for weed control in advance of topsoil stripping. Addition of Section 10.4 Document Update Information
7.0	October 2016	Document migration to new Sharepoint.
8.0	30 May 2017	Minor updates Section 6 as per DPE review comments. Update Figure 1.2. DPE approve 30 May 2017, approval letter added to Appendix E.
9.0	31 July 2018	Adaptive Management Periodic Review. General updates throughout the document including Section 6 to reflect completion of initial 3 year period. H Simms – transferred to current template.
10.0	12 June 2019	Reviewed against section 8.1.4 of DA 305-11-01 Modification 7 Environmental Assessment and modified DA conditions. Updated as per 2019 Independent Environmental Audit recommendations. Updated Section 10.6 with additional related documents. Updated monitoring years in Table 6.1. New Section 3.4 on implications of the Modification 7 approval. New section 4.19 on the specific management requirements of the Modification 7 Area. Update to climate data in Section 3.1.
11.0	16 July 2020	Updated document template and references throughout. Updated Section 4 to include reference to the Biodiversity Inspection process. Update Section 5 to remove LFA monitoring in alignment with UQ recommendations.

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10.4 Document Update Information and Notification

Date	Reason for change	Change Summary	Departmental Notification
23 June 2016	2016 Independent Environmental Audit recommendation	Update to Section 6 as per 2016 Independent Audit recommendation to include additional options for weed control in advance of topsoil stripping.	DPE: In accordance with DA305-11-01, Schedule 5 Condition 10 (c), LCO submitted the BMP to DPE for re-approval by the Secretary. DoE: As per Condition 22 of EPBC 2013/6908, LCO will continue to carry out the activity in accordance with the BMP approved by the Department and the changes made are textual updates only to reflect LCO's topsoil pre-stripping weed management methods. DoE provided with an email containing a copy of the updated BMP and a summary of changed made.
31 July 2018	Adaptive Management Periodic Review.	General updates throughout the document including Section 6 to reflect completion of initial 3 year period.	DPE: In accordance with DA305-11-01, Schedule 5 Condition 10 (c), LCO submitted the BMP to DPE for re-approval by the Secretary. DoE: As per Condition 22 of EPBC 2013/6908, LCO will continue to carry out the activity in accordance with the BMP approved by the Department and the changes made are textual updates only to reflect completion of the initial 3year period. DoE provided with an email containing a copy of the updated BMP and a summary of changed made.
	2019 Independent Environmental	General updates throughout the document with to align with	DPE:

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Date	Reason for change	Change Summary	Departmental Notification
	Audit recommendations Modification 7 approval Adaptive Management Periodic Review	Modification 7 of DA 305-11-01 including addition of Section 3.4 and 4.19. Updated Section 3.3.4, 4.3, 4.10, 4.11.1, 4.12, 5, 5.5 and 5.3.9 as per recommendations of 2019 Independent Environmental Audit.	In accordance with DA305-11-01, Schedule 5 Condition 10 (c), LCO submitted the BMP to DPE for re-approval by the Secretary. DoE: As per Condition 22 of EPBC 2013/6908, LCO will continue to carry out the activity in accordance with the BMP approved by the Department and the changes made are textual updates only to reflect completion of the initial 3 year period. DoE provided with an email containing a copy of the updated BMP and a summary of changed made.
16 July 2020			

Table 17 Document Update Information

Appendix A - Management Actions for Target MNES

Management Action Committed to in BMP	Related to Key MNES relevant to Liddell BMP Area (Yes/No/Not Applicable)			Comments
	Spotted- tailed Quoll	Regent Honeyeater	Swift Parrot	
Fencing, Signage and Access Control	Yes	Yes	Yes	Boundary and internal fencing (as required) to protect habitat from disturbance by grazing (cattle and feral pigs) and unauthorised access/disturbance. Will also assist natural regeneration in remnant areas and aid establishment of flowering foraging species in rehabilitation areas.
Access Track Management	Yes	Yes	Yes	Well managed access tracks reduce the need for new or informal tracks, thus less vegetation damage and will limit vehicle movements in BMP area reducing likelihood of interaction spotted tailed quoll
Creek and Drainage Line Protection	Yes	Yes	Yes	Particularly valuable for spotted-tailed quoll which uses creek lines as zones of high activity. Regent honeyeaters known to nest in riparian zones in some areas. Healthy riparian zones generally benefits biodiversity values.
Pathogen Management	No	Yes	Yes	Reduction of potential for pathogens to impact local vegetation preserves habitat condition.
Vegetation Clearing	Yes	Yes	Yes	Sensitive pre-clearance and tree felling procedures can reduce direct impact on MNES, particularly spotted-tailed quoll.
Remnant Vegetation and Habitat Management	Yes	Yes	Yes	Management remnant vegetation to protect or enhance its condition and habitat value will benefit all species.
Rehabilitation Works	Yes	Yes	Yes	Spotted-tailed quolls shown to den in rehabilitation at nearby Mt Owen. All works to return vegetation to cleared areas will increase habitat available, providing suitable species selection (including target flowering species for birds).

