



Australian Government

Department of Agriculture, Water and the Environment

Mr Chris Lauritzen  
General Manager – Resource Development  
MACH Energy Australia Pty Ltd  
GPO Box 94  
BRISBANE QLD 4001

**Mount Pleasant Project, 4km northwest of Muswellbrook, New South Wales  
(EPBC 2011/5795): Offset Management, Re-establishment and Mine Site  
Rehabilitation Plans.**

Dear Mr Lauritzen

Thank you for submitting the above management plans for approval in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Officers of the Department have advised me on the plans and on the requirements of the EPBC Act conditions of approval for this project. On this basis, and as a delegate of the Minister for the Environment, I have decided to approve:

- the *Mount Pleasant Operation: Offset Management Plan and Re-Establishment Plan*, Revision 2, signed on 7 October 2020, in accordance with Conditions 11 and 32D of the approval; and
- the *Mount Pleasant Operation: EPBC Act Threatened Ecological Community Mine Site Rehabilitation Plan*, Revision 4, signed on 10 May 2020, in accordance with Condition 19 of the approval.

The approved plans must now be implemented, and must be published on a website within one month of the date of this notice. Please note that if you wish to vary an approved plan you must do so in accordance with Conditions 32-32D of the approval.

Should you require any further information please contact Vaughn Cox directly or by email at [postapproval@awe.gov.au](mailto:postapproval@awe.gov.au).

Yours sincerely

Declan O'Connor-Cox, Assistant Secretary (A/g)  
Environment Assessments (Vic, Tas) and Post Approvals Branch

22 October 2020

## MOUNT PLEASANT OPERATION

### EPBC ACT

### THREATENED ECOLOGICAL COMMUNITY

### MINE SITE REHABILITATION PLAN

Document ID:	01057237		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	22 October 2020	Status:	Approved
Endorsed By:	Chris Lauritzen	Revision Number:	01

This document has been prepared and is certified by:

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Document status

Revision	Reason for issue	Author	Reviewed	Issued to	Date
A	Internal Draft	R. Etherington	L. Grigg	-	21/10/2019
0	Issued for information	R. Etherington	L. Grigg	MACH Energy	21/10/2019
1	Issued for information	R. Etherington	L. Grigg	MACH Energy	31/10/2019
2	Issued for information	R. Etherington	A. Paddock	MACH Energy	05/11/2019
3	Address Committee Comments	R. Etherington	A. Paddock	MACH Energy	25/11/2019
4	Address DAWE Comments	R. Etherington	A. Paddock	MACH Energy	20/04/2020

## Declaration of Accuracy

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Management Plan (use correct title of signed document) is complete, current and correct.
2. I am duly authorised to sign this declaration on behalf of the approval holder.
3. I am aware that:
  - a. Section 490 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
  - b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) where the person knows the information or document is false or misleading.
  - c. The above offences are punishable on conviction by imprisonment, a fine or both.

**Signed**



**Full Name** Chris Lauritzen

**Organisation** MACH Energy Australia Pty Ltd

**Date** 10/05/2020



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## Glossary of Terms

Acronym	Description
cm	Centimetres
DECCW	Department of Environment, Climate Change and Water
EEC	Endangered Ecological Community
ha	Hectare
m	Metres
MOP RMP	Mining Operations Plan and Rehabilitation Management Plan
MPO	Mount Pleasant Operations
PCT	Plant Community Type
RMM	Rehabilitation Monitoring Manual
SSD	State Significant Development
TEC	Threatened Ecological Community
TEC MSRP	Threatened Ecological Community Mine Site Rehabilitation Plan

## 1 Introduction

This section provides background information relevant to the development and scope of this document.

### 1.1 Project Overview

The Mount Pleasant Operation (MPO) involves the construction and operation of an open cut coal mine and associated infrastructure, located approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton, in the Upper Hunter Valley of New South Wales (NSW). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively. The owner of the MPO is MACH Energy Australia Pty Ltd (MACH Energy).

The current operations are conducted in accordance with NSW Development Consent DA 92/97, the Authorities for Mining Leases (MLs) 1645, 1713, 1708, 1709 and ML 1750 and Environmental Protection Licence 20850 issued by the NSW Government and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval 2011/5795 issued by the Commonwealth Government. The EPBC Act Approval 2011/5795 Project Area is shown on Figure 1-1.

### 1.2 Scope

The scope of this document is to present a Threatened Ecological Community Mine Site Rehabilitation Plan (TEC MSRP) as required by Condition 19 of EPBC Act Approval 2011/5795. Condition 19 of EPBC Act Approval 2011/5795 states that:

“The person taking the action must, within three years of the commencement of construction, submit to the Minister for approval a Mine Site Rehabilitation Plan for the progressive rehabilitation and revegetation of no less than 1,000 ha of White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland and Derived Native Grassland Ecological Community on the project area”.

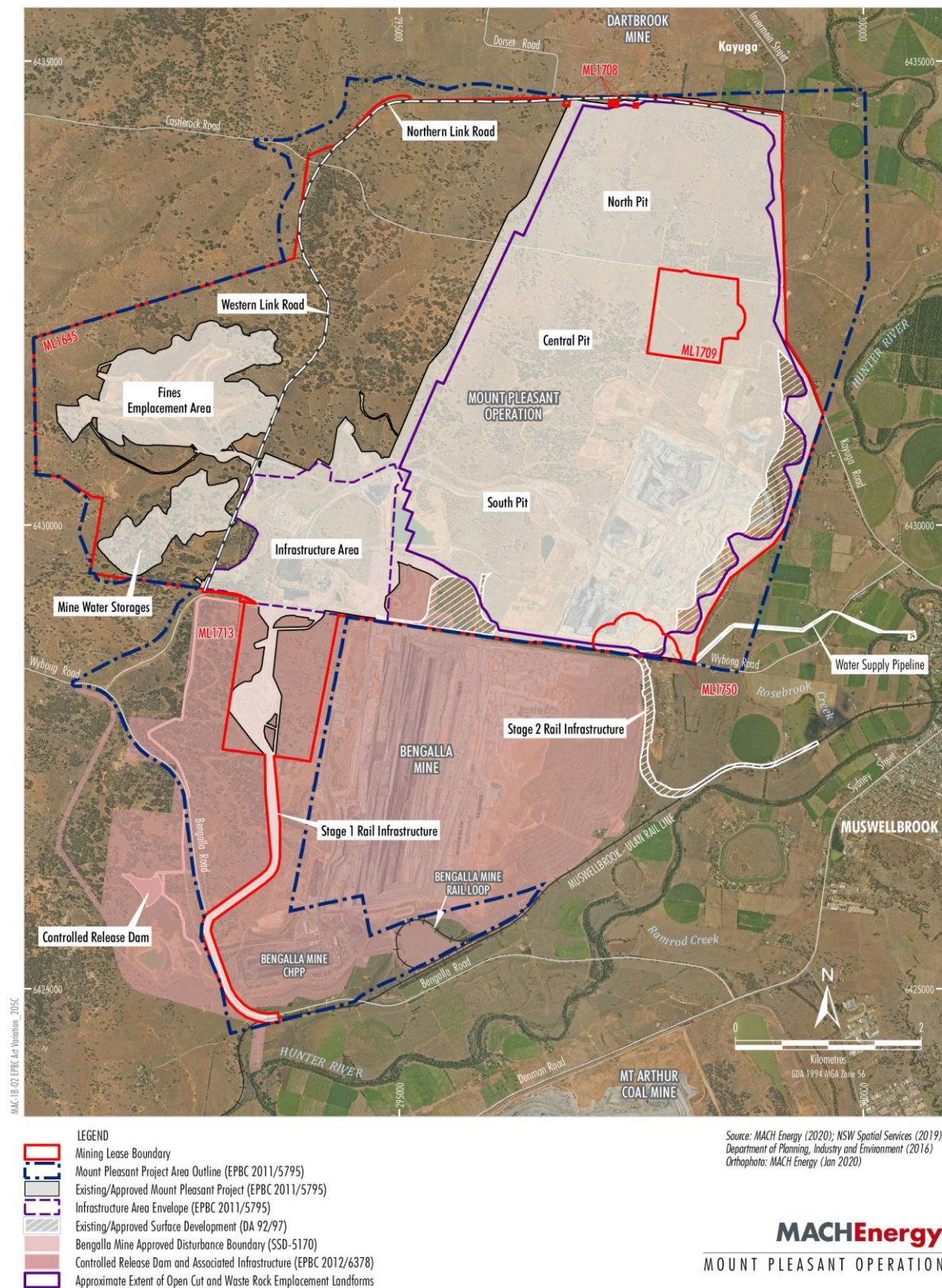
Condition 20 of EPBC Approval 2011/5795 details the minimum requirements of the TEC MSRP. These requirements are outlined in Table 1-1 along with a reference to where they are addressed in this TEC MSRP.

Many of the requirements of the TEC MSRP align with the requirements for the MPO’s Mining Operations Plan and Rehabilitation Management Plan (MOP/RMP), prepared in accordance with the MPO’s ML Authorities and NSW Development Consent DA 92/97. Accordingly, Table 1-1 also provides the relevant Sections from the MPO’s currently approved MOP/RMP (1 July 2020 to 30 June 2021) which also include information that addresses the requirements for this TEC MSRP. The relevant Sections from the MPO MOP/RMP are provided in Appendix C of this TEC MSRP.

Table 1-1 Requirements of Condition 20 of EPBC Act Approval 2011/5795 for the TEC MSRP

Condition	Requirement	TEC MSRP Section	MPO MOP/RMP Section
20(a)	The desired outcomes/objectives of implementing the Plan.	2.1	NA
20(b)	Details of the vegetation communities to be rehabilitated and the timing of progressive rehabilitation.	2.2, 2.3	3.2.8, 7.2.3 (Appendix C)
20(c)	Criteria to determine success of rehabilitation of White Box - Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland Ecological Community.	2.4	NA





**Appendix A**  
**Mount Pleasant Project Area**

Figure 1-1 MPO EPBC Approval Project Area

Condition	Requirement	TEC MSRP Section	MPO MOP/RMP Section
20(d)	A process to progressively report to the department the rehabilitation management actions undertaken and the outcome of those actions, and the mechanisms to be used to identify the need for improved management.	2.5, 2.6, 2.7	8, 9, 10 (Appendix C)
20(e)	A description of the potential risks to successful management and rehabilitation on the project site, and a description of the contingency measures that would be implemented to mitigate these risks.	2.6.1	3.9 (Appendix C)
20(f)	Details of parties responsible for reviewing and implementing the Plan.	2.7	NA
20(g)	Details of long-term management and protection of the mine site.	2.8	NA

With regard to the scope of this TEC MSRP, it is also important to note that although EPBC Act Approval 2011/5795 has effect until 28 October 2035 and provides approval to clear up to 2,591 ha of EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community (Box Gum Grassy Woodland TEC) within the MPO Project Area over the life of the MPO, the MPO's NSW Development Consent DA 92/97 limits mining operations at the MPO up until 22 December 2026. The currently approved final landform as at December 2026 is shown in Figure 4 in Appendix 2 of Development Consent DA 92/97.

The total disturbance area of the MPO as at 22 December 2026 would be approximately 1,093 ha, which is approximately 1,498 ha less disturbance than that approved under EPBC Approval 2011/5795 (i.e. 2,591 ha), and includes disturbance to approximately 135 ha of Box Gum Grassy Woodland TEC.

Considering development of the MPO is currently limited to December 2026, current mine planning and progressive rehabilitation planning reflects this. Conceptual MPO layouts as at 2021 and 2025 are provided in Figures 1 and 2 of Appendix 2 of NSW Development Consent DA 92/97. As such, progressive rehabilitation implementation scheduling described in Section 2.3 of this TEC MSRP, reflect these figures. MACH Energy currently proposes to extend mining operations beyond 22 December 2026, up to 2048, as part of a Development Application under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*. This application would, if approved, result in a modified surface development footprint for the MPO and would continue to provide opportunity for rehabilitation and revegetation of 1,000 ha of Box Gum Grassy Woodland TEC across the entire EPBC Act Approval Project Area.

Should the Development Application not proceed for any reason, MACH Energy would at that time, submit a variation application for EPBC Approval 2011/5795 that reflects the significantly reduced surface disturbance footprint of the MPO and subsequently proposes a reduced Box Gum Grassy Woodland TEC rehabilitation and revegetation commitment commensurate with actual disturbance to the vegetation community.



## 2 Threatened Ecological Community Mine Site Rehabilitation Plan

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This section presents the Threatened Ecological Community Rehabilitation Management Plan (TEC MSRP).

### 2.1 Objective

The objective of this TEC MSRP is to achieve the progressive rehabilitation or revegetation of no less than 1,000 ha of White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community ("Box Gum Grassy Woodlands and Derived Grasslands TEC"). The 1,000 ha of rehabilitation and/or revegetation will be undertaken within the MPO EPBC Act Project Area (project area) (Figure 1-1 and Appendix A). This will include MPO mine site rehabilitation areas and areas undisturbed by mining operations, however previously disturbed and degraded by historic agriculture.

The EPBC Approval Project Area north of Wybong Road presents various opportunities to provide for the 1,000 ha requirement. It should be noted however, that the part of the EPBC Approval Project Area south of Wybong Road is controlled by the Bengalla Mining Company and is therefore not available for re-establishment of 1,000 ha of TEC. Ultimate locations of the TEC need to consider other required land uses post-mining. More detail in this regard is provided in Section 2.8.

### 2.2 Threatened Ecological Community (TEC) description

This section describes the structure and composition and the known landform and geochemical requirements of the Box Gum Grassy Woodlands and Derived Grassland TEC.

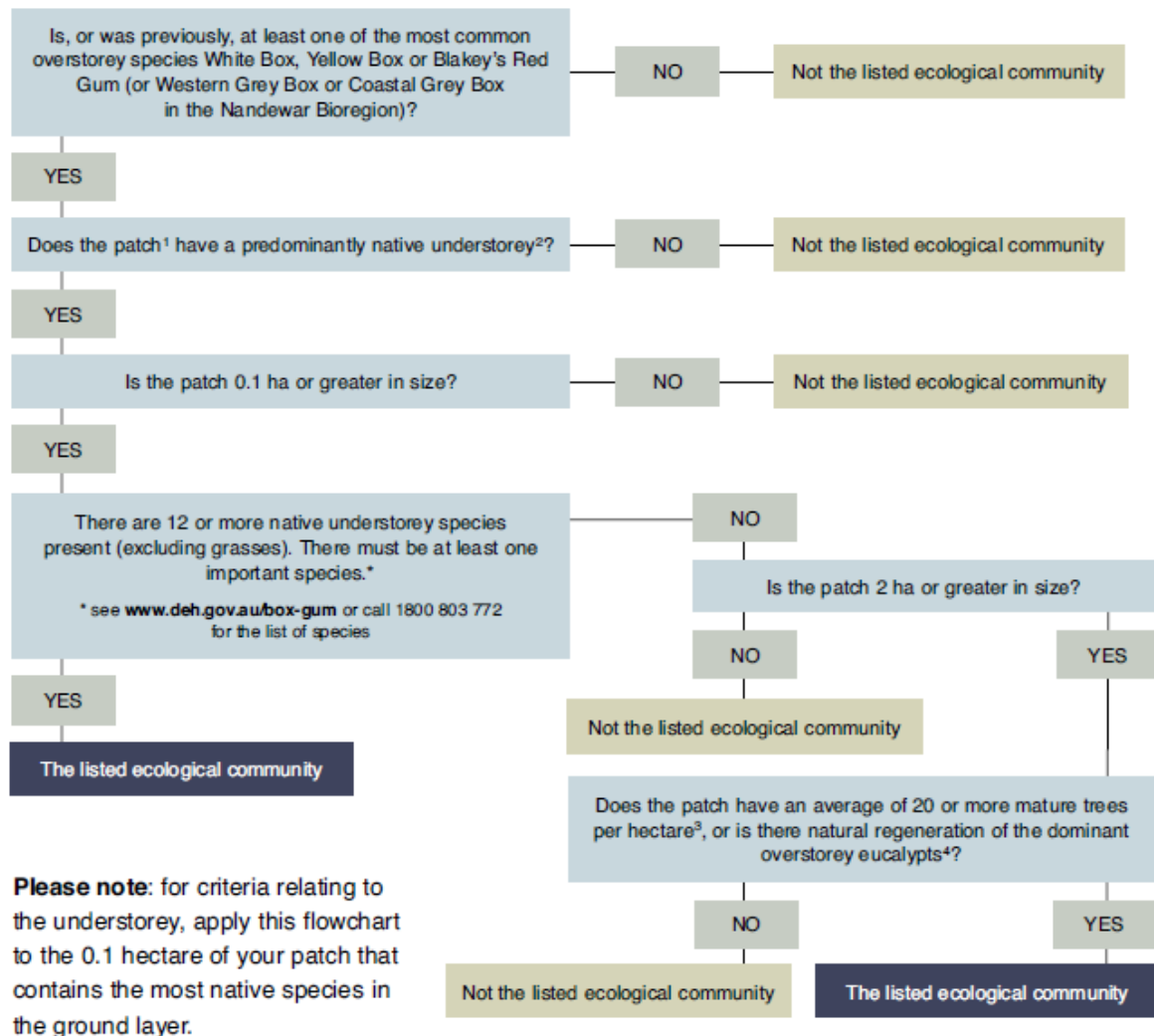
#### 2.2.1 Community structure and composition

Box Gum Grassy Woodlands are defined by a species rich ground layer of native grasses and forbs with an overstorey dominated by *Eucalyptus albens* (white box), *E. melliodora* (yellow box) or *E. blakeyi* (Blakely's red gum) or hybrids of these species (Threatened Species Scientific Committee, 2006; Stol and Prober, 2015). Yellow box and Blakely's red gum are generally dominant on the tablelands, forming mosaics with white box on the eastern slopes (Prober and Thiele, 2004). In its' remnant, unmodified form, the community has an overstorey cover of between 20% and 50% with trees clearly separated (DECCW NSW, 2011). Scattered shrubs can also occur in the community, but to be considered a Box Gum Grassy Woodland and Derived Grassland TEC, a patch must have less than 30% shrub cover (Threatened Species Scientific Committee, 2006).

The community is spatially distributed from Southern Queensland to Victoria on slopes and tablelands of the Great Dividing Range (DECCW) NSW, 2011). Due to the large spatial distribution of the community, the species composition of the understorey varies along the latitudinal and longitudinal gradients of the community's distribution (Prober and Thiele, 2004). Due to the species richness of the ground layer, intact patches of the Box Gum Grassy Woodland are considered of high-conservation value (Stol and Prober, 2015). Even though Box Gum Grassy Woodlands have been extensively cleared for agriculture, due to the productiveness of the soils they grow on (Prober and Thiele, 2004; Cuneo et al., 2018), due to their conservation value, Box Gum Grassy Woodlands can also occur in a Derived Grassland form. In this form the remnant overstorey layer has been cleared or severely thinned but a native understorey remains.

##### 2.2.1.1 Minimum condition requirements for Box Gum Grassy Woodlands TEC

To be considered a TEC, a patch of Box Gum Grassy Woodland and Derived Grassland must meet minimum condition requirements. These requirements are summarised in the *EPBC Act policy statement: White box - Yellow Box - Blakely's red gum grassy woodlands and derived native grasslands* (Threatened Species Scientific Committee, 2006; Figure 2-1).



- Figure 2-1** Flowchart for determining if a patch of Box Gum Grassy Woodland and Derived Grassland is a listed TEC (Department of the Environment and Heritage, 2006)

### 2.2.1.2 Box Gum Grassy Woodland Plant Community Types (PCTs) at the MPO

Pre-mining ecological mapping at MPO shows three Plant Community Types (PCTs) dominated or co-dominated by white box, yellow box and or Blakely's red gum and may therefore constitute a TEC (Table 2-1; Appendix A).

Table 2-1 Pre-mining PCTs aligned with the White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Natural Grassland TEC description

PCT Number	PCT Name	Area of Remnant (ha)	Area of DNG (ha)
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	288	908
618	White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	6	9
1606	White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	103	21

All three PCTs occur in remnant woodland and derived native grassland (DNG) forms. PCT 483 is the dominant and most widespread community at MPO and is characterised by an overstorey of *Eucalyptus albens* (white box) intergraded with *Eucalyptus moluccana* (coastal grey box) with an understorey of scattered *Brachychiton populneus* (kurrajong) and a grassy ground layer. PCTs 618 and 1606 appear to be associated with drainage features on the MPO site (Ausecology, 2019).

Condition assessment against comparable benchmark communities has not been undertaken formally, however observations by Ausecology (2019) suggests that the subject vegetation communities appear to be in generally good condition. Native species diversity in the ground layer has not been assessed against benchmark communities, and as such, is not able to be compared directly with undisturbed condition. Drought conditions at time of assessment may also be functioning to reduce ground layer native species diversity. Weed presence and abundance are generally low. The dominant disturbance factor noted was grazing, which appears to have had a disproportionate impact owing to the prolonged drought conditions impacting the site. The historical fire disturbance regime on the site is also unknown at time of writing and may be a factor in affecting vegetation community condition relative to benchmarks.