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Management Action Committed to in BMP	Related to Key MNES relevant to Liddell BMP Area (Yes/No/Not Applicable)			Comments
	Spotted- tailed Quoll	Regent Honeyeater	Swift Parrot	
Weed Control	Yes	Yes	Yes	More applicable to ground and mid-layers, thus higher benefit to spotted-tailed quoll in preserving native diversity in these layers. Prevents monoculture and suppression of native diversity. Less impact to canopy species (resource for regent honeyeater and swift parrot) however still benefit from maintaining native species diversity and management during vegetation establishment will reduce competition.
Feral Animal Control	Yes	N/a	N/a	Particularly high for spotted-tailed quoll which is preyed upon and suffers prey competition from wild dogs, foxes and cats. Fewer cats reduce possibility of nest predation for regent honeyeater. Fewer introduced herbivores (pigs, rabbits) will reduce habitat damage. Will benefit all species.
Habitat Enhancement	Yes	Yes	Yes	Nest boxes and salvaged log/boulder piles will provide denning opportunities for the spotted-tailed quoll. Target species planting in rehabilitation and regeneration will increase native diversity, aimed at blossom feeders.
Grazing Management	Yes	Yes	Yes	Prevention of overgrazing and trampling of sensitive areas will protect ground layer complexity for spotted-tailed quoll. Excluding grazing from remnant vegetation, rehabilitation and regeneration will reduce impact to these areas and increase likelihood of success. This will benefit all species.
Bushfire Management	Yes	Yes	Yes	Particularly important in maintaining habitat complexity (fallen logs, timber piles etc) for spotted-tailed quoll and its prey species. Inappropriate fire regimes can oversimplify vegetation, limit ability for some flora species to persist and limit foraging resources. Mosaic burning and use of fire as an ecological management tool can benefit vegetation if used appropriately.
Indirect Impact Mitigation	Yes	Yes	Yes	Management of noise, dust, fugitive lighting etc can assist all species, particularly the spotted-tailed quoll which is known to use habitats close to operational areas.

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Appendix B - Recommended Planting List

The following list contains native vascular flora recommended for planting in rehabilitation and revegetation areas as indicated in the Biodiversity Management Plan (BMP). This list includes recommended species plantings as per recommendations in State and Federal Consent Conditions and Approvals as well as native plant species that are currently known to occur within the Approved Modification Area (Umwelt 2013). Names of classes and families follow a modified Cronquist (1981) System.

The following abbreviations or symbols are used in the list:

- subsp. subspecies; and
- var. variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2015), the online plant name database maintained by the National Herbarium of New South Wales. Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources. It should be noted that approval DA 3015-11-01 Mod 5 also indicates that rehabilitation works should include establishment of Narrow-leaved Ironbark - Bulloak Open Forest endangered ecological community (EEC). However as this EEC is not listed under the Threatened Species Conservation Act 1995 (TSC Act) or listed as a Plant Community Type, it has been assumed that plantings for this community will primarily comprise those in the final determination for *Central Hunter Grey Box – Ironbark Woodland EEC*, with supplementary planting from the species currently known to occur on site.

Family	Scientific Name	Common Name	Groundcover (G), Midstorey (M), Sub-Canopy (S) or Wetland (W) Species	Species Previously Recorded at LCO	Central Hunter Box – Ironbark Woodland EEC ^{1, 2}			Narrow-Leaved Spotted Gum Woodland		Ironbark – Woodland EEC ¹
Species Recommended for Low-lying and Wetland Areas					Peake (2006)	Scientific Determination (2010)	VIS Classification (2014)	Peake (2006)	Scientific Determination (2010)	VIS Classification (2014)
Cyperaceae	<i>Lepidosperma laterala</i>	Flat sedge						X		
Poaceae	<i>Microlaena stipoides</i>	Weeping grass	G	X	X					X
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping grass	G			X		X	X	
Poaceae	<i>Oplismenus aemulus</i>	Basket grass	G	X						
Poaceae	<i>Paspalum distichum</i>	Water Couch	G	X						
Poaceae	<i>Phragmites australis</i>	Common Reed	W	X						
Polygonaceae	<i>Rumex brownii</i>		G		X					

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Typhaceae	<i>Typha orientalis</i>	Broad-leaved Cumbungi	W	X						
Juncaceae	<i>Juncus usitatus</i>		G	X						
Cyperaceae	<i>Schoenoplectus mucronatus</i>		G	X						
Scrophulariaceae	<i>Gratiola pedunculata</i>		G	X						
Hydrocharitaceae	<i>Ottelia ovalifolia</i>	Swamp Lily	W	X						
Marsileaceae	<i>Marsilea mutica</i>	Nardoo	W	X						
Boraginaceae	<i>Cynoglossum suaveolens</i>		G	X						
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	C	X						
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	C	X						
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	G	X	X	X		X		
Adiantaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Poison Rock Fern	G	X	X	X	X	X	X	X