#### 2.2.2 Landform characteristics

The PCTs mapped at MPO pre-mining occur on landform patterns described as hills, low hills, and plateaus. Hills are described as landform patterns with high relief ranging from gentle inclines (~2° to ~6° slopes) to precipitous slopes (45° to 72° slope) (Speight, 2009). Low hills are landform patterns with low relief varying from gentle inclines (~2° to ~6°) to very steep slopes (30° to 45°) (Speight, 2009). Whereas plateaus are described as level to rolling landform patterns consisting of plains, rises and low hills (Speight, 2009). Therefore, the Box Gum Grassy Woodland and Derived Grassland TEC can occur across a wide range of landform elements ranging from level country to steep slopes.

A detailed description of the MPO final landform and proposed post-mining land uses is provided in Section 4 of the MPO MOP/RMP, which is provided as Appendix C of this TEC MSRP.

#### 2.2.3 Geochemical characteristics

Soil nutrient levels in Box Gum Grassy Woodlands are naturally low with Phosphorus typically <10 mg/kg and Nitrate <3 mg/kg (Stol and Prober, 2015). As native species are adapted to low nutrient levels exotic species can become dominant in the ground layer when patches are heavily grazed by livestock and/or applied with nitrate and phosphate fertilisers (Stol and Prober, 2015; Cole et al., 2017). Direct seeding of C4 grasses, that sequester



nitrites, coupled with the addition of carbon, and burning of exotic annuals during their growth period, can suppress exotic annuals from dominance (Rawlings, Freudenberger and Carr, 2010; Cole et al., 2017).

### 2.3 Progressive rehabilitation and restoration methods and timing

#### 2.3.1 Progressive rehabilitation and restoration timing

As required by Condition 19 of EPBC Approval 2011/5795, no less than 1,000 ha of Box Gum Grassy Woodlands and Derived Grassland will be established across the EPBC Approval project area, over the mine life, including the post-mining phase. This 1,000 ha will include mine site ‘rehabilitation’ areas and ‘restoration’ areas undisturbed by mining operations, however previously disturbed and degraded by historic agriculture. As described in Section 1.2, the MPO’s NSW Development Consent DA 92/97 limits development of the MPO up to 22 December 2026. Conceptual MPO layouts at 2021 and 2025 provided in Figures 1 and 2 of Appendix 2 of NSW Development Consent DA 92/97 show the progressive development and rehabilitation of the MPO. These figures are provided as Figures 2-2 and 2-3. Plan 4A of the MPO’s MOP/RMP shows the approved MPO final landform as at 22 December 2026. Plan 4A of the MOP/RMP is provided in Figure 2-4.

Accordingly, based on the conceptual MPO layouts at 2021 and 2025 and MPO final landform at December 2026, the progressive rehabilitation schedule is summarised in Table 2-2 below.

Table 2-2 Indicative Progressive Rehabilitation Schedule for Approved MPO up to December 2026

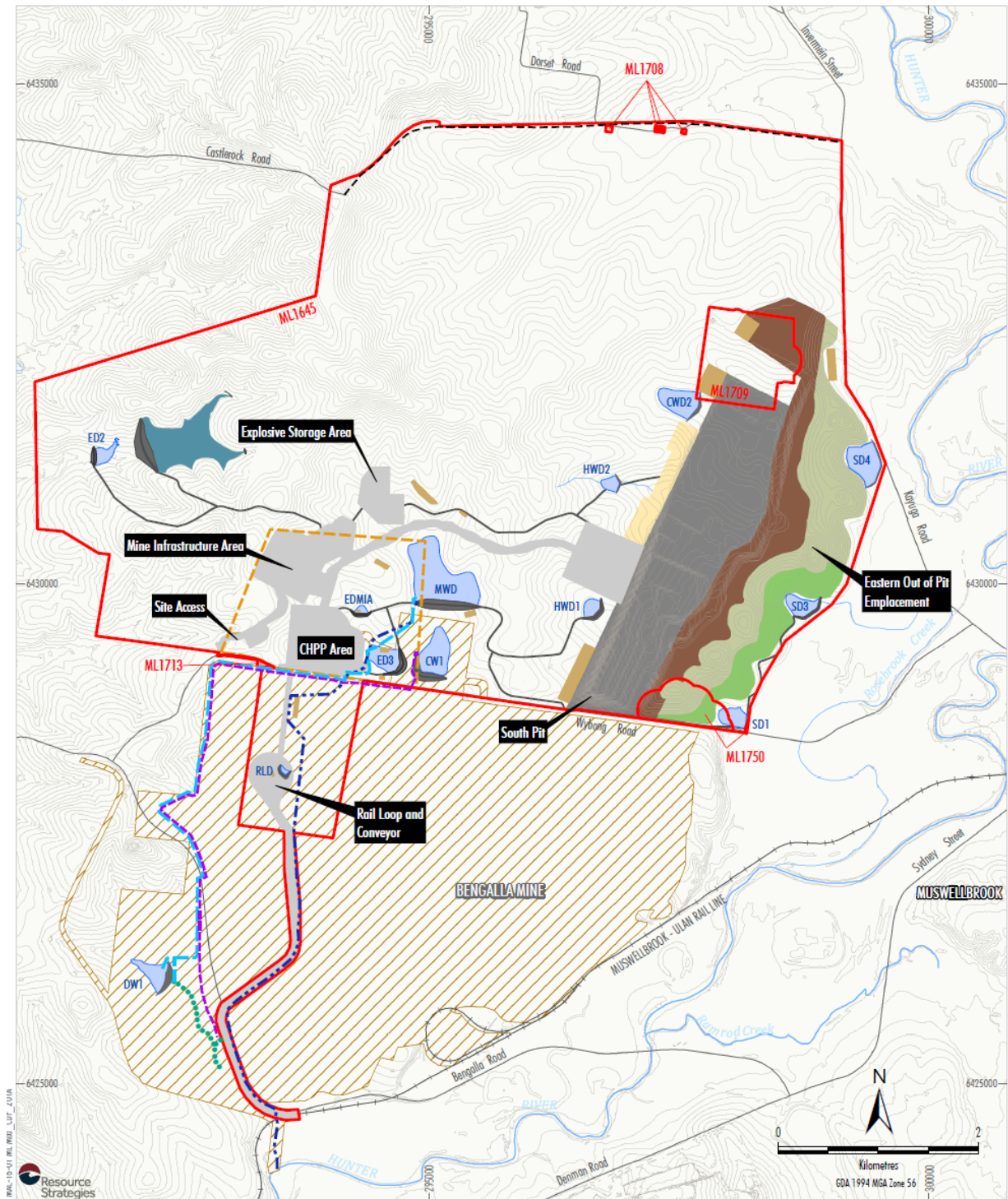
	2021 <sup>1</sup>	2025 <sup>2</sup>	22 December 2026 <sup>3</sup>
MPO indicative rehabilitation progression (Woodland/Grassland rehabilitation)	57	221	505

<sup>1</sup> Area of Established Rehabilitation as shown on Figure 1, Appendix 2 of MPO Development Consent (Figure 2-2).

<sup>2</sup> Area of Established Rehabilitation as shown on Figure 2, Appendix 2 of MPO Development Consent (Figure 2-3).

<sup>3</sup> Area of Secondary Domain D – Native Woodland/Grassland rehabilitation shown on Plan 4A of MPO MOP/RMP (Figure 2-4).

Rehabilitation of Box Gum Grassy Woodlands and Derived Grassland TEC will occur within Secondary Domain D – Woodlands/Grasslands mine site rehabilitation areas as defined in MOP RMP. Secondary Domain D – Woodland/Grassland areas will primarily be established on the Eastern Out-of-Pit Overburden Emplacement as shown on Figure 2-4. As described in the 2020-2021 MOP/RMP, at the end of June 2020, approximately 85 ha of woodland rehabilitation will have been undertaken on the lower and mid outer batters of the Eastern Out-of-Pit Overburden Emplacement. The details (e.g. areas, timing) of progressive rehabilitation of mined landforms and areas will continue to be provided in the MPO MOP/RMP. This TEC MSRP will continue to be revised as necessary to reflect the approved MPO MOP/RMP.

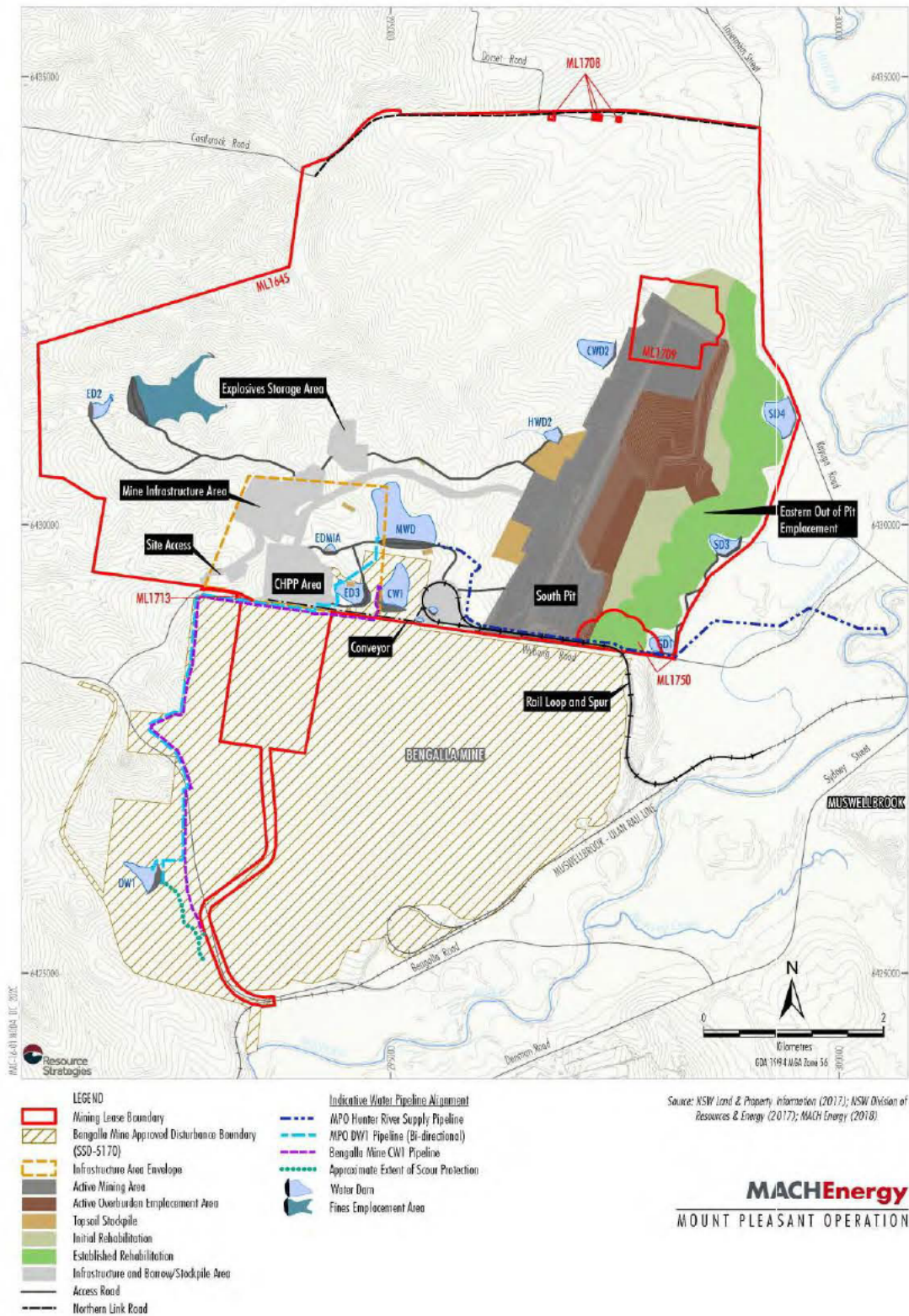


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Figure 2-2 Conceptual project layout plan at 2021

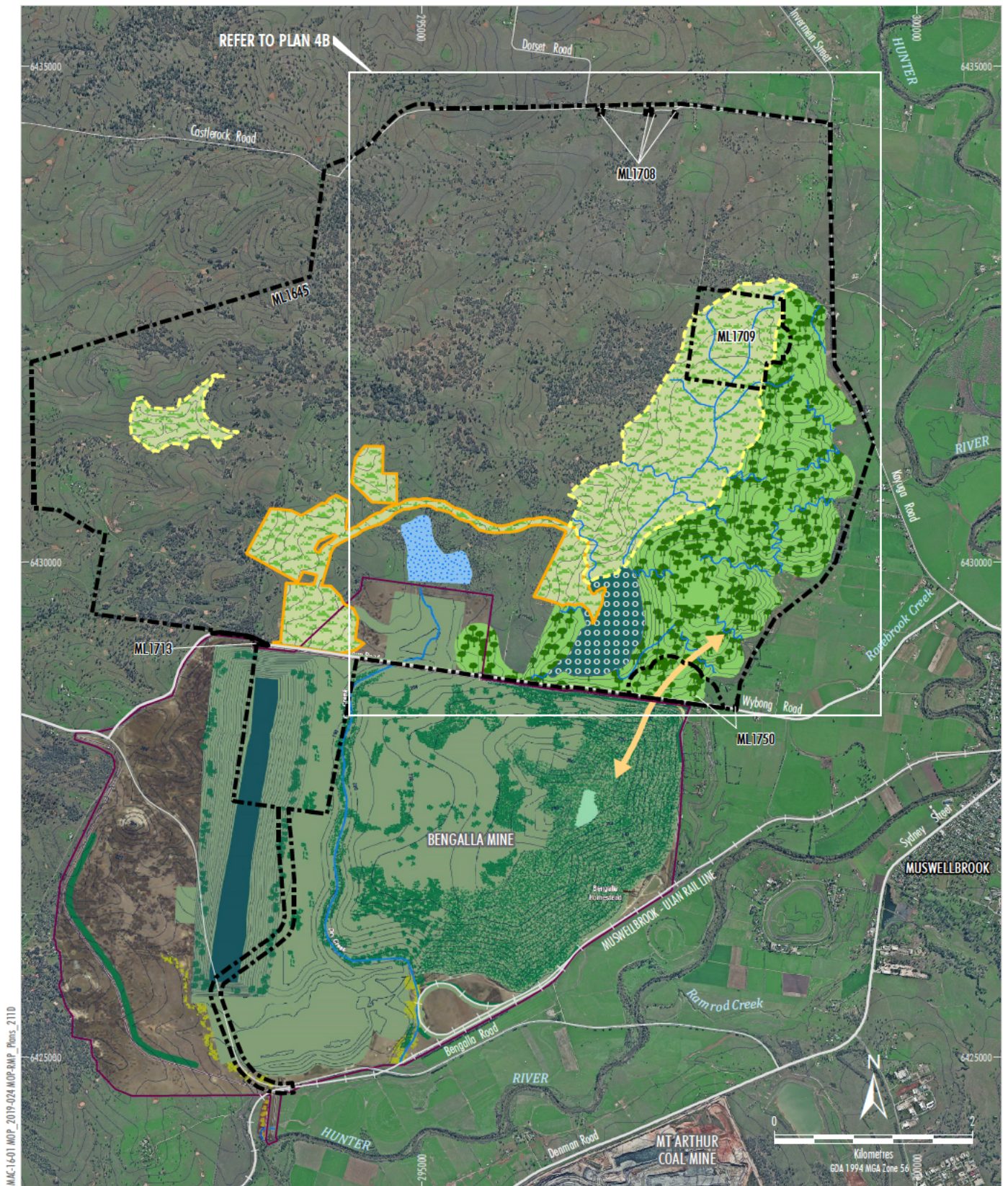


**FIGURE 2 - CONCEPTUAL PROJECT LAYOUT PLAN AT 2025**



**Figure 2-3** Conceptual project layout plan at 2025





**LEGEND**  
Mount Pleasant Mining Lease Boundary  
Secondary/Post-mining Land Use Domains



Domain A - Final Void



Domain B - Water Infrastructure and Storage



Domain C - Agricultural Land



Domain D - Native Woodland/Grassland



Potential Low Intensity Agriculture Area



Potential High Intensity Agriculture Area



Wildlife Corridor

Note: Light vehicle access roads and upslope diversions associated with minimising the catchment of the final void and fines emplacement area are not shown.

Bengalla Mine Conceptual Final Landform \*



Project Boundary (Appendix 2 of Development Consent SSD-5170)  
(Dated 23 December 2016)

\* Digitised from Appendix 9 of Development Consent (SSD-5170)  
and amended in the Mount Pleasant Operation CHPP area.

I, the representative of MACH Energy Australia Pty Ltd,  
certify that the information on this plan is a true  
indication of the proposed development.

04-06-19  
Date

Source: NSW Land & Property Information (2017); NSW Division  
of Resources & Energy (2019); Department of Planning and  
Environment (2016); MACH Energy (2018)  
Orthophoto: MACH Energy (Aug 2016)

**MACHEnergy**

MOUNT PLEASANT OPERATION

Indicative Final Rehabilitation and  
Post-mining Land Use Domains

Plan 4A



### 2.3.2 Progressive rehabilitation and restoration methods

Restoration of Box Gum Grassy Woodlands and Derived Grasslands TEC relates to improving the condition of areas of remnant or DNG forms of Box Gum Grass Woodlands (external to mine development areas) to meet criteria for consideration as a TEC.

There are five stages to the restoration/rehabilitation of the TEC at the MPO (Table 2-3). Stages 1 to 3 are preliminary, and will be undertaken once, for each rehabilitation/restoration area. Stages 4 and 5 are ongoing throughout the MPO mine life. Section 2.3.2.1 presents the methods that will be utilised during Stage 4, the restore/rehabilitate stage. Section 2.3.2.2 presents the planting and direct seeding methods for Box Gum Grassy Woodlands and Derived Grassland TEC mine site rehabilitation areas and restoration areas that have been identified as requiring revegetation in order to achieve a TEC condition.

Table 2-3 Five restoration/rehabilitation stages for Box Gum Grassy Woodland and Derived Grassland TEC areas at the MPO

Stage		Rehabilitation	Restoration
<b>Preliminary</b>			
1	Identify	TEC Rehabilitation Management Units (RMUs) will be identified within Secondary Domain D – Woodland/Grassland areas (Figure 2-4).	Patches of PCTs 483, 618 or 1606 mapped remnant woodland or DNG that will not be utilised as part of the mining operation will be identified as part of a desktop assessment. Each patch will be assigned a unique code to identify the patch in perpetuity (e.g. PCT0483_01 etc.)
2	Assess	N/A	All patches of PCTs 483, 618 or 1606 identified as per Section 2.3.1 will be assessed against the criteria for TEC listing as per the flowchart in Figure 2-1
3	Prioritise	N/A	All patches not considered to meet the TEC criteria will be prioritised based on estimated effort required to restore to TEC condition. Management units for ongoing restoration management will be developed using the unique code assigned during the identification stage
<b>Ongoing</b>			
4	Restore/Rehabilitate	Rehabilitate areas utilised by mining operations to TEC woodland/grassland	Restore using appropriate methods to return the patch to a TEC condition
5	Monitor	Monitor rehabilitated/restored areas to track progress towards TEC condition	

#### 2.3.2.1 Assisted natural regeneration

Areas of Box Gum Grassy Woodland and Derived Grassland that do not meet the criteria for TEC may still possess important elements of the community (i.e. soil seed bank, fauna habitat, paddock trees, soil biology etc.) and are therefore a priority for restoration (DECCW NSW, 2011). Assisted natural regeneration measures at MPO will include:

- **Reduction of grazing pressure.** Intense, sustained grazing by hooved animals can have a deleterious effect on sensitive forbs and important grasses such as *Themeda triandra* and *Poa* spp. (Rawlings, Freudenberger and Carr, 2010; Stol and Prober, 2015). Furthermore, soil nutrient levels can be increased and weed invasion become more prevalent in heavily grazed patches (Rawlings, Freudenberger and Carr, 2010; Stol and Prober, 2015; Cole et al., 2017). Accordingly, livestock will be excluded from areas being restored, or otherwise managed to reduce grazing pressure, thus allowing natural regeneration while assisting to control weeds and fire risk.
- **Reintroduction of appropriate disturbance regimes.** Box Gum Grassy Woodlands have developed from frequent, low intensity fires and grazing by native herbivores (Stol and Prober, 2015). With the introduction of agriculture and grazing by domestic livestock these disturbance regimes have been altered, therefore altering the species composition of the Box Gum Grassy Woodland understorey (Stol and Prober, 2015). In Box Gum Grassy Woodlands disturbance reduces the biomass of native grasses allowing native forbs to occupy inter-tussock spaces. This may be achieved by:
  - introducing ecological sensitive burns (including cultural burning practices) with consideration to weather conditions, season and life history of native forbs to reduce native grass biomass (Stol and Prober, 2015).
  - mowing/slashing of the ground layer following the native forb growing, flowering and seeding season can achieve similar, yet not as effective, results to fire (Stol and Prober, 2015). This is because mowing/slashing can benefit some exotic flora species as well as increase the risk of weed seed spread on machinery (Stol and Prober, 2015).
- **Direct seeding.** See Section 2.3.2.
- **Retaining dead standing trees and coarse woody debris (CWD)** in the patch provides habitat for fauna, particularly reptiles such as: skinks, lizards and snakes (Rawlings, Freudenberger and Carr, 2010; Stol and Prober, 2015). At low-to-moderate browsing pressure from macropods, CWD can improve protection from over browsing in Box Gum Grassy Woodlands (Stapleton, Ikin and Freudenberger, 2017).

#### 2.3.2.2 Planting and direct seeding

Planting involves the establishment of indigenous plants to create self-sustaining functional remnant vegetation communities. Replanting will be undertaken in areas that have been highly disturbed, have lost the ability to regenerate naturally and/or require soil stabilisation. Replanting techniques at MPO will include:

- **Direct seeding** which involves the application of native seed directly to the soil surface (Cuneo et al., 2018). Direct seeding has been shown to facilitate establishment of native species of Central Hunter Grey Box-Ironbark and Central Hunter Ironbark-Spotted Gum Forest communities to meet early rehabilitation benchmark criteria at an open-cut mine in the Hunter Valley (Cuneo et al., 2018). Key considerations for direct seeding are:
  - The use of clean, weed-free seed for planting and seeding (Cuneo et al., 2018).

- Development of a species list for collection that reflects the species found at MPO.
- Seed collection of local provenances and from multiple parent plants (Gibson-Roy et al., 2010), in line with seed collection guidelines (e.g. *FloraBank Guidelines* (FloraBank, 1999); *Plant Germplasm Conservation in Australia* (Australian Network for Plant Conservation (ANPC), 2009)).
- Timing of sowing prior to rainfall periods assists in germination rates as does imbibing seed prior to application (Cuneo et al., 2018). Seeding will be prioritised to occur when there is suitable soil moisture (Gibson-Roy et al., 2010), typically 1 to 2 days after 25 mm of rainfall, in spring or autumn.
- For overstorey species consideration will be given to the number of seeds per gram for direct seeding, as Eucalypt seed sizes and weights are highly variable and equal portioning of seed by weight alone can lead to significant imbalances in species composition (Cuneo et al., 2018).
- **Tubestock planting** includes the installation of plants germinated and established past seedling stage in a nursery situation. The following will be undertaken when tubestock planting where possible:
  - Seed collection of local provenances and from multiple parent plants (Gibson-Roy et al., 2010; Rawlings, Freudenberger and Carr, 2010), in line with seed collection guidelines (e.g. *FloraBank Guidelines* (FloraBank, 1999); *Plant Germplasm Conservation in Australia* (Australian Network for Plant Conservation (ANPC), 2009)).
  - Chemical control of weeds at least one week prior to planting. An area of at least 1 m diameter around each tree or seeding patch is to be sprayed or mechanically weeded to remove all competition for site resources. Weed control will be continued for two years while native species are establishing (Rawlings, Freudenberger and Carr, 2010).
  - Cultivation for tube stock planting would be to a depth of 500 to 600 mm at least 6 months prior to planting and when soil moisture is low to improve sub surface soil shatter (Rawlings, Freudenberger and Carr, 2010).
  - If there are nutrient imbalances, amelioration will be undertaken to improve soil condition before commencing restoration (Rawlings, Freudenberger and Carr, 2010).
  - Planting will be prioritised to occur when there is suitable soil moisture, preferably 1 to 2 days after 25 mm of rainfall, in spring or autumn.
  - Planting stock is to be at least 25 cm in height, with a well-established root system, in good condition and sun hardened (Rawlings, Freudenberger and Carr, 2010).
  - The tube stock root plug is to be saturated at the time of planting.
  - All plants would be planted deep, with their root plug at least 50 mm below ground and gently firmed in to remove any air pockets in the soil.
  - Where there is a chance of browsing by rabbits, macropods and other herbivores, sturdy tree guards would be utilised to allow tubestock to establish. Tree guards would only be removed once the tubestock has grown above the tree guard.

### 2.3.3 Weed control

High conservation value Box Gum Grassy Woodlands typically have a very low abundance of weeds when compared to highly disturbed and degraded patches of the same community type (Stol and Prober, 2015). Exotic species can reduce the ability of native species to establish (Cole et al., 2017) and it is therefore important to manage weeds in rehabilitation and restoration of the TEC at the MPO.

Weed control actions specific to Box Gum Grassy Woodlands TEC rehabilitation and restoration at the MPO may include:

- **Weed hygiene practices** (e.g. undertaking vehicle inspections and conducting vehicle wash down at a designated MPO location if necessary) to minimise the potential for new weed species being brought into restoration/rehabilitation areas and or spreading. Cattle should be held for approximately one week in a holding paddock to reduce the risk of weed seed spread.
- **Herbicide application** measures that do not negatively impact the native plants in the ground layer.
- For heavily infested areas, **scalping** by removing the top 100 mm of soil to remove the weed seed bank can be employed (Gibson-Roy et al., 2010). However, it should be noted that this technique will also remove all native species in the seed bank and should be used as a last resort (Cole et al., 2017). Scalping would only be used where: nutrient levels have been high for a long time, exotic species have consistently been dominant, and erosion risk is low (Rawlings, Freudenberger and Carr, 2010).

### 2.3.4 Pest fauna control

Rabbits and hares can cause substantial damage to native grass swards, tree sapling establishment and disturb soils and cause weed invasion (Stol and Prober 2015). Over abundant macropod populations may need to be controlled to reduce browsing of sapling overstorey species and sensitive forb species such as orchids (Stol and Prober, 2015; Stapleton, Ikin and Freudenberger, 2017). Feral deer and feral pigs can also cause damage to new plantings and feral pigs can also cause soil disturbance resulting in weed invasion and/or erosion.

Where these pests are inhibiting the performance of restoration/rehabilitation activities, pest animal control measures consistent with the MPO Biodiversity Management Plan will be used.

### 2.3.5 Research trials

To better inform restoration of Box Gum Grassy Woodlands and Derived Grasslands at the MPO, research trials will be implemented to build on existing knowledge. Research trials that may be conducted include:



Table 2-4 *Proposed rehabilitation/restoration research themes*

Research Theme	Purpose	Benefit
Grazing trials	Intense, sustained grazing can have a deleterious effect on sensitive forbs and grasses as well as creating soil nutrition issues and introducing weed seed (Rawlings, Freudenberger and Carr, 2010; Stol and Prober, 2015; Cole et al., 2017). Grazing trials would be implemented where identified restoration areas are being grazed as part of current lease agreements.	Implementation of grazing trials would allow early detection of deleterious effects on forb and grass species, introduction of new weed species and soil nutrition issues which may threaten attainment of the success criteria. Early detection of these issues would enable adaptive management measures to be put in place.
Interaction of macropods and restoration/rehabilitation	Over abundant macropod populations may reduce browsing of sapling overstorey species and sensitive forb species such as orchids (Stol and Prober, 2015; Stapleton, Ikin and Freudenberger, 2017). Monitoring of macropod abundance and behaviour in restoration/rehabilitation areas in conjunction with restoration/rehabilitation monitoring data and control sites within exclusion fencing may indicate if macropods are substantially impacting upon recruiting overstorey species and sensitive forb species.	Recruitment of overstorey species and forb species richness are success criteria for restoration and rehabilitation of Box Gum Grassy Woodland and DNG TEC. Understanding the effect of macropod abundance and browsing of overstorey recruits and sensitive forbs species would enable implementation of adaptive management measures such as control and exclusion fencing to ensure restoration/rehabilitation success criteria are met.
Direct seeding techniques and methods	Direct seeding involves the application of native seed directly to the soil surface (Cuneo et al., 2018). This technique can be used to establish native species at rehabilitation and enhance native species richness at restoration sites. Research trial could be conducted to understand the effect of direct seeding timing (time of year, time since rainfall) on species establishment, need to imbibe seed prior to sowing, proportion of species seeding at harvest site to establishing on rehabilitation/restoration site etc.	The success of direct seeding will likely govern the attainment of success criteria concerning understorey cover, forb species richness and key species establishment. Therefore, information garnered from research trials would be used to optimise the direct seeding process and ultimately assist in achieving the success criteria.

Research Theme	Purpose	Benefit
Ecologically sensitive/cultural burns	Box Gum Grassy Woodlands have developed from frequent, low intensity fires and grazing by native herbivores (Stol and Prober, 2015). Reintroduction of ecologically sensitive/cultural burns are recommended to reduce grass biomass and enable forbs to establish in the inter-tussock space (Stol and Prober, 2015). It will be important to understand how restoration and rehabilitation responds to fire at different times of the year and at different frequencies – as too frequent and/or too intense fires can negatively effect on mature overstorey trees, the recruitment of overstorey trees and have a deleterious effect on understorey species.	Reintroduction of ecological disturbance regimes such as fire is necessary to maintain understorey diversity and the open grassy woodland structure of the Box Gum Grassy Woodland TEC (Stol and Prober, 2015). Therefore, research trials tailored to understand the optimal intensity and frequency of ecologically sensitive/cultural burns would assist in attaining all species richness and vegetation structure success criteria.

## 2.4 Performance indicators and success criteria

Rehabilitation objectives, performance indicators and completion criteria have been developed for the MPO and are described in Section 6 of the MPO MOP/RMP, which is provided at Appendix C of the TEC MSRP. A criteria set has been prepared for each of the following key rehabilitation phases (as required by the MOP Guidelines):

- Decommissioning phase;
- Landform Establishment phase;
- Growth Media Development phase;
- Ecosystem and Land Use Establishment phase; and
- Ecosystem and Land Use Sustainability phase.

As a sub-set of this, Table 2-5 presents the performance indicators and success criteria to assess the condition of rehabilitated or restored Box Gum Grassy Woodlands and Derived Grassland areas for consideration as a TEC. Additional success criteria have been included for the rehabilitation areas and include chemical, physical and biological properties of the soils of Box Gum Grassy Woodlands and Derived Grasslands.

It should be noted that as rehabilitation sites will not have an existing overstorey in an intact or paddock tree capacity and cannot meet the “Has, or did have, white box, yellow box or Blakely’s red gum (or hybrids of these species) as the most common overstorey species.”. It is proposed that rehabilitation areas have a success criterion of “Regeneration of dominant overstorey eucalypts (>15 cm diameter at 130 cm above the ground) ” This is derived from the *Nationally threatened species and ecological communities guidelines - EPBC Act policy statement: White box - Yellow Box - Blakely's red gum grassy woodlands and derived native grasslands* (Footnote 4 in Figure 2-1).

**Table 2-5** *Performance indicators and success criteria for the establishment of 1,000 ha of Box Gum Grassy Woodland and Derived Grassland at the MPO*

Objective	Performance Indicator	Management Area	Success Criteria
Rehabilitate and revegetate no less than 1,000ha of White Box – Yellow Box – Blakelys Red Gum Grassy Woodland and Derived Native Grassland Ecological Community on the project area.	Soils	Rehabilitation	Topsoil to have geochemical (i.e. pH, nitrate, phosphate, organic carbon), physical (i.e. texture, structure and Emerson Aggregate) and biological /organic properties within the range of values recorded at analogue sites and have been assessed by a suitably qualified person as suitable for supporting long-term establishment of Box Gum Grassy Woodlands and Derived Grassland TEC.
	Patch size	Rehabilitation and Restoration	Individual rehabilitation and revegetation patches are $\geq 0.1$ ha, and cumulatively cover no less than 1,000ha
	Native perennial cover	Rehabilitation and Restoration	$\geq 50\%$ of perennial vegetation cover in the ground layer of each patch is native vegetation.
	Understorey Species	Rehabilitation and Restoration	There are $\geq 12$ native understorey species (excluding grasses) present (measured in a 1,000 m <sup>2</sup> plot) in each patch.
		Rehabilitation and Restoration	One ‘important’ species present (measured in a 1,000 m <sup>2</sup> plot) in each patch. Important species are listed in Appendix B.
	Overstorey species	Restoration	Each patch has, or did have, white box, yellow box or Blakely’s red gum (or hybrids of these species) as the most common overstorey species.
		Rehabilitation	Regeneration of dominant overstorey eucalypts (>15 cm diameter at 130 cm above the ground) equivalent to densities in analogue remnant Box Gum Grassy Woodlands and Derived Grassland sites.
	Overstorey structure	Restoration	If any indicators in the Understorey Species performance indicator are not met, the restoration patch can still be considered a TEC if the following are all met in addition to all other non-understorey indicators for restoration:  1. Patch size >2 ha.

			2. ≥20 mature (≥39.8 cm diameter at 130 cm above ground) trees per hectare OR natural regeneration (≥15 cm diameter at 130 cm above the ground) present.
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## 2.5 Monitoring program

Monitoring of rehabilitation and restoration areas to track progress against success criteria will be undertaken consistent with the monitoring methodologies in the MPO MOP/RMP. The MPO's rehabilitation monitoring program is described in Section 8 of the MPO MOP/RMP, which is provided in Appendix C to this TEC MSRP. The MPO's rehabilitation monitoring program methodologies include Ecosystem Function Analysis (EFA) and rapid visual assessments of revegetated areas.

MACH Energy has collaborated with Ausecology to develop a Rehabilitation Monitoring Manual (RMM) for the MPO. A preliminary version of the RMM has been developed, with a finalised version currently in preparation. The RMM aims to guide rehabilitation monitoring at the MPO so that the monitoring program can be consistently replicated year to year, and produce statistically robust and consistent data.

The RMM will detail MPO rehabilitation objectives, performance indicators and completion criteria, and the rehabilitation monitoring methodologies and monitoring parameters. The RMM will also include a Rehabilitation Verification and Inspection Checklists that will be used to track rehabilitation performance towards completion criteria and document whether a rehabilitation management unit area requires any corrective actions to improve performance. An EFA data collection form will also be included to enable efficient and complete data collection.

Once the RMM is finalised it will be incorporated into the MPO's MOP/RMP and this TEC MSRP.

### 2.5.1 Analogue Monitoring Sites

A total of six analogue sites have been established in PCTs (Ausecology, 2019):

- 483 - Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley.
- 1606 - White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter.

Four sites have been established in PCT483 and two sites established in PCT1606, located within the MPO Development Consent boundary. These PCTs are representative of the White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community listed under the EPBC Act. Sites were selected by spatial analysis of slope and aspect to select analogue sites with similar slope and aspect to the final landform of the out-of-pit overburden dump (Ausecology, 2019). The purpose of these analogue sites is to provide baseline data to determine the success of rehabilitation as defined in the MPO MOP/RMP. Success criteria for this TEC MSRP are based on set species richness and vegetation structure criteria that defines a patch as Box Gum Grassy Woodland TEC. Therefore, baseline vegetation data is not required for this plan. However, soil sampling at analogue sites will be used to determine suitability to establish Box Gum Grassy Woodland TEC in rehabilitation RMUs.

## 2.6 Risk management

Section 3 of the MPO MOP/RMP provides an overview of the risk assessments undertaken by MACH Energy to assess the risks to rehabilitation, biodiversity and land management at the MPO. Section 3 of the MOP/RMP outlines the risk assessment methodology and outcomes from the risk assessments. The key risks were assessed using the likelihood ratings, maximum reasonable consequence ratings, risk matrix and risk classifications listed in Table 3-1, Table 3-2, Table 3-3 and Table 3-4, respectively, of the MOP/RMP.

The risk triggers and treatment measures are detailed in the Trigger Action Response Plan provided in Section 9 of the MOP/RMP. Sections 3 and 9 of the MOP/RMP are provided in Appendix C of this TEC MSRP.

Section 3.2 of the MOP/RMP describes the management of risks relating to rehabilitation, and includes a description of spontaneous combustion and acid mine drainage management, soil management, weed and pest control, slope management, erosion and sediment control and bushfire management (refer Appendix C).

An assessment of the potential risks associated with restoration and rehabilitation of Box Gum Grassy Woodlands and Derived Grasslands TEC at the MPO and the potential mechanisms that may be used for the protection of the TEC restoration and rehabilitation areas in the long-term are described in Section 2.6.1. The mechanism for decision making the response to non-compliance is presented in Section 2.6.2.

#### 2.6.1 Risk assessment and contingency measures

Table 2-6 presents the potential risks to the success of restoration and rehabilitation of Box Gum Grassy Woodlands and Derived Grasslands at the MPO and a description of contingency measures that may be implemented to mitigate these risks.

Table 2-6 Risk assessment and contingency measures

Aspect	Risk	Controls
Bushfire	Bushfire causing mortality to planted trees and or substantial damage to rehabilitation/restoration areas.	Implement fire management practices consistent with the MPO BMP, including: <ul style="list-style-type: none"> <li>Management of fire breaks and water supply infrastructure.</li> <li>Review the use of ecological sensitive burns including cultural burning practices (or when burns unachievable (i.e. during total fire bans), the use of crash grazing by cattle) in restoration areas to reduce fuel loads.</li> <li>Following fire bans.</li> <li>Controlling the performance of hot work.</li> </ul>
Drought	Prolonged period with below average rainfall resulting in failure of restoration or rehabilitation areas.	Engage suitably qualified person to inspect drought affected rehabilitation area and recommend appropriate management actions including whether re-planting/re-seeding feasible option considering drought conditions. Assess potential water source/supply options and trials.  Where possible use seed from local provenance and maintain contingency supplies of seed.
Over grazing	Stock over grazing preventing natural regeneration or is causing damage to revegetation areas.	Reduce or remove stock temporarily, and review and modify strategic grazing regime.



Aspect	Risk	Controls
Storms/high-rainfall events	Storms or high rainfall event causing erosion or flooding of rehabilitation and restoration areas causing mortality in revegetation.	<p>Review final landform and drainage structure of as built designs to confirm constructed in accordance with approved design.</p> <p>Monitor rehabilitation and restoration areas following storm or high rainfall event and replant/reseed as necessary.</p> <p>Assess restoration areas prior to planting and design/locate plantings with consideration to drainage.</p>
Incompatible soil properties	Chemical, physical and biological properties of rehabilitation topsoil incompatible with establishing Box Gum Grassy Woodland.	Conduct soil testing prior to seeding and or planting to as part of the rehabilitation monitoring program to identify any chemical, physical or biological soil properties incompatible with establishing Box Gum Grassy Woodlands.
Pests	Overabundance of native (macropods) and/or non-native (rabbits, hares, deer etc) herbivores causing mortality or substantial reduction of trees and forbs in rehabilitation or restoration areas.	<p>Implement pest control practices consistent with the MPO BMP, including the following as relevant:</p> <ul style="list-style-type: none"> <li>▪ Removal (i.e. shooting, destruction of burrows, trapping, baiting).</li> <li>▪ Mitigation (i.e. exclusion fencing, tree guarding).</li> </ul>
	Insect attacks (e.g. locusts and beetles) leading to failure of rehabilitation or restoration.	<p>Avoid planting during insect prone periods where possible.</p> <p>Use local provenance seed that are suited to localised insect predation (where practical).</p>
Weeds	New weeds brought in or new weed infestations created by unclean machinery and plant.	Develop and implement weed hygiene protocols for machinery and plant accessing rehabilitation and restoration areas as per the MPO BMP.

Aspect	Risk	Controls
	Exotic weeds dominating restoration and/or rehabilitation areas causing non-compliance with success criteria.	Undertake weed control as required consistent with the MPO BMP, including the following as relevant: <ul style="list-style-type: none"> <li>Physical removal.</li> <li>Herbicide application.</li> <li>Removal of grazing pressure.</li> <li>Scalping.</li> </ul>
	Seed used in direct seeding contaminated with weeds.	Seed to be collected consistent with FloraBank guidelines and by trained and competent seed collectors.  Equipment used for seed collection to be inspected to confirm weed seed free.  Seed collections to occur from relatively weed free paddocks, where possible.
	Topsoil with significant weed seed bank causing native species to fail during rehabilitation.	Undertake weed control prior to topsoil stripping, where possible.
Inadequate training/competency	Tubestock planting and direct seeding failure due to poor training or incompetency.	Ensure planting personnel are trained in planting methods.  Ensure site preparation, tubestock/seed procurement and planting/seeding are performed by trained, competent persons.
Inadequate planning	Insufficient provision of financial, human and equipment resources leading to failure to meet success criteria, including increased maintenance costs and timeframe.	Undertaken review of budget and resourcing allocation and allocate sufficient and available resources to cover requirements to implement rehabilitation objectives.

Aspect	Risk	Controls
Scientific uncertainty	Failure to achieve performance indicators and/or success criteria for rehabilitation and or restoration areas	<p>Measures may include:</p> <ul style="list-style-type: none"><li>▪ Engaging a suitably qualified person/specialist to assess requirements for achieving ecological success criteria.</li><li>▪ Assessing the requirement for additional rehabilitation areas to achieve 1,000 ha requirement.</li><li>▪ During the post-mining phase, and during consultation with relevant regulatory agencies and the ultimate landholder, promote the use of mechanisms that facilitate management of the rehabilitation and restoration areas to achieve the ecological success criteria.</li><li>▪ Assess requirement for an extension to the period of effect of EPBC Approval 2011/5795.</li></ul>

## 2.6.2 Trigger Action Response Plan (TARP)

Compliance assessment categories have been developed for consideration of each Restoration Management Unit (RestMU) and Rehabilitation Management Unit (RMU) in relation to the success criteria. Levels of compliance are detailed in Table 2-7. Compliance is assessed in relation to individual success criteria.