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Anthericaceae	<i>Arthropodium milleflorum</i>	Pale vanilla-lily	G		X			X		
Anthericaceae	<i>Laxmannia compacta</i>		G		X					
Anthericaceae	<i>Laxmannia gracilis</i>							X	X	
Asphodelaceae	<i>Bulbine bulbosa</i>		G		X					
Commelinaceae	<i>Commelina cyanea</i>	Native wandering Jew	G	X	X			X		
Lomandraceae	<i>Lomandra bracteata</i>				X					
Lomandraceae	<i>Lomandra confertifolia</i>				X					
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Matt-rush	G	X	X			X		
Lomandraceae	<i>Lomandra longifolia</i>							X		
Lomandraceae	<i>Lomandra multiflora</i>	Many-flowered Mat-rush	G	X			X			X
Lomandraceae	<i>Lomandra multiflora</i>		G	X	X	X		X	X	

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	subsp. <i>multiflora</i>									
Orchidaceae	<i>Diuris punctata</i> var. <i>punctata</i>							X		
Orchidaceae	<i>Microtis unifolia</i>		G		X					
Orchidaceae	<i>Pterostylis curta</i>		G		X					
Orchidaceae	<i>Pterostylis cycnocephala</i>							X		
Poaceae	<i>Aristida leichhardtiana</i>		G	X						
Poaceae	<i>Aristida lignosa</i>							X		
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass	G	X	X	X	X	X		X
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass	G	X	X			X		
Poaceae	<i>Rytidosperma bipartita</i>		G		X					
Poaceae	<i>Rytidosperma carphoides</i>	Short Wallaby Grass	G	X						

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Poaceae	<i>Rytidosperma fulvum</i>		G	X	X			X		X
Poaceae	<i>Rytidosperma racemosa</i>		G	X	X					
Poaceae	<i>Rytidosperma tenuoir</i>		G	X				X		
Poaceae	<i>Austrostipa aristiglumis</i>		G		X					
Poaceae	<i>Austrostipa scabra</i>	Speargrass	G	X	X	X				
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	G	X	X					
Poaceae	<i>Bothriochloa biloba</i>	Lobed bluegrass	G		X					
Poaceae	<i>Bothriochloa decipiens</i>	Red Grass	G	X	X	X				
Poaceae	<i>Bothriochloa macra</i>	Red Grass	G	X	X			X		
Poaceae	<i>Chloris truncata</i>	Windmill Grass	G	X	X					
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	G	X	X	X				
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	G	X	X	X	X	X	X	X

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Poaceae	<i>Cynodon dactylon</i>	Common Couch	G	X	X					
Poaceae	<i>Dichanthium sericeum</i> subsp. <i>Sericeum</i>		G		X					
Poaceae	<i>Dichelachne micrantha</i>		G		X			X		
Poaceae	<i>Digitaria brownii</i>		G		X					
Poaceae	<i>Digitaria diffusa</i>		G	X	X					
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>		G					X	X	
Poaceae	<i>Echinopogon ovatus</i>	Hedgehog grass	G		X			X		
Poaceae	<i>Enteropogon acicularis</i>		G	X						
Poaceae	<i>Entolasia marginata</i>							X		
Poaceae	<i>Entolasia stricta</i>							X	X	

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Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	G	X	X					
Poaceae	<i>Eragrostis leptocarpa</i>							X		
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	G	X	X	X		X		
Poaceae	<i>Eragrostis molybdea</i>		G		X					
Poaceae	<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass	G	X						
Poaceae	<i>Heteropogon contortus</i>		G		X					
Poaceae	<i>Notodanthonia longifolia</i>		G		X					
Poaceae	<i>Panicum effusum</i>	Poison or Hairy Panic	G	X	X					
Poaceae	<i>Panicum simile</i>	Panicum simile	G	X						
Poaceae	<i>Panicum subxerophilum</i>		G		X					
Poaceae	<i>Paspalidium gracile</i>		G		X					

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Poaceae	<i>Paspalidium distans</i>		G					X	X	
Poaceae	<i>Poa sieberiana</i>	Tussock Poa	G	X						
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	G	X	X	X				
Poaceae	<i>Sporobolus elongatus</i>							X		
Poaceae	<i>Themeda australis</i>		G		X		X	X	X	
Poaceae	<i>Tragus australianus</i>		G		X					
Xanthorrhaceae	<i>Xanthorrhoea acaulis</i>		M		X					
Zygophyllaceae	<i>Zygophyllum glaucum</i>		G		X					
Acanthaceae	<i>Brunoniella australis</i>	blue trumpet	G	X	X	X				X
Acanthaceae	<i>Rostellularia adscendens</i> subsp. <i>adscendens</i>		G		X					
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	G	X						

Apiaceae	<i>Centella asiatica</i>	pennnywort	G	X						
Apiaceae	<i>Daucus glochidiautus</i>	Native carrot						X		
Apiaceae	<i>Hydrocotyle laxiflora</i>		G		X					
Apocynaceae	<i>Sarcostemma brunonianum</i>		G							
Asteraceae	<i>Brachyscome multifida</i>	Rocky daisy	G					X	X	
Asteraceae	<i>Calocephalus citreus</i>	Lemon Beauty-heads	G	X	X					
Asteraceae	<i>Calotis cuneata</i>	Mountain Burr-Daisy	G	X						
Asteraceae	<i>Calotis cuneifloia</i>		G		X			X	X	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	G	X	X	X		X		
Asteraceae	<i>Cassinia aculeata</i>	Dolly Bush	M	X				X		
Asteraceae	<i>Cassinia quinquefaria</i>				X	X				
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting	G	X	X	X		X	X	

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Asteraceae	<i>Cotula australis</i>	Common cotula	G		X					
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bear's Ear	G	X						
Asteraceae	<i>Epaltes australis</i>	Spreading nut-heads						X		
Asteraceae	<i>Euchiton involucratus</i>	Star Cudweed	G	X						
Asteraceae	<i>Euchiton sphaericus</i>		G	X				X		
Asteraceae	<i>Glossocardia bidens</i>	Cobblers tack			X			X		
Asteraceae	<i>Lagenifera gracilis</i>				X					
Asteraceae	<i>Lagenifera stipitata</i>	Blue Bottle-daisy	G	X						
Asteraceae	<i>Leiocarpa leptolepis</i>	Pale plove-daisy	G		X					
Asteraceae	<i>Olearia elliptica</i> subsp. <i>elliptica</i>				X					X
Asteraceae	<i>Ozothamnus diosmifolius</i>							X		

Asteraceae	<i>Pseudognaphalium letealbum</i>	Jersey cudweed	G					X		
Asteraceae	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	Indian weed			X					
Asteraceae	<i>Solenogyne bellioides</i>		G		X					
Asteraceae	<i>Triptilodiscus pygmaeus</i>		G		X					
Asteraceae	<i>Vernonia cinerea</i> var. <i>cineria</i>				X			X	X	
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	G	X	X	X				
Asteraceae	<i>Vittadinia muelleri</i>	Fuzzweed	G	X						
Asteraceae	<i>Vittadinia pterochaeta</i>		G	X						
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell	G	X	X			X	X	
Campanulaceae	<i>Wahlenbergia gracilentia</i>	Annual Bluebell	G	X						

Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell	G	X	X			X	X	
Campanulaceae	<i>Wahlenbergia luteola</i>				X					
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Bulloak	S	X	X	X	X	X	X	
Celastraceae	<i>Denhamia silvestris</i>		M					X		
Chenopodiaceae	<i>Chenopodium melanocarpum</i>				X					
Chenopodiaceae	<i>Einadia hastata</i>				X					
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	G	X	X	X				
Chenopodiaceae	<i>Einadia polygonoides</i>				X					
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	G	X	X					
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	M	X	X					
Chenopodiaceae	<i>Maireana enchylaenoides</i>		G		X					

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Chenopodiaceae	<i>Maireana microphylla</i>		M	X	X					
Clusiaceae	<i>Hypericum gramineum</i>	Small St John's Wort	G	X	X			X	X	
Clusiaceae	<i>Hypericum perforatum</i>	St. Johns Wort	G	X						
Convolvulaceae	<i>Convolvulus erubescens</i>	Blushing bindweed	G		X					
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	G	X	X	X		X	X	
Convolvulaceae	<i>Dichondra sp. A</i>						X			
Crassulaceae	<i>Crassula sieberiana</i>		G		X					
Cupressaceae	<i>Callitris endlicheri</i>	Black cypress pine	C		X	X				
Cyperaceae	<i>Carex fascicularis</i>		G		X					
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	G	X	X					
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	G	X	X	X				
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	G	X	X			X		

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Cyperaceae	<i>Gahnia aspera</i>		G		X					
Cyperaceae	<i>Scleria mackaviensis</i>		G		X					
Dilleniaceae	<i>Hibbertia diffusa</i>		M					X		
Dilleniaceae	<i>Hibbertia fasciculata</i>							X		
Dilleniaceae	<i>Hibbertia linearis</i>		M					X		
Dilleniaceae	<i>Hibbertia obtusifolia</i>		M		X			X		
Droseraceae	<i>Drosera pygmaea</i>							X		
Epacridaceae	<i>Melichrus urceolatus</i>	Urn Heath	G	X		X		X	X	
Ericaceae	<i>Acrotriche rigida</i>				X					
Ericaceae	<i>Leucopogon juniperinus</i>							X		
Ericaceae	<i>Lissanthe strigosa</i>	Peach heath	M					X	X	
Euphorbiaceae	<i>Chamaesyce drummondii</i>	caustic weed	G	X	X					