Table 2-7 Levels of compliance

Level of Compliance	Definition
Not Yet Compliant	The RestMU's or RMU's realisation against applicable performance indicators is such that it is unlikely to meet the respective completion criterion without low impact works.
Near Compliant	The RestMU's or RMU's realisation against applicable performance indicators is such that it is likely to meet the respective completion criterion over time without any works.
Compliant	The RestMU's or RMU's realisation against applicable performance indicators is such that it is compliant with the respective completion criterion.

A Trigger Action Response Plan (TARP) for rehabilitation performance is presented in Table 2-8. The TARP is RMU-focused and based on assessment of compliance for each completion criteria. Examples of each trigger are also provided in the table.

Table 2-8 Generalised Trigger Action Response Plan (TARP) for actions required based on monitoring

Trigger	Action	Response	Example/s
<p>RestMU is:</p> <ul style="list-style-type: none"> <li>▪ <u>compliant</u> with patch size and overstorey species performance indicators but <u>not yet compliant</u> with one or more performance indicator.</li> </ul> <p>RMU is:</p> <ul style="list-style-type: none"> <li>▪ <u>compliant</u> with patch size performance indicator but <u>not yet compliant</u> with one or more performance indicator.</li> </ul>	Rectify	Requires low impact works for RMU to become compliant.	<ul style="list-style-type: none"> <li>▪ Erosion feature within RMU requires rectification and Erosion and Sediment Control (ESC) measures put in place.</li> <li>▪ A minor area of the RMU requires topsoil respreading and reseeding.</li> <li>▪ Weed control to eliminate or reduce a weed infestation.</li> <li>▪ Addition of fertiliser to surface (i.e. not requiring incorporation with soil)</li> <li>▪ Addition of mulch to soil surface.</li> <li>▪ Placement of Erosion and Sediment Control (ESC) measures by hand.</li> <li>▪ Tubestock planting or hand seeding to infill areas within the RestMU/RMU.</li> </ul>

Trigger	Action	Response	Example/s
<p>RestMU is:</p> <ul style="list-style-type: none"> <li>▪ <u>compliant or near compliant</u> with patch size, native perennial cover, understorey species and overstorey species performance indicators</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>▪ <u>compliant or near compliant</u> with patch size, native perennial cover and overstorey species performance indicators AND <u>not yet compliant</u> with understorey species but <u>compliant</u> with overstorey structure performance indicator</li> </ul> <p>RMU is:</p> <ul style="list-style-type: none"> <li>▪ <u>compliant OR near compliant</u> with soils, patch size, native perennial cover and understory species performance indicators.</li> </ul>	Monitor	Continue routine maintenance/management whilst monitoring in line with the RMM to track trajectory towards outstanding success criteria to identify if rectification works are required.	<ul style="list-style-type: none"> <li>▪ Analysis of soil testing results suggests growing media is not optimal but within normal tolerances. Therefore, results of next round of ecological monitoring to inform decision to Rectify.</li> </ul>
RestMU/RMU is <u>compliant</u> with all performance indicators.	Maintain	Continue to perform routine maintenance/management and monitor in line with the RMM to maintain compliance with the success criteria.	

## 2.7 Plan review, implementation and reporting

### 2.7.1 Review and implementation

The Environmental Superintendent or delegate of MACH Energy is responsible for the review and implementation of this plan.

The plan will be reviewed by MACH Energy every two years for the first six years of implementation to account for any approved modifications to the MPO, any learnings from operations, monitoring data and trials, and revised if necessary.

### 2.7.2 Reporting

Reporting to the department will occur on an annual basis as part of the annual EPBC compliance report required by Condition 28 of EPBC Approval 2011/5795. The report will provide at a minimum:

- A summary of operational activities conducted in line with this plan over the preceding year.
- Status of progress towards the completion criteria based on monitoring data.
- A summary of new risks (if any) to achieving the completion criteria.
- A forecast of planned operational activities for the next reporting period.
- Supply of monitoring reports (if monitoring was required during the reporting period).

An annual rehabilitation monitoring report will be prepared by a suitably qualified person and will report on the progress of rehabilitation performance as informed by the rehabilitation monitoring program methodologies described in Section 8.1 of the MOP/RMP. A summary of the results from the rehabilitation monitoring report will be included in the MPO Annual Review and Annual Rehabilitation Report, prepared in accordance with the requirements of the MPO's NSW Development Consent DA 9/97 and ML Authorities.

## 2.8 Long-term management and protection of the mine site

MACH Energy has undertaken a preliminary assessment of potential post-mining land uses of the MPO area (e.g. nature conservation, agriculture) considering relevant strategic land use objectives of the area in the vicinity of the MPO and the potential benefits of the post-mining land use to the environment, future landholders and the community. This has included consultation with Muswellbrook Shire Council who has indicated a preference for the inclusion of some intensive agricultural/industrial post-mining land uses that provide employment for the local community.

Accordingly, proposed final land uses for the MPO area include permanent water infrastructure and storage areas, agricultural land, native woodland and grassland areas and the final void.

It is expected that land tenure for the MPO area (i.e. the entire area encompassed by EPBC Approval 2011/5795 Project Area, the MPO's NSW Development Consent approved surface development area and the MPO MLs), post-closure, would be determined based on the mechanisms available at the time under NSW or Federal regulatory frameworks and in consultation with relevant regulatory authorities and stakeholders, including the ultimate landholder.

MACH Energy anticipates that considering the effort and expenditure committed to revegetating and rehabilitating 1,000 ha of White Box EEC across the MPO Project Area, MACH Energy would, during consultation with relevant regulatory authorities and stakeholders including the ultimate landholder, promote the use of mechanisms that provide conservation outcomes for the EEC areas and provide for other land uses that MPO has committed to provide within the MPO Project Area (i.e. agricultural areas). Notwithstanding, following ultimate closure and relinquishment of the NSW and Federal Approvals, as well as the mining tenements, the

vegetation will have the protection of the NSW Biodiversity Conservation Act 2016, the EPBC Act and the Muswellbrook Shire Council local planning scheme.

This TEC MSRP will be updated to incorporate post-closure planning outcomes as they are undertaken.



### 3 References

#### 3.1 Mount Pleasant Operations Documents

Document ID	Title	Version
MP001-0000-ENV-PLN-0010	Mount Pleasant Operation Mining Operations Plan and Rehabilitation Plan (1 July 2019 – 30 June 2020).	02
MP001-0000-H&S-PLN-0023	Mount Pleasant Operation Rehabilitation Strategy	01
MP001-0000-ENV-PLN-0012	Mount Pleasant Operation Biodiversity Management Plan	00

#### 3.2 External References

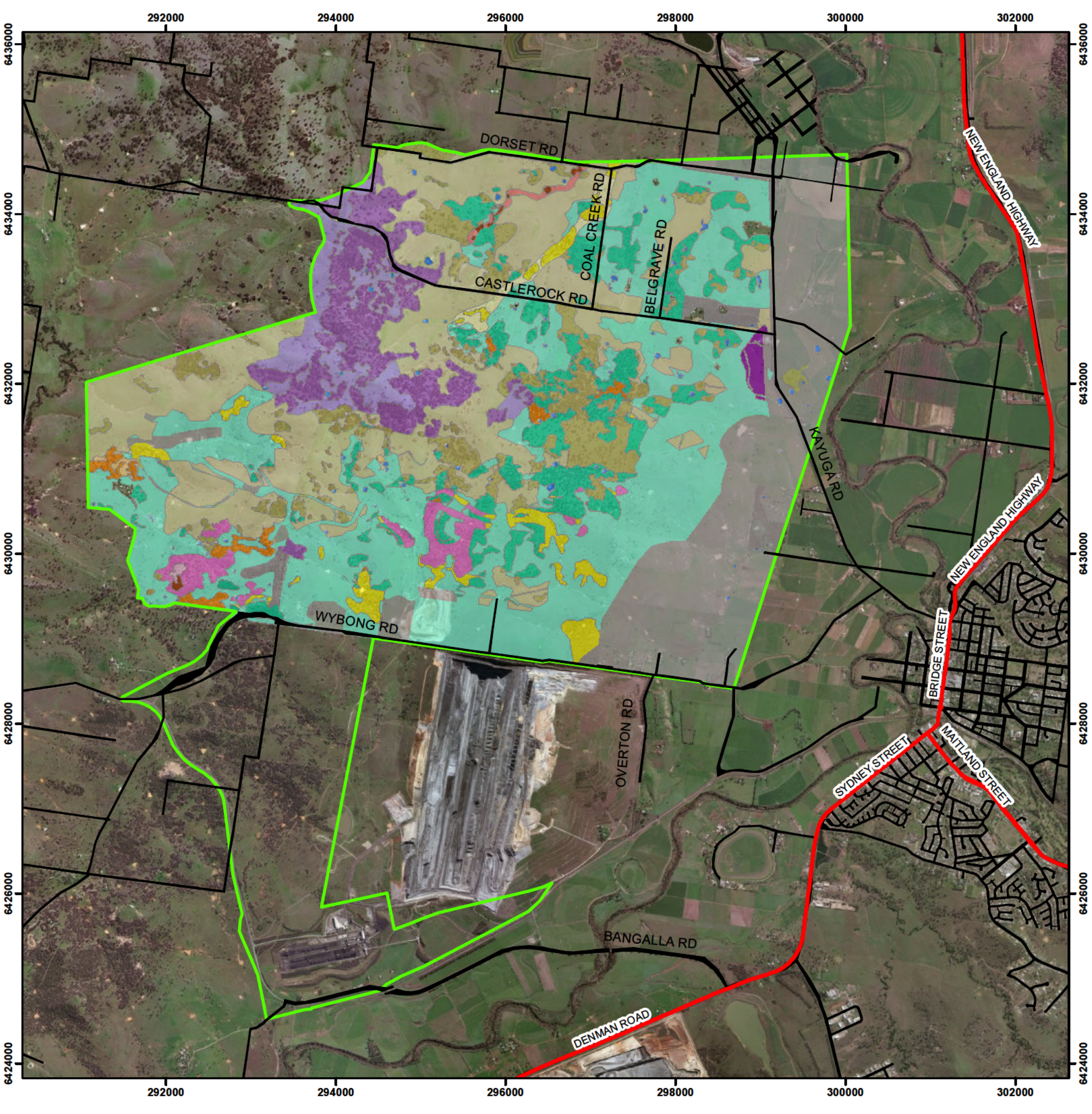
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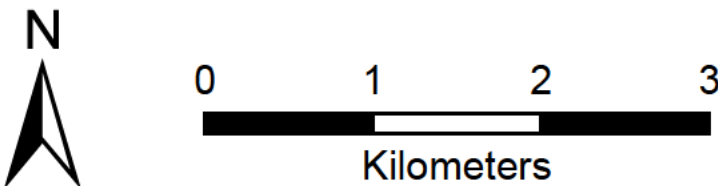
## Appendix A – Mapping of Pre-mining Vegetation Communities

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Appendix A:  
Premining Vegetation Communities



Scale: 1:45,000  
Coordinate System: GDA 1994 MGA Zone 56

Legend

- Major Road
- Roads
- EPBC Act Approval 2011/5795

PreminingVegetationCommunities

Vegetation Mapping

- White Box - Narrow-leaved Ironbark - Blakely's Red Gum (PCT1606) <sup>1</sup>
- White Box - Narrow-leaved Ironbark - Blakely's Red Gum (PCT1606) [DNG] <sup>1</sup>
- Spotted Gum - Narrow-leaved Ironbark Woodland (PCT1602) <sup>2</sup>
- Spotted Gum - Narrow-leaved Ironbark Woodland (PCT1602) [DNG]
- Spotted Gum - Grey Box x White Box Woodland/Forest (PCT1604) <sup>2</sup>
- Spotted Gum - Grey Box x White Box Woodland/Forest (PCT1604) [DNG]
- Slaty Box Woodland (PCT1655) [DNG]
- Narrow-leaved Ironbark - Grey Box grassy woodland (PCT1691) <sup>3</sup>
- Narrow-leaved Ironbark - Grey Box grassy woodland (PCT1691) [DNG]
- Narrow-leaved Ironbark Shrubby Forest (PCT1605) <sup>3</sup>
- Narrow-leaved Ironbark Shrubby Forest (PCT1605) [DNG]
- Grey Box x White Box Grassy Woodland (PCT483) <sup>1</sup>
- Grey Box x White Box Grassy Woodland (PCT483) [DNG] <sup>1</sup>
- Forest Red Gum Grassy Open Forest (PCT618) <sup>1</sup>
- Forest Red Gum Grassy Open Forest (PCT618) [DNG] <sup>1</sup>
- Non-native
- Dam

Data sources:  
Primary Domains, Rehabilitation Areas, Imagery MACH Energy 2019;  
Vegetation Communities, Hunter Eco 2017.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar  
Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,  
swisstopo, and the GIS User Community

Document History:

Rev	Reason for Issue	Author	Reviewer	Approver	Date
A	Internal Draft	RE	LG		21/10/19
0	Issued for information	RE	LG	LG	21/10/19
1	Issued for information	CP	RE	LG	29/10/19



## **Appendix B – Box Gum Grassy Woodland Ecological Community Species List**

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White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community **Species List**

This species list is designed to provide information about plant species that can be found in the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999*. The species list was developed to complement the Listing Information Guide, and should be read in that context.

It provides information on scientific and common names of the species, the kind of plant the species is, whether it is an 'important' species for the purposes of this ecological community and whether it is exotic or native, perennial or annual.

The list is not exhaustive and not all of the species listed will occur in every patch of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. If there are any species that you think should be added to the list, removed from the list, or that are categorised incorrectly, please contact Peter.Komidar@deh.gov.au. As such, this document may change over time and you should check that you are referring to the most recent version of the list.

Pictures and distribution maps can be found at <http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm>

**Caveat:** This list has been compiled from a range of sources. While reasonable efforts have been made to ensure the accuracy of the information, no guarantee is given, nor responsibility taken, by the Commonwealth for its accuracy, currency or completeness. The Commonwealth does not accept any responsibility for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the information contained in this list. The information contained in this list does not necessarily represent the views of the Commonwealth. The list is not intended to be a complete source of information on the species it deals with.

Scientific Name	common name	category	native or exotic	Important species	annual/perennial	Family	Common name of family	Old scientific name
<b>Native</b>								
<b>Fern</b>								
<i>Asplenium flabellifolium</i>	Necklace Fern	Fern	Native		perennial	Aspleniaceae	ferns	
<i>Botrychium australe</i>	Parsley Fern	Fern	Native		perennial	Ophioglossaceae	ferns	
<i>Cheilanthes austrotenuifolia</i>	Rock-fern	Fern	Native		perennial	Adiantaceae	maidenhair fern	
<i>Cheilanthes distans</i>	Bristly Cloak Fern	Fern	Native	Important	perennial	Adiantaceae	maidenhair fern	
<i>Cheilanthes sieberi</i>	Narrow Rock Fern	Fern	Native		perennial	Adiantaceae	maidenhair fern	
<i>Pteridium esculentum</i>	Common Bracken, Gurgi (Cadigal), Austral Bracken, Bracken	Fern	Native		perennial	Dennstaedtiaceae	bracken ferns	
<b>Grass</b>								
<i>Aristida behriana</i>	Brush Wiregrass, Bunch Wiregrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Aristida calycina</i>	Dark Wire-grass, Branched Wiregrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Aristida ramosa</i>	Purple Wiregrass, Kerosene Grass, Prickly Threeawn	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia bipartita</i>	Bandicoot Grass, Wallaby Grass, Leafy Wallaby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia caespitosa</i>	Ringed Wallaby-grass, Common Wallaby-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia carphoides</i>	Short Wallaby-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia laevis</i>	Wallaby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia monticola</i>	Small-flower Wallaby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	<i>Notodanthonia monticola</i> , <i>Rytidosperma monticola</i>
<i>Austrodanthonia pilosa</i>	Velvet Wallaby Grass, Smooth-flowered Wallaby-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia racemosa</i>	Clustered Wallaby-grass, Slender Wallaby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrodanthonia setacea</i>	Bristly Wallaby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrofestuca eriopoda</i>	Snow Fescue	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrostipa bigeniculata</i>	Tall Speargrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrostipa blackii</i>	Crested Spear-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrostipa densiflora</i>	Dense Spear-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

<i>Austrostipa nodosa</i>	Knotty Speargrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrostipa rudis</i>	Veined Speargrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Austrostipa scabra</i>	Corkscrew, Corkscrew Speargrass, Rough Spear-grass, Rough Needle-grass, Speargrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Bothriochloa macra</i>	Redgrass, Redleg Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Chloris truncata</i>	Windmill Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Chloris ventricosa</i>	Tall Windmill Grass	Grass	Native			Poaceae	grass, bamboo, spinifex	
<i>Cymbopogon refractus</i>	Barbed Wire Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Deyeuxia quadriseta</i>	Reed Bent-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichanthium sericeum</i>	Queensland Blue-grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne crinita</i>	Longhair Plumegrass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne hirtella</i>	Slender Plumegrass	Grass	Native	Important	annual	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne inaequiglumis</i>	Plume Grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne micrantha</i>	Short-hair Plumegrass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne parva</i>	Plume Grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Dichelachne rara</i>	Plume Grass	Grass	Native	Important	annual	Poaceae	grass, bamboo, spinifex	
<i>Echinopogon caespitosus</i>	Tufted Hedgehog-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Echinopogon cheeli</i>	Long-flowered Hedgehog Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Echinopogon ovatus</i>	Forest Hedgehog-grass, Hedgehog Grass, Rough-bearded Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Elymus scaber</i>	Common Wheat-grass, Wheatgrass, Rough Wheatgrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Enneapogon nigricans</i>	Black-head Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Glyceria australis</i>	Australian Sweetgrass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Imperata cylindrica</i>	Blady Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Joycea pallida</i>	Silvertop Wallaby Grass, Redanther Wallaby Grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	<i>Chionochloa pallida</i> , <i>Danthonia pallida</i>
<i>Microlaena stipoides</i>	Microlaena, Weeping Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Panicum effusum</i>	Hairy Panic, Poison Panic	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Poa labillardierei</i>	Tussock Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Poa meionectes</i>	Fine-leaved Snow Grass, Fine-leaved Tussock-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Poa petrophila</i>	Rock Tussock-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Poa sieberiana</i>	Snow Grass, Fine-leaved Tussock-grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Rytidosperma nudiflorum</i>	Alpine Wallby Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	<i>Danthonia nudiflora</i> , <i>Notodanthonia nudiflora</i>
<i>Sorghum leiocladum</i>	Wild Sorghum	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Sporobolus creber</i>	Western Rat-tail Grass, Slender Rat's Tail Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Sporobolus elongatus</i>	Slender Rat's-tail Grass	Grass	Native		perennial	Poaceae	grass, bamboo, spinifex	
<i>Themeda australis</i> (syn. <i>Themeda triandra</i> )	Kangaroo Grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Themeda triandra</i> (syn. <i>Themeda australis</i> )	Kangaroo Grass	Grass	Native	Important	perennial	Poaceae	grass, bamboo, spinifex	
<i>Tripogon loliiformis</i>	Fiveminute Grass	Grass	Native	Important	annual	Poaceae	grass, bamboo, spinifex	
<b>Herb</b>								
<i>Acaena agnipila</i>	Sheep's Burr, Bidgee-widgee	Herb	Native		perennial	Rosaceae	roses, blackberries, apples	
<i>Acaena echinata</i>	Sheep's Burr	Herb	Native		perennial	Rosaceae	roses, blackberries, apples	
<i>Acaena novae-zelandiae</i>	Bidgee-widgee, Biddy Biddy	Herb	Native		perennial	Rosaceae	roses, blackberries, apples	
<i>Acaena ovina</i>	Sheep's Burr, Bidgee-widgee	Herb	Native		perennial	Rosaceae	roses, blackberries, apples	
<i>Ajuga australis</i>	Australian Bugle, Austral Bugle	Herb	Native	Important	perennial	Lamiaceae	mints, sages, mintbush	
<i>Alternanthera nana</i>	Hairy Joyweed, Downy Pigweed	Herb	Native	Important	annual	Amaranthaceae	cockscorns, mulla-mullas, pussytails	
<i>Ammobium alatum</i>	Tall Ammobium	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