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Euphorbiaceae	<i>Euphorbia planiticola</i>		G		X					
Euphorbiaceae	<i>Phyllanthus hirtellus</i>							X		
Euphorbiaceae	<i>Phyllanthus virgatus</i>		G	X	X	X		X		
Fabaceae (Caesalpinioideae)	<i>Cassia aciphylla</i>		M	X						
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides</i> form taxon 'zygophylla'				X					
Fabaceae (Faboideae)	<i>Chorizema parviflorum</i>	Eastern flame pea								
Fabaceae (Faboideae)	<i>Daviesia genistifolia</i>	Broom Bitter Pea	M	X						
Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i>		M	X					X	
Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i>							X		
Fabaceae (Faboideae)	<i>Desmodium brachypodum</i>	Large Tick- trefoil	G	X	X			X		

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Fabaceae (Faboideae)	<i>Desmodium varians</i>	Slender Tick- trefoil	G	X	X	X		X	X	
Fabaceae (Faboideae)	<i>Glycine clandestina</i>		G	X	X			X	X	
Fabaceae (Faboideae)	<i>Glycine stenophita</i>		G		X					
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	Glycine	G	X	X	X		X	X	
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	False Sarsaparilla	G	X	X			X		
Fabaceae (Faboideae)	<i>Hovea longipes</i>				X					
Fabaceae (Faboideae)	<i>Indigofera australis</i>	Australian indigo						X		
Fabaceae (Faboideae)	<i>Jacksonia scoparia</i>	dogwood	M		X					
Fabaceae (Faboideae)	<i>Pultenaea microphylla</i>		M	X				X		
Fabaceae (Faboideae)	<i>Pultenaea spinosa</i>		M					X	X	
Fabaceae (Faboideae)	<i>Rhychosia minima</i>		G		X					
Fabaceae (Faboideae)	<i>Swainsona galegifolia</i>				X					

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Fabaceae (Faboideae)	<i>Templetonia stenophylla</i>	leafy templetonia	M	X	X					
Fabaceae (Faboideae)	<i>Zornia dyctiocarpa</i>		G	X						
Fabaceae (Mimosoideae)	<i>Acacia amblygona</i>	Fan wattle			X			X		
Fabaceae (Mimosoideae)	<i>Acacia bulgaensis</i>					X				
Fabaceae (Mimosoideae)	<i>Acacia decora</i>	western golden wattle	M	X	X					
Fabaceae (Mimosoideae)	<i>Acacia falcata</i>		M	X	X			X	X	
Fabaceae (Mimosoideae)	<i>Acacia gunnii</i>				X					
Fabaceae (Mimosoideae)	<i>Acacia implexa</i>	Hickory Wattle	M	X	X					
Fabaceae (Mimosoideae)	<i>Acacia melvillei</i>				X					
Fabaceae (Mimosoideae)	<i>Acacia paradoxa</i>				X					
Fabaceae (Mimosoideae)	<i>Acacia parvipinnula</i>							X	X	
Fabaceae (Mimosoideae)	<i>Acacia pendula</i>		M		X	X				

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Fabaceae (Mimosoideae)	<i>Acacia pravifolia</i>									
Fabaceae (Mimosoideae)	<i>Acacia salicina</i>	Cooba	M	X						
Geraniaceae	<i>Geranium homeanum</i>		G	X						
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	G	X						
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>		G					X		
Goodeniaceae	<i>Goodenia rotundifolia</i>							X		
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushion	G	X				X	X	
Haloragaceae	<i>Haloragis serra</i>		G		X					
Lamiaceae	<i>Ajuga australis</i>		G		X	X		X		
Lamiaceae	<i>Mentha satureioides</i>	Native Pennyroyal	G	X						
Lamiaceae	<i>Salvia plebeia</i>		G		X					
Lamiaceae	<i>Spartothamnel la juncea</i>	Bead bush			X					

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Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot	G	X	X			X	X	
Loganiaceae	<i>Mitrasacme alsinoides</i>							X		
Malvaceae	<i>Melhania oblongifolia</i>		M		X					
Malvaceae	<i>Sida corrugata</i>		G	X	X					
Malvaceae	<i>Malvastrum coromandelianum</i>				X					
Meliaceae	<i>Melia azedarach</i>	White Cedar	S	X						
Myoporaceae	<i>Eremophila debilis</i>	Amulla	G	X	X	X	X	X	X	X
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	C	X	X	X				
Myrtaceae	<i>Corymbia maculata</i>		C					X	X	X
Myrtaceae	<i>Eucalyptus canaliculata</i>	Grey gum						X		
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	C	X	X	X	X	X	X	X

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Myrtaceae	<i>Eucalyptus fibrosa</i>		C					X	X	
Myrtaceae	<i>Eucalyptus glaucina</i>		C						X	
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	C	X	X	X	X	X	X	X
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	C	X				X	X	
Myrtaceae	<i>Kunzea ambigua</i>		M					X		
Nyctaginaceae	<i>Boerhavia dominii</i>	tarvine	V		X					
Oleaceae	<i>Notelaea microcarpa</i> var. <i>microcarpa</i>	Mock olive	M		X	X				
Oxalidaceae	<i>Oxalis chnoodes</i>		G					X		
Oxalidaceae	<i>Oxalis exilis</i>							X		
Oxalidaceae	<i>Oxalis radicata</i>		G		X					
Oxalidaceae	<i>Oxalis rubens</i>							X		
Oxalidaceae	<i>Oxalis perennans</i>		G	X				X		