<i>Ammobium craspedioides</i>	Yass Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Aphanes australiana</i>	Australian Piert	Herb	Native		annual	Rosaceae	roses, blackberries, apples	
<i>Arachnorchis</i> spp.	Spider Orchids	Herb	Native	Important	perennial	Orchidaceae	orchids	<i>Caladenia</i>
<i>Arthropodium milleflorum</i>	Vanilla-lily, Pale Vanilla-lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Arthropodium minus</i>	Small Vanilla Lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Asperula conferta</i>	Common Woodruff	Herb	Native	Important	perennial	Rubiaceae	gardenias, coffee	
<i>Asperula scoparia</i>	Prickly Woodruff	Herb	Native	Important	perennial	Rubiaceae	gardenias, coffee	
<i>Billardiera scandens</i>	Appleberry, Snotberry, Apple Dumplings	Climber	Native		perennial	Pittosporaceae	native frangipani	
<i>Brachyscome aculeata</i>	Hill Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome aculeata</i>
<i>Brachyscome decipiens</i>	Field Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome decipiens</i>
<i>Brachyscome diversifolia</i>	Large-headed Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome diversifolia</i>
<i>Brachyscome graminea</i>	Grass Dairy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome graminea</i>
								<i>Brachyscome heterodonta</i> , <i>Brachyscome dentata</i> , <i>Brachyscome dentata</i>
<i>Brachyscome heterodonta</i>	Lobe-seed Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Brachyscome multifida</i>	Cut-leaved Daisy	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	<i>Brachyscome multifida</i>
<i>Brachyscome rigidula</i>	Leafy Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome rigidula</i>
<i>Brachyscome scapigera</i>	Tufted Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome scapigera</i>
<i>Brachyscome spatulata</i>	Spoon Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Brachyscome spatulata</i>
<i>Brunonia australis</i>	Pincushion, Blue Pincushion	Herb	Native	Important	perennial	Brunoniaceae	brunonias	
<i>Brunoniella australis</i>	Blue Trumpet	Herb	Native		perennial	Acanthaceae	bear's britches	<i>Ruellia australis</i>
<i>Bulbine bulbosa</i>	Bulbine Lily, Native Onion, Native Leek, Golden Lily	Herb	Native	Important	perennial	Asphodelaceae	lilies	
<i>Bulbine glauca</i>	Rock Lily	Herb	Native	Important	perennial	Asphodelaceae	lilies	
<i>Burchardia umbellata</i>	Milkmaids	Herb	Native	Important	perennial	Colchicaceae	lilies	
<i>Caesia calliantha</i>	Blue Grass-Lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Calocephalus citreus</i>	Lemon Beautyheads	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Calochilus robertsonii</i>	Purplish Beard Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	plus other <i>Calochilus</i> species
<i>Calotis cuneifolia</i>	Purple Burr-daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Calotis glandulosa</i>	Mauve Burr-daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Calotis lappulacea</i>	Yellow Burr-daisy, Yellow Daisy-burr	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Calotis scabiosifolia</i>	Rough Burr-daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Carex inversa</i>	Knob Sedge, Common Sedge	Herb	Native		perennial	Cyperaceae	sedges	
<i>Centella asiatica</i>	Pennywort	Herb	Native	Important	perennial	Apiaceae	carrots, parsley, fennel	
<i>Centella cordifolia</i>	Centella	Herb	Native		perennial	Apiaceae	carrots, parsley, fennel	
<i>Centrolepis strigosa</i>	Hairy Centrolepis	Herb	Native		annual	Centrolepidaceae	sedges	
<i>Chamaesyce drummondii</i>	Caustic-weed	Herb	Native		perennial	Euphorbiaceae	spurge	
<i>Chenopodium pumilio</i>	Clammy Goosefoot, Small Crumbweed	Herb	Native		annual	Chenopodiaceae	saltbushes, bluebushes, samphires, chenopods	
<i>Chrysocephalum apiculatum</i>	Yellow Buttons, Common Everlasting	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting, Yellow Buttons	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Clematis microphylla</i>	Small-leaved Clematis	Climber	Native		perennial	Ranunculaceae	buttercups, anemones	
<i>Convolvulus erubescens</i>	Australian Bindweed, Blushing Bindweed	Herb	Native		perennial	Convolvulaceae	morning glory, bindweed	
<i>Correa reflexa</i>	Common Correa, Native Fuchsia	Herb	Native		perennial	Rutaceae	boronias, citrus, native fuchsias	
<i>Cotula australis</i>	Common Cotula, Carrot Weed	Herb	Native		annual	Asteraceae	daisies, sunflower	
<i>Craspedia canens</i>	Billy Buttons, Grey Billybuttons	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Craspedia variabilis</i>	Billy Buttons	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Crassula colorata</i>	Annual Stonecrop, Dense Crassula, Dense Stonecrop	Herb	Native		annual	Crassulaceae	stonecrops	
<i>Crassula helmsii</i>	Swamp Stonecrop	Herb	Native		annual	Crassulaceae	stonecrops	
<i>Crassula sieberiana</i>	Australian Stonecrop, Sieber Crassula	Herb	Native		perennial	Crassulaceae	stonecrops	
<i>Cullen microcephalum</i>	Dusky Scurf-pea, Mountain Psoralea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Psoralea adscendens</i>



White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

<i>Cullen tenax</i>	Emu-foot, Emu Grass, Tough Scurf-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Psoralea tenax</i>
<i>Cymbonotus lawsonianus</i>	Bear's Ear, Austral Bears-ears, Bears-ears	Herb	Native		perennial	Asteraceae	daisies, sunflower	Maybe be syn <i>Cymbonotus preissianus</i>
<i>Cymbonotus preissianus</i>	Austral Bear's Ear	Herb	Native		perennial	Asteraceae	daisies, sunflower	Maybe be syn <i>Cymbonotus lawsonianus</i>
<i>Cynoglossum australe</i>	Australian Forget-me-not, Australian Hound's-tongue	Herb	Native		perennial	Boraginaceae	heliotropes, forget-me-nots, borage	
<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue	Herb	Native		perennial	Boraginaceae	heliotropes, forget-me-nots, borage	
<i>Daucus glochidiatus</i>	Australian Carrot, Native Carrot, Austral Carrot	Herb	Native	Important	annual	Apiaceae	carrots, parsley, fennel	
<i>Derwentia perfoliata</i>	Digger's Speedwell	Herb/Shrub	Native		perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Desmodium brachypodum</i>	Large Tick-trefoil	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Desmodium varians</i>	Slender Tick-trefoil	Herb	Native	Important	annual	Fabaceae	peas, eg. sturt desert pea	
<i>Dianella longifolia</i>	Smooth Flax Lily	Herb	Native	Important	perennial	Phormiaceae	lilies	
<i>Dianella revoluta</i>	Blueberry Lily, Black-Anther Flax Lilly, Spreading Flax Lily	Herb	Native	Important	perennial	Phormiaceae	lilies	
<i>Dichondra repens</i>	Kidney Grass, Kidney Weed	Herb	Native		perennial	Convolvulaceae	morning glory, bindweed	
<i>Dichopogon fimbriatus</i>	Chocolate Lily, Nodding Chocolate Lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Dichopogon strictus</i>	Chocolate Lily	Herb	Native		perennial	Anthericaceae	lilies	
<i>Dipodium punctatum</i>	Hyacinth Orchid, Pink Hyacinth Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris aequalis</i>	Buttercup Doubletail	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris behrii</i>	Golden Cowslips	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris chryseopsis</i>	Common Golden Moths	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris dendrobioides</i>	Long-tail Purple Diuris, Wedge Diuris	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris maculata</i>	Leopard Orchid, Nanny Goats, Leopard Diuris, Spotted Doubletail	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris monticola</i>	Highland Golden Moths	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris ochroma</i>	Pale Golden Moths	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris pedunculata</i>	Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	Annual or perennial?
<i>Diuris punctata</i>	Purple Donkey-orchid, Purple Double-tails, Purple Diuris, Purple Cowslip, Dotted Double tails	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Diuris semilunulata</i>	Donkey-ears	Herb	Native	Important	perennial	Orchidaceae	orchids	<i>Diuris maculata</i>
<i>Diuris sulphurea</i>	Tiger Orchid, Hornet Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Drosera peltata</i>	Hairy Climbing Sundew, Pale Sundew	Herb	Native		perennial	Droseraceae	sundews	
<i>Drosera pygmaea</i>	Pigmy Sundew, Tiny Sundew	Herb	Native		perennial	Droseraceae	sundews	
<i>Einadia nutans</i>	Climbing Saltbush, Nodding Saltbush	Herb	Native		perennial	Chenopodiaceae	saltbushes, bluebushes, samphires, chenopods	
<i>Eriochilus cucullatus</i>	Parson's Bands	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Erodium crinitum</i>	Native Crowfoot, Blue Storks-bill, Blue Crowfoot, Blue Herons-bill	Herb	Native		annual	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Eryngium ovium</i>	Blue Devil	Herb	Native	Important	annual	Apiaceae	carrots, parsley, fennel	
<i>Eryngium rostratum</i>	Blue Devil	Herb	Native		annual	Apiaceae	carrots, parsley, fennel	
<i>Eryngium vesiculosum</i>	Prostrate Blue Devil, Prickfoot	Herb	Native	Important	perennial	Apiaceae	carrots, parsley, fennel	
<i>Euchiton gymnocephalus</i>	Creeping Cudweed	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Euchiton involucratus</i>	Star Cudweed	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Euchiton sphaericus</i>	Annual Cudweed, Star Cudweed	Herb	Native		annual	Asteraceae	daisies, sunflower	
<i>Euphrasia collina</i>	Eyebright	Herb	Native		perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Galium gaudichaudii</i>	Rough Bedstraw	Herb	Native	Important	perennial	Rubiaceae	gardenias, coffee	

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<i>Gastrodia sesamoides</i>	Cinnamon Bells, Potato Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Genoplesium</i>	Midge Orchids	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Geranium antrorsum</i>	Antrorse Geranium	Herb	Native	Important	perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Geranium graniticola</i>	Granite Cranesbill	Herb	Native	Important	perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Geranium neglectum</i>	Swamp Cranes-bill	Herb	Native		perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Geranium retrorsum</i>	Common Cranes-bill	Herb	Native		perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Geranium solanderi</i>	Native Geranium	Herb	Native		perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Glossodia major</i>	Wax-lip Orchid, Parson-in-the-pulpit	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Glycine clandestina</i>	Twining Glycine	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Glycine tabacina</i>	Glycine Pea, Variable Glycine	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Gonocarpus elatus</i>	Hill Raspswort	Herb	Native		perennial	Haloragaceae	raspsworts, milfoils	
<i>Gonocarpus tetragynus</i>	Common Raspswort	Herb	Native		perennial	Haloragaceae	raspsworts, milfoils	
<i>Goodenia bellidifolia</i>	Daisy-leaved Goodenia, Rocket Goodenia	Herb	Native		perennial	Goodeniaceae	goodenias, dampieras	
<i>Goodenia hederacea</i>	Forest Goodenia, Ivy Goodenia	Herb	Native	Important	perennial	Goodeniaceae	goodenias, dampieras	
<i>Goodenia humilis</i>	Swamp Goodenia	Herb	Native		perennial	Goodeniaceae	goodenias, dampieras	
<i>Goodenia pinnatifida</i>	Scrambled Eggs, Cut-leaf Goodenia	Herb	Native	Important	perennial	Goodeniaceae	goodenias, dampieras	
<i>Goodenia stelligera</i>	Spiked Goodenia	Herb	Native		perennial	Goodeniaceae	goodenias, dampieras	
<i>Gratiola nana</i>	Creeping Brooklime	Herb	Native	Important	perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Gratiola pedunculata</i>	Brooklime	Herb	Native	Important	perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Gratiola peruviana</i>	Austral Brooklime	Herb	Native	Important	perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Gypsophila tubulosa</i>	Annual Chalkwort	Herb	Native		annual	Caryophyllaceae	carnations	<i>Gypsophila australis</i>
<i>Helichrysum collinum</i>	Hill Daisy	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Helichrysum scorpioides</i>	Button Everlasting	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Herb	Native		perennial	Apiaceae	carrots, parsley, fennel	
<i>Hymenochilus bicolor</i>	Bicolor Greenhood	Herb	Native	Important	perennial	Orchidaceae	orchids	<i>Pterostylis bicolor</i> annual or perennial?
<i>Hymenochilus cycnocephalus</i>	Swan Greenhood	Herb	Native	Important	perennial	Orchidaceae	orchids	<i>Pterostylis cycnocephala</i>
<i>Hymenochilus muticus</i>	Midget Greenhood, Blunt Greenhood, Dwarf Greenhood	Herb	Native	Important	perennial	Orchidaceae	orchids	<i>Pterostylis mutica</i> annual or perennial?
<i>Hypericum gramineum</i>	Small St John's Wort	Herb	Native	Important	perennial	Clusiaceae	garcinias	
<i>Hypericum japonicum</i>	Small St John's Wort, Matted St John's Wort	Herb	Native	Important	perennial	Clusiaceae	garcinias	
<i>Isoetopsis graminifolia</i>	Grass Cushion	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	
<i>Isotoma axillaris</i>	Rock Isotome	Herb	Native		perennial	Lobeliaceae	lobelias	
<i>Kennedia prostrata</i>	Running Postman, Scarlet Running Pea, Scarlet Coral-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Lagenophora stipitata</i>	Blue-bottle Daisy, Common Lagenophora	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Lagenifera stipitata</i>
<i>Laxmannia gracilis</i>	Slender Wire-Lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Leptorhynchus elongatus</i>	Lanky Buttons, Hairy Buttons	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Leptorhynchus elongatus</i>
<i>Leptorhynchus squamatus</i>	Scaly Buttons	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Conyza squamata</i> , <i>Chrysocoma squamata</i> , <i>Leptorhynchus squamatus</i>
<i>Leucochrysum albicans</i>	Hoary Sunray	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Helipterum albicans</i>

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<i>Limosella australis</i>	Australian Mudwort	Herb	Native		perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Linum marginale</i>	Wild Flax, Native Flax	Herb	Native	Important	perennial	Linaceae	flaxes	
<i>Lobelia dentata</i>	Toothed Lobelia, Wavy Lobelia	Herb	Native		perennial	Lobeliaceae	lobelias	perennial?
<i>Lobelia gibbosa</i>	Tall Lobelia	Herb	Native		perennial	Lobeliaceae	lobelias	perennial?
<i>Lomandra bracteata</i>	Mat-rush	Herb	Native		perennial	Lomandraceae	lomandras	
<i>Lomandra filiformis</i>	Wattle Mat-rush	Herb	Native		perennial	Lomandraceae	lomandras	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush, Honey Weed	Herb	Native		perennial	Lomandraceae	lomandras	
<i>Lomandra multiflora</i>	Many-flowered Matrush	Herb	Native		perennial	Lomandraceae	lomandras	
<i>Lotus australis</i>	Austral Trefoil, Australian Trefoil	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Lythrum salicaria</i>	Purple Loosestrife	Herb	Native		perennial	Lythraceae	loose strifes, crepe myrtles	
<i>Mentha diemenica</i>	Slender Mint	Herb	Native		perennial	Lamiaceae	mints, sages, mintbush	
<i>Mentha satereioides</i>	Creeping Mint, Native Pennyroyal	Herb	Native		perennial	Lamiaceae	mints, sages, mintbush	
<i>Microseris lanceolata</i>	Yam Daisy, Murnong	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Microtis parviflora</i>	Slender Onion-orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Microtis unifolia</i>	Common Onion-orchid, Onion-orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	
<i>Mimulus repens</i>	Creeping Monkey-flower	Herb	Native		annual	Scrophulariaceae	foxgloves, snapdragons, witchweeds	annual or perennial
<i>Opercularia diphylla</i>	Stinkweed	Herb	Native		perennial	Rubiaceae	gardenias, coffee	
<i>Opercularia hispida</i>	Hairy Stinkweed	Herb	Native		perennial	Rubiaceae	gardenias, coffee	
<i>Ophioglossum lusitanicum</i>	Adder's Tongue	Herb	Native	Important	perennial	Ophioglossaceae	ferns	
<i>Oreomyrrhis argentea</i>	Silvery Caraway	Herb	Native		perennial	Apiaceae	carrots, parsley, fennel	
<i>Oreomyrrhis eriopoda</i>	Australian Caraway	Herb	Native	Important	perennial	Apiaceae	carrots, parsley, fennel	
<i>Oxalis exilis</i>	Shady Wood Sorrel, Indian Sorrel	Herb	Native		perennial	Oxalidaceae	wood sorrels, soursob	
<i>Oxalis perennans</i>	Grassland Wood Sorrel, Grass Wood-sorrel, Creeping Yellow Sorrel	Herb	Native		perennial	Oxalidaceae	wood sorrels, soursob	
<i>Patersonia sericea</i>	Silky Purple-flag	Herb	Native		perennial	Iridaceae	irises, patersonias	
<i>Pelargonium australe</i>	Native Storks-bill, Austral Storks-bill, Wild Geranium	Herb	Native	Important	perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Pelargonium inodorum</i>	Scentless Storks-bill	Herb	Native	Important	annual	Geraniaceae	storksbills, cranesbills, geraniums	annual or short-lived perennial
<i>Pelargonium rodneyanum</i>	Magenta Storks-bill	Herb	Native	Important	perennial	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Plantago debilis</i>	Shade Plantain, Slender Plantain	Herb	Native		perennial	Plantaginaceae	plantains	
<i>Plantago euryphylla</i>	Plantain	Herb	Native		perennial	Plantaginaceae	plantains	
<i>Plantago gaudichaudii</i>	Narrow-leaf Native Plantain, Narrow Plantain	Herb	Native	Important	perennial	Plantaginaceae	plantains	
<i>Plantago varia</i>	Variable Plantain, Small Plantain, Sago-weed	Herb	Native	Important	perennial	Plantaginaceae	plantains	
<i>Podolepis hieracioides</i>	Tall Copper-wire Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Polygala japonica</i>	Dwarf Milkwort	Herb	Native	Important	perennial	Polygalaceae	milkworts	
<i>Poranthera microphylla</i>	Small Poranthera, Small-leaved Poranthera	Herb	Native	Important	annual	Euphorbiaceae	spurges	
<i>Portulaca oleracea</i>	Common Pigweed, Common Purslane, Munyeroo	Herb	Native		annual	Portulacaceae	purslanes, pigweeds	
<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	plus other <i>Prasophyllum</i> species
<i>Pratia purpurascens</i>	Whiteroot	Herb	Native		perennial	Lobeliaceae	lobelias	annual or perennial?
<i>Pseudognaphalium luteoalbur</i>	Jersey Cudweed	Herb	Native		annual	Asteraceae	daisies, sunflower	
<i>Ptilotus erubescens</i>	Hairy Tails, Hairy Heads	Herb	Native	Important	perennial	Amaranthaceae	cockscombs, mulla-mullas, pussytails	
<i>Ranunculus graniticola</i>	Granite Buttercup	Herb	Native		perennial	Ranunculaceae	buttercups, anemones	
<i>Ranunculus lappaceus</i>	Common Buttercup, Australian Buttercup	Herb	Native	Important	perennial	Ranunculaceae	buttercups, anemones	
<i>Ranunculus pachycarpus</i>	Thick-fruited Buttercup	Herb	Native		perennial	Ranunculaceae	buttercups, anemones	
<i>Rhodanthe anthemoides</i>	White Sunray, Chamomile Sunray	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	<i>Helipterum anthemoides</i>