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Phormiaceae	<i>Dianella caerulea</i>				X			X		
Phormiaceae	<i>Dianella longifolia</i>		G	X	X			X		
Phormiaceae	<i>Dianella revoluta</i>		G	X						
Phormiaceae	<i>Dianella revoluta</i> var. <i>revoluta</i>				X			X	X	
Phyllanthaceae	<i>Breynia oblongifolia</i>	coffeebush			X	X	X	X	X	
Pittosporaceae	<i>Bursaria spinosa</i>	blackthorn	M		X	X	X	X	X	X
Plantaginaceae	<i>Plantago debilis</i>		G	X	X			X		
Plantaginaceae	<i>Plantago gaudichaudii</i>							X		
Plantaginaceae	<i>Plantago hispidula</i>		G		X					
Proteaceae	<i>Grevillea montana</i>							X		
Proteaceae	<i>Hakea sericea</i>	needlebush	M					X	X	

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Proteaceae	<i>Persoonia linearis</i>	narrow-leaved geebung						X		
Proteaceae	<i>Persoonia pauciflora</i>							X		
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	G	X	X			X		
Rubiaceae	<i>Opercularia diphylla</i>		G					X	X	
Rubiaceae	<i>Pomax umbellata</i>		G				X	X	X	
Rubiaceae	<i>Psydrax odorata</i>	Shiny-leaved canthium			X					
Santalaceae	<i>Santalum lanceolatum</i>	Northern sandalwood	M		X					
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky hhop bush			X	X				
Scrophulariaceae	<i>Myoporum montanum</i>	Water bush			X					
Scrophulariaceae	<i>Veronica plebeia</i>	Trailing Speedwell	G	X	X			X		
Solanaceae	<i>Nicotiana megalosiphon subsp. megalosiphon</i>		M		X					

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Solanaceae	<i>Solanum cinereum</i>		G		X	X				
Solanaceae	<i>Solanum elegans</i>		G		X					
Solanaceae	<i>Solanum papaverifolium</i>		M					X		
Solanaceae	<i>Solanum prinophyllum</i>							X	X	
Stackhousiaceae	<i>Stackhousia muricata</i>		G		X					
Stackhousiaceae	<i>Stackhousia viminea</i>	Slender Stackhousia	G	X	X			X	X	
Sterculaceae	<i>Brachychiton populneus</i> subsp. <i>populneus</i>	Kurrajong	S	X	X	X				
Thymeleaceae	<i>Pimelea curviflora</i>	Rice flower	M		X					
Thymeleaceae	<i>Pimelea curviflora</i> var. <i>sericea</i>	Rice flower	M		X					
Verbenaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	M	X						

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Verbenaceae	<i>Verbena gaudichaudii</i>		G		X					
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¹ Requirement for rehabilitation from DA 305-11-01

² Requirement for rehabilitation under 2013-6908 Approval

Note this species list excludes mistletoes and vines. Species in **Bold** print are recommended by OEH

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Appendix C - OEH Correspondence



Office of
Environment
& Heritage

Your reference: DA 305-11-01 Mod 5
Our reference: DOC15/106694-04
Contact: Ziggy Andersons, 4908 6820

Mr Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330.

Dear Mr de Somer

RE: OEH REVIEW OF LIDDELL COAL OPERATIONS BIODIVERSITY MANAGEMENT PLAN - MUSWELLBROOK AND SINGLETON LGA's

In regards to the above Biodiversity Management Plan (BMP), the Office of Environment and Heritage (OEH) has undertaken a review and has provided comments below.

Overall OEH supports the objectives and the proposed methods however there are a number of points that need to be incorporated to ensure the management plan is effective. The points requiring addressing include:

- To be able to assess the adequacy of the BMP a number of complementary plans as well as sub-plans need to be reviewed to ensure compliance with conditions of consent these include:
 - Stock Rotation Plan;
 - Bushfire Management Plan;
 - Offset Management Plan;
 - Rehabilitation Management Plan; and
 - Water Management Plan.
- These plans were not provided for review as such OEH is not in a position to satisfactorily assess the adequacy of the BMP regarding matters covered by these plans;
- In regards to weed control the BMP makes reference to 'developed weed eradication plans' (p. 58) again these have not been provided for review;
- No details of what Liddell Coal is proposing, or committing to, regarding alternate technologies to reduce poisoning of non-target species (Tiger Quoll) are provided; and
- There is minimal quantifiable performance criteria included within the plan, specifically for seedling survival and weed control. Percentage targets are recommended for both these parameters to monitor the effectiveness of the proposed works and to assist with the development of triggers for corrective actions.

In addition, OEH notes that floristic cover and abundance appears to be measured using the Braun-Blanquet scale. This method combines both features (for example so that a single large fig covering most of a quadrat or a quadrat largely covered by a small annual herb with have the same score but have very different structure). OEH has found that Braun-Blanquet values are often too coarse for statistical analysis to detect trends before they are obvious. Therefore, OEH recommends that more precise cover and

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abundance values are recorded during subsequent site inspections, for which the 'DECCW Vegetation Field Survey Form' in Sivertsen (2009: pp. 59-65) is recommended so as to be able to have a better chance of detecting and measuring change.

In regards to analysis of monitoring data, OEH recommends that appropriate statistical analysis is undertaken to enable changes to be measured, and where possible, enable earlier adaptive management measures to be implemented before any problems may become obvious. The Analysis of Similarity (ANOSIM) has often been used to assess changes in plant species composition in space and time (e.g. Brown, 2006; Wevill and Florentine, 2014; and Wilkins et al., 2003) and OEH recommends consideration of this type of analysis in vegetation monitoring for this project, if appropriate in relation to the type of data gathered, the questions being asked and underlying assumptions. OEH recommends that such analysis is presented in the Annual Environmental Management Reports produced by the mine site.

If you have any enquiries concerning this advice, please contact Ziggy Andersons, Conservation Planning Officer, on 4908 6820.

Yours sincerely



27 APR 2015

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

From: [Ziggy Andersons](#)
To: [Desomer, Ben \(Liddell - AU\)](#)
Cc: [Robert Gibson](#); Alice.Smith@planning.nsw.gov.au; [Richard Bath](#)
Subject: RE: Revised Liddell BMP
Date: Monday, 11 May 2015 8:57:04 AM

Heya ben,

Thank you for providing the revised Biodiversity Management Plan. Yes OEH is generally satisfied with the amended Biodiversity Management Plan. As I stated in our phone call on Friday our interest is focused on the pending Offset Management Plan.

Regards,

Zig

Ziggy Andersons
Conservation Planning Officer
Hunter Central Coast Region
Regional Operations Group
Office of Environment and Heritage
Locked bag 1002 Dangar NSW 2309
M: 0409 707 492
W: www.environment.nsw.gov.au

From: Ben.Desomer@glencore.com.au [mailto:Ben.Desomer@glencore.com.au]
Sent: Friday, 8 May 2015 3:48 PM
To: Andersons Ziggy
Cc: Gibson Robert
Subject: Revised Liddell BMP

Good afternoon Ziggy,

As discussed, please find attached a response table for the comments you provided on our BMP and an updated version of the BMP with various text edits highlighted reflecting these changes. Note that some highlighted sections are addressing changes made from DoE comments as well. A copy of the approved Mining Operations Plan (Rehabilitation Management Plan) will be forwarded by separate email for your records.

Please advise whether you are satisfied with the amendments or require further work?

Happy to discuss further as required. Have a good weekend.

Regards,

Ben de Somer
Environment & Community Manager
Liddell Coal Operations Pty Ltd - A Glencore Managed Company
Telephone: +61 2 6570 9947
Fax: +61 2 6570 9999
Mobile: +61 (0) 427 936 734

Email: ben.desomer@glencore.com.au

Appendix D - Department of Environment Correspondence



Australian Government
Department of the Environment

Our reference: 2013/6908

Contact Officer: Manel Samarakoon
Telephone: (02) 6274 1080 Facsimile: (02) 6274 1878
Email: post.approvals@environment.gov.au

Mr Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Dear Mr Somer

Extension of Liddell open cut coal mining operations – EPBC 2013/6908
Approval of Plan for Biodiversity Management and Plan for Water Management

I refer to your recent correspondence to the Department which attached copies of the following documents:

- Plan for Water Management, version 2.0, 13 May 2015 (condition 12)
- Plan for Biodiversity Management, version 2.0, 12 May 2015 (conditions 2, 3 & 4)

Officers of the Post Approvals Section have reviewed the above plans and found them to satisfactorily meet the requirements of the relevant approval conditions. On this basis, and as delegate of the Minister for the Environment, I have decided to approve the above plans. You must now undertake the action in accordance with the approved plans.

Please ensure that you maintain accurate records of all activities associated with, or relevant to the conditions of approval, so that they can be made available to the Department on request. Such documents may be subject to audit and used to verify compliance. Summaries of results of audits may be published by the Department. Information about the monitoring and audit program can be found on the Department's website at <http://www.environment.gov.au/resource/compliance-and-enforcement-policy-environment-protection-and-biodiversity-conservation-act>

You should note that any transfer of this approval to another person must have the consent of the Minister for the Environment under section 145B of the EPBC Act.

If you have any enquiries please contact Manel Samarakoon on 02 6274 1080.