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<i>Rhodanthe pygmaea</i>	Pigmy Sunray	Herb	Native		annual	Asteraceae	daisies, sunflower	<i>Helipterum pygmaeum</i>
<i>Rostellularia adscendens</i>	Pink-tongues, Bearded Anthem, Dwarf Justicia	Herb	Native			Acanthaceae	bear's britches	annual or perennial?
<i>Rumex brownii</i>	Swamp Dock, Slender Dock	Herb	Native		perennial	Polygonaceae	docks, buckwheat	
<i>Rumex dumosus</i>	Wiry Dock	Herb	Native	Important	perennial	Polygonaceae	docks, buckwheat	
<i>Rumex tenax</i>	Shiny Dock	Herb	Native		perennial	Polygonaceae	docks, buckwheat	
<i>Rutidosia leiolepis</i>	Monaro Golden Daisy	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Rutidosia leptorhynchoides</i>	Button Wrinklewort	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Rutidosia multiflora</i>	Small Wrinklewort	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	
<i>Scleranthus biflorus</i>	Spiny Mat-plant, Knawel, Cushion-bush, Two-flowered Knawel	Herb	Native	Important	perennial	Caryophyllaceae	carnations	
<i>Scleranthus diander</i>	Tufted Knawel	Herb	Native		perennial	Caryophyllaceae	carnations	
<i>Scutellaria humilis</i>	Dwarf Skullcap	Herb	Native		perennial	Lamiaceae	mints, sages, mintbush	
<i>Sebaea ovata</i>	Yellow Centaury	Herb	Native	Important	annual	Gentianaceae	gentians	
<i>Selliera radicans</i>	Swamp Weed	Herb	Native		perennial	Goodeniaceae	goodenias, dampieras	
<i>Senecio hispidulus</i>	Hill Fireweed	Herb	Native		perennial	Asteraceae	daisies, sunflower	annual or perennial?
<i>Senecio quadridentatus</i>	Cotton Fireweed	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Senecio tenuiflorus</i>	Woodland Groundsel, Narrow Groundsel, Cotton Groundsel, Slender Fireweed	Herb	Native		annual	Asteraceae	daisies, sunflower	annual or biennial
<i>Sida corrugata</i>	Corrugated Sida	Herb	Native	Important	perennial	Malvaceae	cotton, hibiscus	
<i>Solenogyne dominii</i>	Smooth Solenogyne	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Solenogyne gunnii</i>	Hairy Solenogyne	Herb	Native	Important	perennial	Asteraceae	daisies, sunflower	
<i>Spiranthes sinensis</i>	Austral Ladies' Tresses	Herb	Native	Important	perennial	Orchidaceae	orchids	annual or perennial?
<i>Stackhousia monogyna</i>	Creamy Candles, Creamy Stackhousia	Herb	Native	Important	perennial	Stackhousiaceae	stackhousiaceae	
<i>Stackhousia viminea</i>	Slender Stackhousia	Herb	Native		perennial	Stackhousiaceae	stackhousiaceae	
<i>Stellaria angustifolia</i>	Swamp Starwort	Herb	Native		perennial	Caryophyllaceae	carnations	
<i>Stellaria filiformis</i>	Thread Starwort	Herb	Native	Important	annual	Caryophyllaceae	carnations	
<i>Stellaria multiflora</i> (Back Creek)	Back Creek Many Flowered Starwort, Back Creek Rayless Starwort	Herb	Native		annual	Caryophyllaceae	carnations	uncertain taxonomy, categorised based on <i>Stellaria multiflora</i>
<i>Stellaria pungens</i>	Prickly Starwort	Herb	Native		perennial	Caryophyllaceae	carnations	
<i>Stuartina hamata</i>	Crooked Cudweed, Hooked Cudweed	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	
<i>Stuartina muelleri</i>	Spoon Cudweed	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	
<i>Stylidium despectum</i>	Dwarf Triggerplant	Herb	Native		annual	Stylidiaceae	triggerplants, styleworts	
<i>Stylidium graminifolium</i>	Grass Triggerplant	Herb	Native	Important	perennial	Stylidiaceae	triggerplants, styleworts	
<i>Stypandra glauca</i>	Nodding Blue Lily	Herb	Native	Important	perennial	Phormiaceae	lilies	
<i>Swainsona behriana</i>	Behr's Swainson-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Swainsona monticola</i>	Mountain Swainson-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Swainsona oroboides</i>	Variable Swainson-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Swainsona queenslandica</i>	Smooth Darling Pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Swainsona galegifolia</i>
<i>Swainsona recta</i>	Mountain Swainson-pea, Small Purple-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Swainsona reticulata</i>	Kneed Swainson-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Swainsona sericea</i>	Silky Swainson-pea	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Tetratheca spp.</i>	Black-eyed Susans	Herb	Native		perennial	Tremandraceae	black-eyed susans	
<i>Thelymitra ixioides</i>	Spotted Sun-orchid, Dotted Sun-orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	annual or perennial?
<i>Thelymitra malvina</i>	Mauve-tuft Sun-orchid, Mauve-tufted sun orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	annual or perennial?
<i>Thelymitra pauciflora</i>	Slender Sun-orchid, Few-flowered Sun-orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	annual or perennial?
<i>Thelymitra rubra</i>	Pink Sun-orchid, Salmon Sun-orchid, Red Sun-orchid	Herb	Native	Important	perennial	Orchidaceae	orchids	annual or perennial?
<i>Thesium australe</i>	Austral toadflax, Austral Toad-flax, Australian Toadflax	Herb	Native	Important	perennial	Santalaceae	sandalwood	
<i>Thysanotus patersonii</i>	Twining Fringe-lily	Herb	Native	Important	perennial	Anthericaceae	lilies	

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<i>Thysanotus tuberosus</i>	Common Fringe-lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Trachymene humilis</i>	Alpine Trachymene	Herb	Native		perennial	Apiaceae	carrots, parsley, fennel	
<i>Tricoryne elatior</i>	Yellow Rush-lily, Yellow Autumn-lily	Herb	Native	Important	perennial	Anthericaceae	lilies	
<i>Triptilodiscus pygmaeus</i>	Austral Sunray	Herb	Native	Important	annual	Asteraceae	daisies, sunflower	
<i>Urtica incisa</i>	Stinging Nettle	Herb	Native		perennial	Urticaceae	stinging nettles	
<i>Velleia montana</i>	Velleia	Herb	Native	Important	perennial	Goodeniaceae	goodenias, dampieras	
<i>Velleia paradoxa</i>	Spur Velleia	Herb	Native	Important	perennial	Goodeniaceae	goodenias, dampieras	
<i>Veronica calycina</i>	Hairy Speedwell	Herb	Native		perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Veronica gracilis</i>	Slender Speedwell	Herb	Native	Important	perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Veronica plebeia</i>	Trailing Speedwell, Creeping Speedwell	Herb	Native		perennial	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Viola betonicifolia</i>	Showy Violet, Arrow-head Violet, Native Violet, Purple Violet	Herb	Native	Important	perennial	Violaceae	voilets	
<i>Viola caleyana</i>	Swamp Violet	Herb	Native		perennial	Violaceae	voilets	
<i>Viola hederacea</i>	Native Violet, Ivy-leaf Violet, Ivy-leaved Violet	Herb	Native		perennial	Violaceae	voilets	
<i>Viola sieberiana</i>	Diamond Violet	Herb	Native		perennial	Violaceae	voilets	
<i>Vittadinia cuneata</i>	Fuzzweed	Herb	Native		annual	Asteraceae	daisies, sunflower	can be annual or perennial
<i>Vittadinia muelleri</i>	Narrow-leaf New Holland Daisy	Herb	Native		perennial	Asteraceae	daisies, sunflower	
<i>Wahlenbergia ceracea</i>	Waxy Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia communis</i>	Tufted Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia densifolia</i>	Fairy Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia gracilentia</i>	Annual Bluebell	Herb	Native		annual	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia gracilis</i>	Australian Bluebell, Sprawling Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia graniticola</i>	Granite Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia littorcola</i>	Edge Bluebell, Coast Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia luteola</i>	Yellow-wash Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia multicaulis</i>	Tadgell's Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia planiflora</i>	Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wahlenbergia stricta</i>	Tall Bluebell, Austral Bluebell, Australian Bluebell	Herb	Native		perennial	Campanulaceae	wahlenbergias, bluebells	
<i>Wurmbea dioica</i>	Early Nancy	Herb	Native	Important	perennial	Colchicaceae	lilies	
<i>Xerochrysium bracteatum</i>	Golden Everlasting	Herb	Native		annual	Asteraceae	daisies, sunflower	<i>Bracteantha bracteata</i>
<i>Xerochrysium subundulatum</i>	Orange Everlasting, Alpine Everlasting	Herb	Native		annual	Asteraceae	daisies, sunflower	<i>Bracteantha subundulata</i> , <i>Helichrysium acuminatum</i>
<i>Xerochrysium viscosum</i>	Sticky Everlasting	Herb	Native		annual	Asteraceae	daisies, sunflower	<i>Bracteantha viscosa</i>
<i>Zornia dyctiocarpa</i>	Zornia	Herb	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<b>Sedge/Rush</b>								
<i>Isolepis cernua</i>	Nodding Club-rush	Sedge/Rush	Native		perennial	Cyperaceae	sedges	
<i>Isolepis hookeriana</i>	Grassy Club-sedge, Grassy Club-rush	Sedge/Rush	Native		annual	Cyperaceae	sedges	
<i>Isolepis inundata</i>	Swamp Club-sedge, Swamp Club-rush	Sedge/Rush	Native		perennial	Cyperaceae	sedges	
<i>Juncus australis</i>	Austral Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	<i>Juncus communis</i>
<i>Juncus bufonius</i>	Toad Rush	Sedge/Rush	Native		annual	Juncaceae	rushes	
<i>Juncus flavidus</i>	Yellow Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Juncus fockei</i>	Slender Joint-leaf Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Juncus homalocaulis</i>	Wiry Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Juncus sarophorus</i>	Broom Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Juncus subsecundus</i>	Finger Rush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Lepidosperma laterale</i>	Sword Sedge, Variable Swordsedge	Sedge/Rush	Native		perennial	Cyperaceae	sedges	
<i>Luzula densiflora</i>	Dense Woodrush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Luzula meridionalis</i>	Common Woodrush	Sedge/Rush	Native		perennial	Juncaceae	rushes	



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<i>Luzula modesta</i>	Southern Woodrush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Luzula ovata</i>	Clustered Woodrush	Sedge/Rush	Native		perennial	Juncaceae	rushes	
<i>Schoenus apogon</i>	Common Bog Sedge, Fluke Bogrush	Sedge/Rush	Native		annual	Cyperaceae	sedges	
<b>Shrub</b>								
<i>Acacia brownii</i>	Prickly Moses, Golden Prickly Wattle, Heath Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia dawsonii</i>	Poverty Wattle, Dawson's Wattle, Mitta Wattle	Shrub	Native	Important	perennial	Mimosaceae	wattles (acacias)	
<i>Acacia deanei</i>	Deane's Wattle, Green Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia decora</i>	Western Silver Wattle, Showy Wattle, Western Golden Wattle, Pretty Wattle	Shrub	Native	Important	perennial	Mimosaceae	wattles (acacias)	
<i>Acacia decurrens</i>	Black Wattle, Early Black Wattle, Green Wattle, Queen Wattle, Sydney Green Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia doratoxylon</i>	Currawang, Lancewood, Spearwood, Cooriwan, Hickory, Brown Lancewood	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia falcata</i>	Sickle Wattle, Burra, Sickle-shaped Acacia, Sally, Hickory Wattle, Silver-leaved Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia genistifolia</i>	Spreading Wattle, Early Wattle, Wild Irishman	Shrub	Native	Important	perennial	Mimosaceae	wattles (acacias)	
<i>Acacia gunnii</i>	Ploughshare Wattle, Dog's Tooth Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia mearnsii</i>	Black Wattle, Green Wattle, Late Black Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia paradoxa</i>	Prickly Acacia, Acacia Hedge, Kangaroo Thorn, Hedge Wattle, Kangaroo Acacia, Prickly Wattle, Paradoxa Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia parramattensis</i>	Sydney Green Wattle, Parramatta Wattle, Parramatta Green Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia rubida</i>	Red-stem Wattle, Red-leaved Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia siculiformis</i>	Dagger Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia ulicifolia</i>	Prickly Moses, Juniper Wattle	Shrub	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia verniciflua</i>	Varnish Wattle	Shrub/Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acrotriche serrulata</i>	Honeypots	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Astroloma humifusum</i>	Native Cranberry, Cranberry Heath	Shrub	Native	Important	perennial	Epacridaceae	southern heaths or epacrids	
<i>Astrotricha ledifolia</i>	Common Star-hair	Shrub	Native		perennial	Araliaceae	ginseng	
<i>Banksia marginata</i>	Silver Banksia, Honeysuckle Banksia, Dwarf Honeysuckle, Warrock	Shrub/Tree	Native		perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Boronia algida</i>	Alpine Boronia	Shrub	Native		perennial	Rutaceae	boronias, citrus, native fuchsias	
<i>Bossiaea buxifolia</i>	Box-leaved Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Bossiaea prostrata</i>	Creeping Bossiaea, Prostrate Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Bossiaea riparia</i>	River Leafless Bossiaea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Brachyloma daphnoides</i>	Daphne Heath	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Bursaria spinosa</i>	Australian Blackthorn, Bursaria, Blackthorn, Native Blackthorn, Sweet Bursaria (Native Box), Whitethorn, Christmas Bush, Prickly Pine, Prickly Box	Shrub/Tree	Native		perennial	Pittosporaceae	native frangipani	
<i>Callistemon sieberi</i>	Alpine Bottlebrush, River Bottlebrush	Shrub/Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Calytrix tetragona</i>	Fringe Myrtle, Common Fringe-myrtle, Heath Myrtle	Shrub	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Cassinia aculeata</i>	Common Cassinia, Chinese-scrub, Sifton Bush, Dogwood, Dolly Bush	Shrub	Native		perennial	Asteraceae	daisies, sunflower	

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<i>Cassinia arcuata</i>	Drooping Cassinia, Chinese Tea-scrub, Sifton Bush, Chinese Shrub	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Cassinia longifolia</i>	Shiny Cassinia, Cauliflower Bush, Long-leaf Dogwood	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Cassinia quinquefaria</i>	Rosemary Cassinia	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Cheiranthra cyanea</i>	Finger Flower	Shrub	Native		perennial	Pittosporaceae	native frangipani	
<i>Comesperma ericinum</i>	Heath Milkwort, Heath-leaved False-pea, Pyramid Flower	Shrub	Native		perennial	Polygalaceae	milkworts	
<i>Cryptandra amara</i>	Bitter Cryptandra	Shrub	Native		perennial	Rhamnaceae	blueblossom	
<i>Daviesia genistifolia</i>	Spiny Bitter-pea, Broom Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Daviesia latifolia</i>	Hop Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Daviesia virgata</i>
<i>Daviesia mimosoides</i>	Narrow-leaf Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Daviesia ulicifolia</i>	Gorse Bitter-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Dillwynia cinerascens</i>	Grey Parrot-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Dillwynia glauca</i>	Michelago Parrot-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Dillwynia prostrata</i>	Matted Parrot-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Dillwynia retorta</i>	Heathy Parrot-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Dillwynia sericea</i>	Showy Parrot-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Discaria pubescens</i>	Australian Anchor-plant	Shrub	Native	Important	perennial	Rhamnaceae	blueblossom	
<i>Dodonaea procumbens</i>	Trailing Hop-bush	Shrub	Native	Important	perennial	Sapindaceae	hop bushes	
<i>Dodonaea viscosa</i>	Sticky Hop-bush, Giant Hop-bush	Shrub	Native		perennial	Sapindaceae	hop bushes	
<i>Einadia hastata</i>	Saloop, Berry Saltbush	Shrub	Native		perennial	Chenopodiaceae	saltbushes, bluebushes, samphires, chenopods	
<i>Epacris</i> spp.	Native Heaths	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Eremophila debilis</i>	Winter Apple, Creeping Boobialla, Amulla	Shrub	Native		perennial	Myoporaceae	emu bush	
<i>Exocarpos cupressiformis</i>	Cherry Ballart, Native Cherry, Wild Cherry, Cherry Wood	Shrub/Tree	Native	Important	perennial	Santalaceae	sandalwood	
<i>Exocarpos strictus</i>	Pale Ballart, Pale-fruit Ballart, Dwarf Cherry	Shrub	Native	Important	perennial	Santalaceae	sandalwood	
<i>Geijera parviflora</i>	Wilga	Shrub/Tree	Native		perennial	Rutaceae	boronias, citrus, native fuchsias	
<i>Gompholobium huegeli</i>	Pale Wedge-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Grevillea iaspicula</i>	Wee Jasper Grevillea	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Grevillea lanigera</i>	Woolly Grevillea	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Grevillea ramosissima</i>	Fan Grevillea, Branching Grevillea, Prickly Parsley Bush	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Grevillea rosmarinifolia</i>	Rosemary Grevillea	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Grevillea wilkinsonii</i>	Tumut Grevillea	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Hakea microcarpa</i>	Small-fruit Hakea, Small-fruited Needlebush	Shrub	Native	Important	perennial	Proteaceae	waratahs, banksias, grevilleas, proteas	
<i>Hardenbergia violacea</i>	False Sarsparilla, Purple Coral-pea, Native Lilac	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Hibbertia calycina</i>	Lesser Guinea-flower	Shrub	Native	Important	perennial	Dilleniaceae	hibbertias	
<i>Hibbertia obtusifolia</i>	Hoary Guinea-flower	Shrub	Native	Important	perennial	Dilleniaceae	hibbertias	
<i>Hibbertia riparia</i>	Stream Guinea-flower, Erect Guinea-flower	Shrub	Native	Important	perennial	Dilleniaceae	hibbertias	<i>Hibbertia stricta</i>
<i>Hovea linearis</i>	Creeping Hovea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Hovea heterophylla</i>
<i>Hymenanthera dentata</i>	Tree Violet	Shrub	Native		perennial	Violaceae	voilets	
<i>Indigofera adesmiifolia</i>	Tick Indigo, Leafless Indigo, Broad-leaved Indigo	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	

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<i>Indigofera australis</i>	Austral Indigo, Australian Indigo, Native Indigo, Hill Indigo	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Jacksonia scoparia</i>	Winged Broom-pea, Dogwood, Broom	Shrub/Tree	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Jasminum suavisissimum</i>	Native Jasmine, Sweet Jasmine	Shrub	Native		perennial	Oleaceae	olives	
<i>Kunzea ericoides</i>	Burgan, Kanuka	Shrub/Tree	Native	Important	perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Kunzea parvifolia</i>	Violet Kunzea, Tickbush	Shrub	Native	Important	perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Leptospermum myrtifolium</i>	Swamp Myrtle, Swamp Tea-tree, Myrtle-leaved Tea-tree, Grey Tea-tree	Shrub	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Leptospermum obovatum</i>	River Tea-tree, Blunt-leaf Tea-tree	Shrub	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Lespedeza juncea</i>	Perennial Lespedeza	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Leucopogon fletcheri</i>	Pendant Beard Heath	Shrub	Native	Important	perennial	Epacridaceae	southern heaths or epacrids	
<i>Leucopogon fraseri</i>	Beard Heath	Shrub	Native	Important	perennial	Epacridaceae	southern heaths or epacrids	
<i>Leucopogon virgatus</i>	Common Beard Heath	Shrub	Native	Important	perennial	Epacridaceae	southern heaths or epacrids	
<i>Lissanthe strigosa</i>	Peach Heath	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Maireana microphylla</i>	Eastern Cottonbush, Small-leaf Bluebush, Bluebush	Shrub	Native		perennial	Chenopodiaceae	saltbushes, bluebushes, samphires, chenopods	
<i>Melaleuca parvistaminea</i>	Honey-myrtle	Shrub/Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	<i>Melaleuca ternifolia</i>
<i>Melichrus urceolatus</i>	Urn Heath	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Mirbelia oxylobioides</i>	Mountain Mirbelia	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Muehlenbeckia axillaris</i>	Wire Plant, Matted Lignum	Shrub	Native		perennial	Polygonaceae	docks, buckwheat	
<i>Muehlenbeckia tuggeranong</i>	Tuggeranong Lignum	Shrub	Native	Important	perennial	Polygonaceae	docks, buckwheat	
<i>Olearia elliptica</i>	Sticky Daisy-bush	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Ozothamnus</i> spp.	Everlastings	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Pimelea curviflora</i>	Curved Rice-flower	Shrub	Native	Important	perennial	Thymelaeaceae	thymelias	
<i>Pimelea glauca</i>	Shrubby Rice-flower	Shrub	Native	Important	perennial	Thymelaeaceae	thymelias	
<i>Pimelea pauciflora</i>	Poison Pimelea, Poison Rice-flower	Shrub	Native	Important	perennial	Thymelaeaceae	thymelias	<i>Pimelea neo-anglica</i>
<i>Pomaderris pallida</i>	Pale Pomaderris	Shrub	Native		perennial	Rhamnaceae	blueblossom	
<i>Pomaderris</i> spp.	Pomaderris	Shrub/Tree	Native		perennial	Rhamnaceae	blueblossom	
<i>Pultenaea fasciculata</i>	Bush-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Pultenaea microphylla</i>	Spreading Bush-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Pultenaea procumbens</i>	Heathy Bush-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Pultenaea spinosa</i>	Bush-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	<i>Pultenaea cunninghamii</i>
<i>Pultenaea subspicata</i>	Low Bush-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Rhytidosporum procumbens</i>	White Marianth	Shrub	Native		perennial	Pittosporaceae	native frangipani	<i>Pittosporum procumbens</i> , <i>Billardiera procumbens</i>
<i>Rubus parvifolius</i>	Small-leaf Raspberry, Small-leaved Raspberry, Native Raspberry	Shrub	Native		perennial	Rosaceae	roses, blackberries, apples	
<i>Rulingia prostrata</i>	Dwarf Kerrawang	Shrub	Native	Important	perennial	Sterculiaceae	kurrajongs, bottletrees	
<i>Solanum linearifolium</i>	Mountain Kangaroo-apple, Kangaroo-apple	Shrub	Native		perennial	Solanaceae	tomato, potato, tobacco	
<i>Styphelia triflora</i>	Pink Five-corners	Shrub	Native		perennial	Epacridaceae	southern heaths or epacrids	
<i>Templetonia stenophylla</i>	Leafy Templetonia, Leafy Mallee-pea	Shrub	Native	Important	perennial	Fabaceae	peas, eg. sturt desert pea	
<i>Vittadinia gracilis</i>	Woolly New Holland Daisy	Shrub	Native		perennial	Asteraceae	daisies, sunflower	
<i>Westringia eremicola</i>	Slender Westringia	Shrub	Native		perennial	Lamiaceae	mints, sages, mintbush	
<i>Wilsonia rotundifolia</i>	Round-leaf Wilsonia	Shrub	Native		perennial	Convolvulaceae	morning glory, bindweed	
<i>Xanthorrhoea australis</i>	Grass Tree	Grass Tree	Native		perennial	Xanthorrhoeaceae	grass trees	
<b>Tree</b>								
<i>Acacia dealbata</i>	Silver Wattle	Tree/Shrub	Native		perennial	Mimosaceae	wattles (acacias)	

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<i>Acacia implexa</i>	Lightwood, Hickory Wattle, Black Wattle, Hickory, Sally Wattle, Scrub Wattle, Screw-pod Wattle, Bastard Myall, Lignum Vitae, Fish Wattle, Broad-leaf Wattle	Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia melanoxylon</i>	Blackwood, Black Wattle, Hickory, Mudgerabah, Paluma Blackwood, Sally Wattle	Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Acacia obliquinervia</i>	Mountain Hickory Wattle	Tree	Native		perennial	Mimosaceae	wattles (acacias)	
<i>Allocasuarina littoralis</i>	Black Sheoak	Tree	Native		perennial	Casuarinaceae	cassuarinas, she-oaks	
<i>Allocasuarina luehmannii</i>	Buloke, Bull Oak, Bulloak, Bull Sheoak	Tree	Native		perennial	Casuarinaceae	cassuarinas, she-oaks	
<i>Allocasuarina verticillata</i>	Drooping Sheoak, Coast She-oak, Hill-oak, Sheoak	Tree	Native		perennial	Casuarinaceae	cassuarinas, she-oaks	<i>Casuarina stricta</i>
<i>Angophora floribunda</i>	Rough-barked Apple, Roughbark Apple, Apple Box (Qld), Apple, Boondah, Gum Myrtle, Rusty Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Brachychiton populneus</i>	Kurrajong	Tree	Native		perennial	Sterculiaceae	kurrajongs, bottletrees	
<i>Callitris endlicheri</i>	Black Cypress Pine, Black Cypress, Red Cypress, Black Pine, Mountain Pine, Black Callitris, Red Cypress Pine	Tree	Native		perennial	Cupressaceae	cypress pines	
<i>Callitris glaucophylla</i>	White Cypress-pine, White Cypress, White Pine	Tree	Native		perennial	Cupressaceae	cypress pines	
<i>Eucalyptus aggregata</i>	Black Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus albens</i>	White Box	Dominant tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus amplifolia</i>	Cabbage Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	Dominant tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus bridgesiana</i>	Apple Box, But-but	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus caliginosa</i>	New England Stringybark	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus camaldulensis</i>	River Red Gum, Red Gum, Murray Red Gum, River Gum (WA)	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus cinerea</i>	Argyle Apple, Silver-leaved Stringybark	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus conica</i>	Fuzzy Box	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus dalrympleana</i>	Mountain Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus dives</i>	Broad-leaved Peppermint, Peppermint, Blue Peppermint (Vic)	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus goniocalyx</i>	Long-leaved Box, Bundy, Olive-barked Box	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus macrorhyncha</i>	Red Stringybark	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus mannifera</i>	Brittle Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus melliodora</i>	Yellow Box, Yellow Jacket, Honey Box (Qld), Yellow Ironbark (Qld)	Dominant tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus microcarpa</i>	Grey Box, Narrow-leaved Box, Inland Grey Box, Western Grey Box	Dominant tree (in Nandewar)	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

<i>Eucalyptus moluccana</i>	Grey Box, Gum-topped Box	Dominant tree (in Nandewar)	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus nortonii</i>	Mealy Bundy, Large-flowered Bundy	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus ovata</i>	Swamp Gum, Black Gum (southern Tas), White Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus pauciflora</i>	Snow Gum, Cabbage Gum (Tas), Weeping Gum (Tas), White Sally	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus polyanthemos</i>	Red Box	Tree/Mallee	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus populnea</i>	Bimble Box, Poplar Box, Bimbil Box	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus rossii</i>	Scribbly Gum, Snappy Gum, White Gum, Inland Scribbly Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus rubida</i>	Candlebark, Ribbon Gum, White Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus sideroxylon</i>	Red Ironbark, Mugga, Mugga Ironbark	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus stellulata</i>	Black Sally	Tree/Mallee	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Eucalyptus viminalis</i>	Manna Gum, Ribbon Gum	Tree	Native		perennial	Myrtaceae	gum trees, paper barks, bottle brushes, guavas	
<i>Notelaea microcarpa</i>	Native Olive	Tree	Native		perennial	Oleaceae	olives	
<b>Exotic</b>								
<b>Grass</b>								
<i>Aira elegantissima</i>	Delicate Hairgrass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass, Sweet-scented Vernal- grass, Sweet Vernal	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Avena barbata</i>	Bearded Oats	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Avena fatua</i>	Wild Oats	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Briza maxima</i>	Quaking Grass, Blowfly Grass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Briza minor</i>	Shivery Grass, Lesser Quaking Grass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Bromus diandrus</i>	Great Brome	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Bromus molliformis</i>	Silky Brome, Soft Brome	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Cynosurus echinatus</i>	Rough Dogstail	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Dactylis glomerata</i>	Cocksfoot, Orchard Grass	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Holcus lanatus</i>	Yorkshire Fog	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Hordeum leporinum</i>	Barley-grass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Hyparrhenia hirta</i>	Coolatai Grass	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Lolium perenne</i>	Perennial Ryegrass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	annual or short-lived perennial
<i>Lolium rigidum</i>	Ryegrass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Lolium spp.</i>	Ryegrass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Nassella neesiana</i>	Chilean Needle-grass	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Nassella trichotoma</i>	Serrated Tussock	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Paspalum dilatatum</i>	Paspalum	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Phalaris aquatica</i>	Phalaris	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Poa bulbosa</i>	Bulbous Poa	Grass	Exotic		perennial	Poaceae	grass, bamboo, spinifex	
<i>Vulpia bromoides</i>	Squirrel Tail Fescue, Silver Grass	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<i>Vulpia myuros</i>	Rat's Tail Fescue	Grass	Exotic		annual	Poaceae	grass, bamboo, spinifex	
<b>Herb</b>								
<i>Acetosella vulgaris</i>	Sorrel, Sheep Sorrel	Herb	Exotic		perennial	Polygonaceae	docks, buckwheat	
<i>Anagallis arvensis</i>	Scarlet Pimpernel, Blue Pimpernel, Pimpernel	Herb	Exotic		annual	Primulaceae	primroses	



White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List

<i>Arctotheca calendula</i>	Cape Weed, African Marigold, Cape Dandelion	Herb	Exotic		annual	Asteraceae	daisies, sunflower	
<i>Carthamus lanatus</i>	Saffron Thistle	Herb	Exotic		annual	Asteraceae	daisies, sunflower	
<i>Centaurium erythraea</i>	Common Centaury	Herb	Exotic		annual	Gentianaceae	gentians	
<i>Cerastium glomeratum</i>	Broad-leaved Mouse-ear Chickweed, Sticky Mouse-ear Chickweed	Herb	Exotic		annual	Caryophyllaceae	carnations	
<i>Chondrilla juncea</i>	Skeleton-weed	Herb	Exotic		perennial	Asteraceae	daisies, sunflower	
<i>Cirsium vulgare</i>	Spear Thistle	Herb	Exotic		annual	Asteraceae	daisies, sunflower	
<i>Echium plantagineum</i>	Paterson's Curse, Salvation Jane, Murrumbidgee Bluebell, Riverina Bluebell	Herb	Exotic		annual	Boraginaceae	heliotropes, forget-me-nots, borage	
<i>Geranium molle</i>	Cranes-bill Geranium	Herb	Exotic		annual	Geraniaceae	storksbills, cranesbills, geraniums	
<i>Hypericum perforatum</i>	St John's Wort, Perforated St John's Wort	Herb	Exotic		perennial	Clusiaceae	garcinias	
<i>Hypochaeris glabra</i>	Smooth Cat's-ear	Herb	Exotic		annual	Asteraceae	daisies, sunflower	
<i>Hypochaeris radicata</i>	Flatweed, Cat's-ear	Herb	Exotic		perennial	Asteraceae	daisies, sunflower	
<i>Lepidium africanum</i>	Common Pepper-cress, African Pepper-cress, Rubble Pepper-cress	Herb	Exotic		annual	Brassicaceae	cabbages, radishes, wallflowers	annual or perennial
<i>Linaria pelisseriana</i>	Pelisser's Toadflax	Herb	Exotic		annual	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Medicago lupulina</i>	Black Medic, Hop Medic	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Moenchia erecta</i>	Erect Chickweed, Upright Moenchia	Herb	Exotic		annual	Caryophyllaceae	carnations	
<i>Myosotis discolor</i>	Yellow and Blue Forget-me-not, Forget-me-not	Herb	Exotic		annual	Boraginaceae	heliotropes, forget-me-nots, borage	
<i>Orobanche minor</i>	Lesser Broomrape, Broomrape, Clover Broomrape	Herb	Exotic		annual	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Parentucellia latifolia</i>	Red Bartsia, Common Bartsia	Herb	Exotic		annual	Scrophulariaceae	foxgloves, snapdragons, witchweeds	
<i>Petrorhagia nanteuillii</i>	Proliferous Pink, Childing pink	Herb	Exotic		annual	Caryophyllaceae	carnations	
<i>Plantago lanceolata</i>	Ribwort, Ribgrass, Lamb's Tongue	Herb	Exotic		annual	Plantaginaceae	plantains	
<i>Romulea rosea</i>	Onion-grass, Guildford Grass	Herb	Exotic		perennial	Iridaceae	irises, patersonias	
<i>Salvia verbenaca</i>	Wild Sage, Vervain	Herb	Exotic		perennial	Lamiaceae	mints, sages, mintbush	<i>Salvia clandestina</i> , <i>Salvia horminoides</i>
<i>Sherardia arvensis</i>	Blue Fieldmadder, Field Madder	Herb	Exotic		annual	Rubiaceae	gardenias, coffee	
<i>Silene gallica</i>	French Catchfly, Five-wounded Catchfly	Herb	Exotic		annual	Caryophyllaceae	carnations	
<i>Trifolium angustifolium</i>	Narrow-leaved Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium arvense</i>	Hare's-foot Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium campestre</i>	Hop Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium glomeratum</i>	Clustered Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium scabrum</i>	Rough Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium striatum</i>	Knotted Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Trifolium subterraneum</i>	Subterranean Clover, Sub Clover	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<i>Urtica urens</i>	Small Nettle	Herb	Exotic		annual	Urticaceae	stinging nettles	
<i>Vicia sativa</i>	Common Vetch, Narrow-leaved Vetch	Herb	Exotic		annual	Fabaceae	peas, eg. sturt desert pea	
<b>Shrub</b>								
<i>Rosa rubiginosa</i>	Sweetbriar, Briar Rose, Eglantine	Shrub	Exotic		perennial	Rosaceae	roses, blackberries, apples	

## **Appendix C - Sections 3 to 9 of Mt Pleasant Operation Mining Operations Plan and Rehabilitation Management Plan (1 July 2020 – 30 June 2021)**

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### 3 ENVIRONMENTAL ISSUES MANAGEMENT

#### 3.1 REHABILITATION RISK ASSESSMENT

On 29 January 2020 MACH Energy undertook a risk assessment workshop to evaluate the risks associated with successful rehabilitation of the MPO. Participants at the risk assessment workshop included key MPO mine planning and rehabilitation planning personnel, Dr David Freudenberger of the Australian National University (the suitably qualified and experienced person endorsed by the DPIE to author this MOP/RMP), a representative of Ausecology (MPO's rehabilitation monitoring consultants) and representatives from Resource Strategies (MPO's environmental assessment and approval consultants). The risk assessment was facilitated by Mr Peter Standish of Risk Mentor Pty Ltd and undertaken in accordance with the *AS ISO 13000:2018 Risk Management Guidelines*. The *Final Mount Pleasant Operation Rehabilitation Risk Assessment Report April 2020* documents the results of the risk assessment. The Risk Assessment and Treatment Plan from the *Final Mount Pleasant Operation Rehabilitation Risk Assessment Report April 2020* is provided in Attachment 3 of this MOP/RMP.

An overview of the risk assessment methodology and outcomes from the risk assessment are provided below. The April 2020 rehabilitation risk assessment builds upon previous risk assessments undertaken for the MPO.

The key risks to successful rehabilitation, and to biodiversity and land management of the MPO have been assessed using the likelihood ratings, maximum reasonable consequence ratings, risk matrix and risk classifications listed in Table 3-1, Table 3-2, Table 3-3 and Table 3-4, respectively.

**Table 3-1  
Likelihood Ratings**

Class	Likelihood	Likelihood Description	Frequency
A	Almost certain	Recurring event during the life – time of the operation/project.	Occurs more than twice per year
B	Likely	Event that may occur frequently during the life – time of an operation/project.	Typically occurs once or twice per year
C	Possible	Event that may occur during the life – time of an operation/project.	Typically occurs in 1-10 years
D	Unlikely	Event that is unlikely to occur during the life – time of an operation/project.	Typically occurs in 1-100 years
E	Rare	Event that is very unlikely to occur during the life – time of an operation/project.	Greater than 100 year event

**Table 3-2  
Maximum Reasonable Consequence Ratings**

Class	Consequence	Environmental – On Site
1	Minor	Near source confined and promptly reversible impact.
2	Medium	Near source confined and short term reversible impact.
3	Serious	Near source confined and medium term recovery impact.
4	Major	Impact that is confined and requiring long-term recovery, leaving residual damage.
5	Catastrophic	Impact that is widespread-unconfined and requiring long-term recovery, leaving major residual damage (typically years).

**Table 3-3  
Risk Matrix**

Likelihood	Consequence				
	1 – Minor	2 – Medium	3 – Serious	4 – Major	5 – Catastrophic
A – Almost Certain	Moderate	High	Critical	Critical	Critical
B – Likely	Moderate	High	High	Critical	Critical
C – Possible	Low	Moderate	High	Critical	Critical
D – Unlikely	Low	Low	Moderate	High	Critical
E – Rare	Low	Low	Moderate	High	High

**Table 3-4  
Risk Classification**

Risk Class	Risk Management Response
Critical	Risks that significantly exceed the risk acceptance threshold and need urgent and immediate attention.
High	Risks that exceed the risk acceptance threshold and require proactive management. Includes risks for which proactive actions have been taken, but further risk reduction is impracticable. However active monitoring is required and the latter requires the sign-off from business unit senior management.
Moderate	Risks that lie on the risk acceptance threshold and require active monitoring. The implementation of additional measures could be used to reduce the risk further.
Low	Risks that are below the risk acceptance threshold and do not require active management. Certain risks could require additional monitoring.

Table 3-5 provides a summary of the key risks to successful rehabilitation of the MPO and to biodiversity and land management from the *Final Mount Pleasant Operation Rehabilitation Risk Assessment Report*. The risk classification ratings reflect that the risks have been treated/addressed by the risk mitigation measures described in the Risk Assessment and Treatment Plan provided in Attachment 3 of this MOP/RMP and summarised in the Trigger Action Response Plan (TARP) provided in Table 9-1 in Section 9.2.

The April 2020 rehabilitation risk assessment identified 34 risks to achieving the MPO's rehabilitation objectives, completion criteria and post-mining land use goals. Only one risk was ranked as having a high risk (i.e. failure of the Fines Emplacement Area embankment), however, this risk is proactively managed and further risk reduction measures are considered impracticable and cost prohibitive.

**Table 3-5**  
**Key Risks Associated with Site Rehabilitation, Biodiversity and Land Management**

Risk Description	Risk Likelihood Rating	Risk Consequence Rating	Risk Classification
<b>Land Clearance Phase</b>			
Topsoil and subsoil is not stripped separately during soil stripping activities resulting in subsoil being mixed with better quality topsoil.	1	C	L
<b>Active Mining / Production Phase</b>			
Failure of the Fines Emplacement Area embankment could potentially lead to release of fines material from the site	4	E	H
Failure of FEA rehabilitation capping and/or revegetation.	2	D	L
Poor geochemistry of exposed surfaces of overburden emplacements leading to off-site contamination and/or revegetation failure	2	D	L
Spontaneous combustion incident results in failure of an area of rehabilitation.	2	D	L
<b>Decommissioning Phase</b>			
Chemicals, lubricants and constructed (not landform) structures (including demolition activities) which remain at mine completion lead to water quality and public/fauna safety issues from the site	2	D	L
<b>Landform Establishment Phase</b>			
Incorrect geomorphic landform model.	3	D	M
Landform not constructed in accordance with geomorphic design.	3	D	M
Constructed slopes above 10 degrees (e.g. high walls, low walls, locally steepened areas of overburden emplacements) not constructed in accordance with design.	3	D	M
Instability in overburden emplacements due to construction of landform not in accordance with geomorphic design leading to failure (slumping/slip) of an area of overburden emplacement and revegetation failure, and mobilised sediment from the final landform.	2	C	M
Instability or failure of water management drain/structure due to construction of structure not in accordance with geomorphic design leading to failure of a rehabilitation area, and mobilised sediment from the final landform.	2	C	M
Erosion causing failure of an area of rehabilitation.	1	C	L
<b>Growth Medium Development Phase</b>			
Poor soil structure/geochemistry leads to failure to establish required vegetation communities subsequently leads to failure to rehabilitate the MPO to committed standards.	3	D	M
Inadequate or insufficient topsoil to create/enhance the desired ecological communities in mine rehabilitation areas.	3	D	M
Weed presence or infestation of soil stockpile leads to decreased quality of soil seed bank and increased presence of weeds in rehabilitation areas.	2	C	M



**Table 3-5 (Continued)**  
**Key Risks Associated with Site Rehabilitation, Biodiversity and Land Management**

Risk Description	Risk Likelihood Rating	Risk Consequence Rating	Risk Classification
<b>Ecosystem and Land Use Establishment Phase and Ecosystem and Land Use Sustainability Phase</b>			
Failure of revegetation due to sustained drought leads to a failure to rehabilitate the site to committed standards.	2	C	M
Failure of revegetation due to frost/storm/flood/pest infestation leads to a failure to rehabilitate the site to committed standards.	2	C	M
Failure of revegetation due to weed infestation leads to a failure to rehabilitate the site to committed standards.	2	C	M
Failure to establish required habitats leads to a subsequent inability for species to be reintroduced on the site	2	D	L
High fuel loads in rehabilitation areas leads to increased risk of bushfire or bushfire event impacts rehabilitation areas.	2	D	L
Contamination of off-site surface waters with sediment or saline/acidic waters due to a storm or flooding event or inadequate quality of rehabilitation.	3	D	M
Water quality in retained water management areas/dams during post-mining phase remains unfit for relevant post-mining land use (i.e. agriculture or native ecosystem).	3	D	M
Water quality discharged from site during post-mining phase is not yet comparable to surrounding analogue sites and suitable for receiving water, aquatic ecology and riparian vegetation.	3	D	M
Groundwater released from site (dominantly through water pressure from waters in the final void and within the overburden emplacement or migrated hydrocarbons from workshops etc.) leading to degradation of groundwater quality for surrounding users and being expressed in surface intersecting aquifers.	2	D	L
Not implementing rehabilitation in accordance with MPO rehabilitation requirements leading to inability to achieve landform and biodiversity completion criteria.	2	D	L
Inappropriate topsoiling, planting and/or direct seeding techniques resulting in a failure of rehabilitation.	2	D	L
Inadequate or insufficient (incorrect species mix/quality) seed/seedlings for rehabilitation works.	3	D	M
Perennial pasture establishment on Agricultural Land rehabilitation areas is not comparable to with representative grazed analogue site.	1	C	L
Agricultural land rehabilitation area has not achieved its relevant Land Capability Class.	1	C	L
Incompatible neighbouring land owner practices (including interactions with the Bengalla Mine) leading to failure of rehabilitation and revegetation works.	2	D	L
Evidence of acid forming material leading to failure of an area of rehabilitation.	2	C	M
Geotechnical monitoring results indicate instability of active pit or final void (post-closure) which leads to a degradation of site safety with potential impacts on public safety and inability to meet final void completion criteria.	2	D	L

**Table 3-5 (Continued)**  
**Key Risks Associated with Site Rehabilitation, Biodiversity and Land Management**

Risk Description	Risk Likelihood Rating	Risk Consequence Rating	Risk Classification
Final void monitoring results indicate final void system is inconsistent with final void water balance modelling.	3	D	M
<b>General</b>			
A failure to engage appropriately skilled employees/contractors or subject matter experts, leads to poor rehabilitation design and execution, inadequate rehabilitation monitoring programs, analyses and/or response to deteriorating conditions.	-	-	-

Consistent with the MOP Guidelines, the relevant mitigation or treatment measures developed for each of the key risks identified in Table 3-5 above are provided in the Risk Assessment and Treatment Plan in Attachment 3 of this MOP/RMP and summarised in the TARP in Section 9.2.

### 3.1.1 Environmental Risk Management

MACH Energy implements an Environmental Management System (EMS) at the MPO to:

- effectively manage environmental issues;
- ensure compliance with regulatory requirements;
- continually improve environmental performance; and
- satisfy the expectations of stakeholders and the local community.

The EMS forms the basis of environmental management at the MPO and includes procedures, standards and management plans to ensure all regulatory requirements are met. The EMS will continue to operate during, and following, mine closure to ensure all environmental (including monitoring and management) and social responsibilities are met for up to five years after mine closure, or as approved by relevant regulators.