Yours sincerely

Shane Gaddes
Assistant Secretary
Compliance & Enforcement Branch

14/5/2015

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www.environment.gov.au

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Appendix E - Department of Planning and Environment Correspondence

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Planning & Environment

Ben de Somer
Environment and Community Manager
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Contact: Chris Knight
Phone: (02) 6575 3404
Fax: (02) 6575 3415
Email: christopher.knight@planning.nsw.gov.au
Our ref: DA 305-11-01

Dear Ben,

Liddell Coal Operations – Approval of Biodiversity Management Plan

Thank you for forwarding the Liddell Coal Operations Biodiversity Management Plan to the Department of Planning & Environment (the Department or DP&E), as required by Condition 29, Schedule 3 of DA 305-11-01.

The Department has conducted a review and wishes to advise that the Secretary has approved the Biodiversity Management Plan (dated 14th July 2015). This Biodiversity Management Plan must be implemented by Liddell Coal Operations by 31st August 2015.

The Department requests that you place the approved plan, along with a copy of this letter, on your website in accordance with Condition 9, Schedule 5 of DA 305-11-01.

Should you have any queries on this matter, please do not hesitate to contact Chris Knight, Senior Compliance Officer, on (02) 6570 3404 or email christopher.knight@planning.nsw.gov.au.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Scott Brooks'.

Scott Brooks
Investigations (lead) Compliance Northern Region
as the Secretary's Nominee

27-7-2015



Planning Services
Resource Assessments
Contact: Genevieve Seed
Phone: 9274 6489
Email: genevieve.seed@planning.nsw.gov.au

Mr Ben de Somer
Environment and Community Manager
Liddell Coal Operations Pty Ltd
PO Box 7
Singleton NSW 2330

Ben
Dear Mr de Somer

**Liddell Colliery (DA 305-11-01)
Management Plans**

I refer to your emails dated 18 and 19 May 2017 submitting revised Management Plans for the Liddell Colliery, including the:

- Biodiversity Management Plan (condition 29, Schedule 3) (dated June 2017); and
- Air Quality Monitoring Program (condition 19, Schedule 3) (dated June 2017).

The Department has reviewed these plans and considers that they meet the relevant conditions of consent. As such, the Secretary has approved these plans.

The Department requests that the final (untracked) versions of these plans are submitted to the Department no later than 16 June 2017. Additionally, please ensure that the figures in the Biodiversity Management Plan are updated to reflect the current layout of the Biodiversity Offset Areas having regard to the Department's letter of 29 May 2017.

Should you have any enquiries in relation to this matter, please contact Genevieve Seed at the details above.

Yours sincerely,

Howard Reed

Howard Reed 30.5.17
Director
Resource Assessments
as nominee of the Secretary

Department of Planning and Environment
320 Pitt Street, Sydney NSW 2000 | GPO Box 39 Sydney NSW 2001 | www.planning.nsw.gov.au

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Planning Services
Resource Assessments
Name: Ingrid Berzins
Phone: 9373 2885
Email: Ingrid.Berzins@planning.nsw.gov.au

Ben de Somer
Environment & Community Manager
Liddell Coal Operations
PO Box 7
Singleton NSW 2330

Dear Mr de Somer,

**Liddell Colliery (DA 305-11-01)
Approval of Management Plans**

I refer to your emails dated 16 October and 19 October 2018 submitting revised management plans for Liddell Colliery. The Department has reviewed the following revised management plans and is satisfied that they address the relevant conditions of consent:

- Biodiversity Management Plan v8.3 and Biodiversity Offset Management Plan v7 (condition 29 of Schedule 3).

The Secretary therefore approves the Biodiversity Management Plan and the Biodiversity Offset Management Plan.

Please provide final (untracked) versions of these plans to the Department at your earliest convenience and place a copy of them on your company website.

If you have any enquiries about this matter, please contact Ingrid Berzins on the details above.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'MJD', followed by the date '19/10/18'.

Megan Dawson
Acting Director
Resource Assessments
as the Secretary's nominee



**Planning,
Industry &
Environment**

Planning and Assessments
Energy and Resource Assessments
Contact: Anthony Barnes
Phone: 8289 6709
Email: anthony.barnes@planning.nsw.gov.au

Ms Hayley Frazer
Environment and Community Coordinator
Liddell Coal Operations – Glencore
PO Box 7
Singleton NSW 2330

Dear Ms Frazer

**Liddell Colliery Continued Operations (DA 305-11-01)
Approval of Biodiversity Management Plan and Indirect Offset Plan**

I refer to your email dated 9 May 2019, submitting revised Management Plans for approval in accordance with conditions 26 and 29 of Schedule 3 of Liddell Colliery Continued Operations' development consent.

The Department has reviewed the revised plans and considers that the Biodiversity Management Plan and Indirect Offset Plan are consistent with the relevant consent conditions. Therefore, the Secretary has approved these plans.

Please ensure these plans are published on Liddell Colliery's website at your earliest convenience.

Please contact Anthony Barnes at the above if you have any enquiries.

Yours sincerely

17/12/2019

Matthew Sprott
Director
Resource Assessments
as nominee of the Secretary

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