A suite of Environmental Management Plans are required to be developed and implemented for the MPO in accordance with Development Consent DA 92/97 and are listed in Table 3-6.

**Table 3-6**  
**MPO Environmental Management Plans**

Plan	Relevant Development Consent DA 92/97 Condition
Noise Management Plan	Schedule 3, Condition 9
Air Quality and Greenhouse Gas Management Plan	Schedule 3, Condition 23
Aboriginal Heritage Management Plan (including Aboriginal Heritage Conservation Strategy)	Schedule 3, Condition 36
Water Management Plan (including Site Water Balance, Erosion and Sediment Control Plan, Surface Water Management Plan, Groundwater Management Plan and Surface and Ground Water Response Plan)	Schedule 3, Condition 28
Blast Management Plan	Schedule 3, Condition 17

**Table 3-6 (Continued)**  
**MPO Environmental Management Plans**

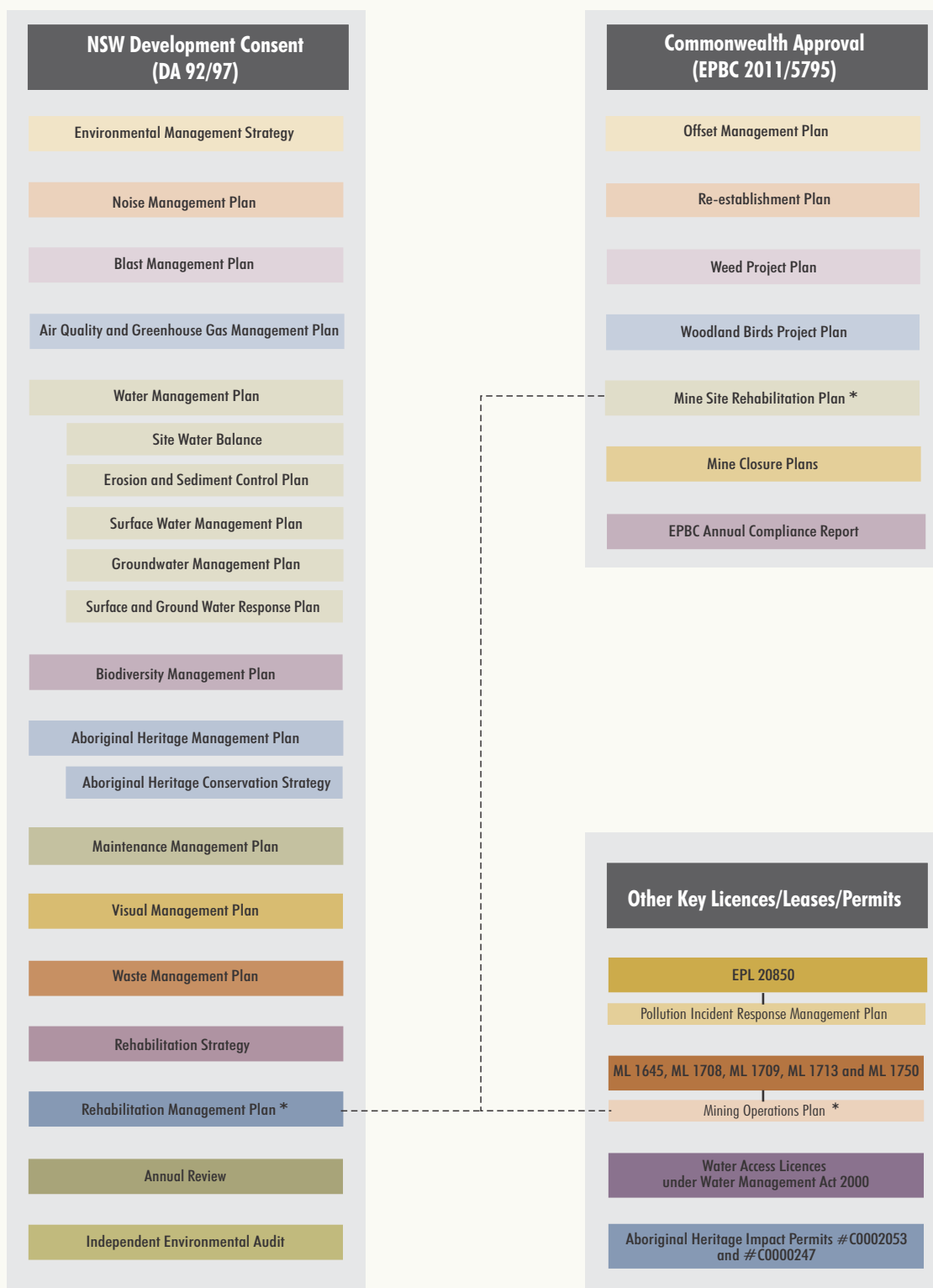
<b>Plan</b>	<b>Relevant Development Consent DA 92/97 Condition</b>
Visual Impact Management Plan	Schedule 3, Condition 47
Waste Management Plan	Schedule 3, Condition 52
Rehabilitation Management Plan (this document)	Schedule 3, Condition 56
Rehabilitation Strategy	Schedule 3, Condition 54
Biodiversity Management Plan	Schedule 3, Condition 32
Maintenance Management Plan	Schedule 3, Condition 41
Construction Environmental Management Plan (relevant to MOD 4 construction works)	Schedule 3, Condition 44I
Environmental Management Strategy	Schedule 5, Condition 1

Copies of the currently approved versions of the above environmental management plans are available on MACH Energy's website for the MPO ([www.machenergyaustralia.com.au](http://www.machenergyaustralia.com.au)).

In addition to the environmental management plans required under Development Consent DA 92/97, a number of management plans are required under the MPO's Commonwealth Approval EPBC 2011/5795. A summary of the MPO's environmental management system including the MPO's key approvals, licences, leases and permits and the MPO's environmental management plans is provided on Figure 3-1.

In addition to the statutory environmental management plans, additional procedures and instructions associated with operational controls have been prepared and implemented, including:

- Environmental Compliance Register;
- Supervisors and Open Cut Examiner Induction;
- Ground Disturbance Permit Procedure;
- Ground Disturbance Permit Form;
- Ground Disturbance Toolbox Talk;
- Spontaneous Combustion Management Plan;
- Topsoil Management Procedure (including Inspection and Test Plan [ITP] procedures);
- Topsoil Register;
- Bushfire Management Plan;
- Rehabilitation Procedure (including ITPs);
- Rehabilitation Monitoring Manual;
- Site Contamination and Prevention Control;
- Weed Control Procedure; and
- Erosion and Sediment Control Standard.



**Notes:**

- \* The Mining Operations Plan has been developed to meet the requirements for a Rehabilitation Management Plan (Condition 56, Schedule 3 of Development Consent [DA 92/97]). Following approval of the Mine Site Rehabilitation Plan (Conditions 19 and 20 of EPBC 2011/5795), the Mining Operations Plan and Rehabilitation Management Plan would be reviewed and revised if necessary.

**Figure 3-1**

### **3.1.2 Environmental Reporting**

An Annual Review is produced for the MPO to fulfil the reporting requirements of the Development Consent, and is provided to regulatory agencies and stakeholders. This report compiles monitoring results and discusses trends, system changes and responses to any potential issues identified during monitoring.

In accordance with Condition 11 of Schedule 5 of Development Consent DA 92/97, the MPO's Annual Review is provided on MACH Energy's website ([www.machenergyaustralia.com.au](http://www.machenergyaustralia.com.au)). MPO reporting systems are further described in Section 10.1.

## **3.2 MANAGEMENT OF RISKS RELATING TO REHABILITATION**

### **3.2.1 Geology and Geochemistry**

Overburden and mine coal reserves will be removed at the MPO progressing north and west, with the overburden and interburden initially being placed in an Overburden Emplacement to the east of the open cuts before being placed behind the advancing open cuts.

Supplementary Report 1 of the 1997 EIS provides a description of the geochemical characterisation of the overburden and interburden materials that are present at the MPO. The sampling program associated with Supplementary Report 1 identified that some of the materials sampled produced leachate that is acidic, saline or sodic on weathering. These are characteristics that are known to produce adverse growing conditions for vegetation growth and an elevated risk of soil erosion and sedimentation, and need to be managed accordingly.

Selective handling of materials is implemented at the MPO, and characterisation of soils and overburden will be undertaken throughout the development of the mine. Topsoil and subsoil characterisation will be undertaken in order to:

- identify any physical or chemical deficiencies or limiting factors (particularly alkalinity, salinity, dispersibility and sodicity) which may affect vegetation establishment, landform stability and propensity for spontaneous combustion; and
- develop selective placement strategies (i.e. separate stockpiles for subsoils and topsoils) and/or develop suitable amelioration techniques.

Overburden characterisation is important for similar reasons, and more specifically to:

- identify material for use in the root zone, which is capable of supporting sustainable vegetation establishment;
- identify materials that limit plant growth or which may contaminate surface or ground water (e.g. salinity), and hence may require special handling, treatment or disposal; and
- identify any propensity for spontaneous combustion.

The January 2020 rehabilitation risk assessment assessed the risk associated with poor geochemistry of exposed overburden emplacement surfaces leading to a potential off-site contamination or revegetation failure risk. With the MPO's existing active management controls in place, as described above, including the management controls for material prone to spontaneous combustion and material prone to generating acid mine drainage described in Sections 3.2.2 and 3.2.3, this risk was ranked as low.



Geochemical evaluation of the MPO fines material has historically been undertaken based on samples from individual seams and composite samples representative of the full mining sequence and is described in the MPO EIS (ERM Mitchell McCotter, 1997). The results of the combined composite samples indicate that the overall tailings from the MPO's multi-seam mining operation are likely to be non-acid forming (ATC Williams, 2018). Further column leach tests indicated elevated salinity levels in leachate which would decrease with time (ATC Williams, 2007; 2018). MACH Energy is currently undertaking additional geochemical characterisation work of the fines material with the University of Newcastle as part of an existing research project (Section 4.4). As the research project progresses, a summary of the available geochemical results will be provided in future versions of the MPO MOP/RMP.

### **3.2.2 Material Prone to Spontaneous Combustion**

A Spontaneous Combustion Management Plan has been developed for the MPO. Spontaneous combustion at the MPO will be managed in accordance with the following objectives:

- ensure that spontaneous combustion outbreaks are minimised;
- endeavour to identify potential areas that may be prone to spontaneous combustion before an outbreak occurs;
- provide for all carbonaceous material to be placed in such a manner that reduces the possible occurrence of spontaneous combustion (carbonaceous material will be placed on lower levels of the overburden emplacements, at a minimum of 5 m from the face of the emplacement);
- where longer term spontaneous combustion problems occur, instigate the Spontaneous Combustion Management Plan to deal with these; and
- creation of final rehabilitation that is free from spontaneous combustion.

Minor spontaneous combustion has been encountered at the neighbouring Bengalla Mine and Mount Arthur Mine. Seams that were found to be more susceptible, when exposed in a normal mining sequence, were the Vaux, Bayswater and Wynn Seams.

Mining at the MPO would encounter these same seams. To date, two occurrences of spontaneous combustion have occurred at the MPO, within a ROM coal storage area and within an in-pit dump area. The Spontaneous Combustion Management Plan includes details of factors that influence self-heating and spontaneous combustion and identifying signs to look for during inspections. The Plan also includes procedures for excavation and management of identified hot material. MACH Energy also conducts reactive ground testing at the MPO to assist with identifying reactive materials.

The occurrences of spontaneous combustion to date have occurred in operational coal storage areas. Notwithstanding, the risk of a spontaneous combustion incident that affects MPO rehabilitation has been assessed as low considering MPO's standard procedure for carbonaceous material placement at a minimum of 5 m from the face of the emplacement, which is consistent with industry best practice (Australian Coal Association Research Program [ACARP], 2008).

### **3.2.3 Material Prone to Generating Acid Mine Drainage**

Geochemical characteristics of the overburden material were tested by the Department of Mineral Resources Development Laboratory (Mountford and Wall, 1995). The only acid forming leachate occurred in samples obtained from the Wynn Seam. Material balance calculations undertaken for the 1997 EIS indicated that dilution and neutralisation will negate any acid forming potential.

Therefore, due to the predicted small proportion of potentially acid forming material, it is expected that operational blending during ROM coal dumping will produce a non-acid forming material within the Overburden Emplacement and back-filled open cuts. The management strategy for the MPO will provide that no zones of poorly blended, potentially acid forming material are exposed in the final surface of the Overburden Emplacement and back-filled open cuts. This will be achieved by excluding the material identified as potentially being acid forming (i.e. non-economic coal and identified coal seam roof and floor rock from the Wynn Seam) from the final face of the Overburden Emplacement with a minimum cover of 10 m of inert material overlying the potentially acid forming material.

Locations of potentially acid forming materials have been identified on-site. The mine plan includes sequencing of mining and emplacing of potentially acid forming material to ensure the material is separated from non-acid forming material. Potentially acid forming material will be emplaced on the Overburden Emplacement away from gullies and drainage lines, and away from the outer slopes. Where possible, potentially acid forming material will be emplaced in-pit.

The risk of incorrect management of acid forming material resulting in rehabilitation failure and potential off-site water quality issues was assessed as low in the January 2020 rehabilitation risk assessment, with implementation of the MPO's existing management controls, as described above.

The MPO's Water Management Plan includes a comprehensive monitoring program that will enable the detection of poor-quality water, and the MPO's Surface and Ground Water Response Plan includes the investigation protocol that will be undertaken in the event of exceedance of WMP trigger levels.

#### **3.2.4 Mine Subsidence**

No subsidence impacts will occur as a result of the operations planned at the MPO, as mining operations are open cut. Minor historical underground workings exist on the northern and southern parts of ML 1645, and parts of ML 1750. These workings do not pose a risk to MPO rehabilitation.

#### **3.2.5 Slope Management – Emplacements, Voids, Highwalls and Endwalls**

Section 4.2.2 provides a detailed description of the design of the MPO final landform to include macro and micro relief, in particular on the eastern face of the Eastern Out-of-Pit Overburden Emplacement, to facilitate a more natural and less engineered landform. In developing a more natural looking landform, MACH Energy has incorporated significant areas of the outer emplacement batters at slopes of less than 10 degrees (lower slopes), and more limited areas of slopes up to approximately 14 degrees (upper slopes), to provide visually important slope variation, while also maintaining waste rock emplacement capacity. Slopes greater than 14 degrees will be constructed in accordance with a geomorphically robust design.

The final void, low walls and ramps cannot be rehabilitated progressively over the mine life as they are required up to the end of production for accessing coal and related infrastructure services. All areas of the site, with the exception of the final voids and their surrounding catchments, will be free draining. This will allow effective catchment contribution and yield to the Hunter River, following the cessation of mining.

The final void landform will be rehabilitated with vegetation species and diversity that are appropriate for the complex landform. The highwall will also be rehabilitated using the best reasonable and feasible rehabilitation technologies available and re-vegetated with species that are appropriate for its steepness and aspect.

Design alternatives for the final void will be continually evaluated and will be prepared as part of the closure planning process at the MPO. Regardless of the final design alternative selected, the location of the final void will be outside the 100-year recurrence interval flood prone area of the Hunter River. Appropriate measures will be used to limit access to steep areas around the final void to restrict cattle, pedestrian and vehicle access. These measures may include large rock placement, landform shaping, or fencing, as agreed with relevant government authorities prior to closure.

The January 2020 rehabilitation risk assessment assessed the risk associated with construction of MPO final landforms that are inconsistent with the geomorphic design principles resulting in landform instability and rehabilitation failure and assessed the risk of instability of the final void. With the MPO's existing active management controls in place (i.e. ITP check processes of landform design and as-constructed verification checks, which are signed-off by relevant MPO managers), these risks were ranked as having a low and medium risk, respectively.

### **3.2.6 Erosion and Sediment Control**

An Erosion and Sediment Control Plan (ESCP) has been developed in accordance with Condition 28(b), Schedule 3 of Development Consent DA 92/97. The ESCP is included in Appendix A of the MPO WMP. The ESCP describes the management of potential erosion impacts as well as implementation of a monitoring program to provide early detection of potential issues and to monitor the effectiveness of controls. A detailed construction ESCP has also been prepared to meet internal MACH Energy planning requirements.

In order to reduce the potential for degradation within the MPO area and adjoining lands, there are two zones of focus that will be adequately managed during the construction phase:

- areas disturbed by construction and initial mining activities; and
- undisturbed areas.

The following measures will be adhered to in all areas of the site where disturbance from construction and/or initial mining activities occurs:

- relevant internal approvals and permits will be obtained before commencement of surface disturbance in the construction stage (e.g. Ground Disturbance Permits);
- the extent of disturbance (including trafficable areas) will be minimised and delineated using appropriate pegging, barriers or signage;
- appropriate erosion and sediment controls will be approved and established prior to land disturbance and will remain in place until exposed areas are stabilised;
- clean water runoff from undisturbed catchments will be diverted around the disturbance areas via diversion drains and banks to discharge into natural watercourses, where practical;
- runoff from disturbed areas will be diverted into sediment dams;
- drains, diversion banks and channels will be stabilised and scour protection will be provided as necessary;
- temporary erosion and sediment control measures will be used on-site and may include silt fences, hay bales, jute mesh, check dams, cross banks, contour banks, armouring and straw mulching; and
- topsoil stockpiled for reuse will be managed as described in Section 3.2.7.

External and internal drainage considerations will be incorporated into the landform design plan to slow and direct water flow and minimise erosion. These concepts are further described in Section 4.2.2. Diversion drains will be constructed as per the design plans.

Regular inspection of disturbance areas is undertaken at the MPO using both drone surveys and on the ground visual inspections. These inspections provide for early detection of any areas of erosion, and for appropriate treatment measures to be implemented.

Although the risk of inadequate erosion control on rehabilitated landforms at the MPO was assessed as posing a medium risk to successful rehabilitation of the MPO, this risk is mitigated to a tolerable level with implementation of the existing management practices and controls in place.

### 3.2.7 Soil Types, Suitability for Rehabilitation and Soil Management

Soil management is fundamental in successful land management and rehabilitation of the MPO. The key objectives for managing the soil landscape (in context of vegetative cover and soil stability) include:

- minimising bare soil patches which could potentially be affected by wind and water movement; and
- maintaining favourable nutrient, infiltration and stability characteristics.

Data derived from the 1997 EIS demonstrates the suitability of the soils of the MPO area for use as growing media and the stripping depth. Table 3-7 summarises the soil types across the MPO area and their characteristics.

**Table 3-7**  
**Summary of Soil Types**

Soil Types	Characteristics
Alluvial – Floodplain Soils	Uniform medium or fine textured clay profile, consisting of clay loams, silty clay loam or light clay topsoils. Slightly to highly dispersive.
Drainage Flat/Drainage Line Soils	Brown solonised soils and brown and yellow solidic soils. Slightly dispersible topsoils and highly dispersible subsoils.
Hillslope Soils	Topsoils are stable though occasionally highly dispersible. Subsoils are highly dispersible.
Sandy Hillslope Soils	Sandy parent material. Topsoil in two layers: <ul style="list-style-type: none"> <li>• Light sandy clay loam, loam fine sandy or fine sandy clay loam.</li> <li>• Clayey sand, sandy loam or light to fine sandy clay loam.</li> </ul> Subsoil is sandy to light medium clay – slightly to highly dispersible.
Volcanic Hillslope Soils	Uniform structured clay soils. Topsoil is fine sandy clay loam or light clay. Subsoils consist of silty to light medium clays. Slight to moderate dispersibility.

Source: ERM Mitchell McCotter (1997).

The suitability of these soils for rehabilitation use, and their stripping depth, is summarised in Table 3-8.

**Table 3-8**  
**Summary of Soil Suitability for Use in Rehabilitation**

<b>Soil Unit Type</b>	<b>Suitable Stripping Depth</b>
Alluvial Soils	Approximately the top 0.5 m of this soil unit is suitable for topsoil, while all remaining material down to at least 2.5 m is suitable for subsoil.
Drainage Flat/Drainage Line Soils	Surface layer is suitable for topsoils. Stripping depth to 0.2 m – though this is dependent on site specific soil characteristics. Soil below these layers is unsuitable due to unsuitable pH, dispersion characteristics, and structure.
Hillslope Soils	Surface soil material can be stripped down to a pale coloured (A2) horizon or in places down to a brighter coloured subsoil clay layer.
Sandy Hillslope Soils	Surface layers are only suitable for topsoil, usually to a depth of 0.1 m. Some areas not suitable due to high sand, gravel content or sandy texture.
Volcanic Hillslope Soils	Topsoil suitable to depths of 0.2 m. Some areas not suited due to shallow soils or high content of gravel or rock.

Source: ERM Mitchell McCotter (1997).

### **Management of Soil during Stripping**

Topsoil stripping activities will be undertaken in accordance with the ESCP, to minimise erosion potential. The areas cleared in advance of mining will be delineated to minimise the potential for accidental additional vegetation clearance and potential impacts to fauna. Where possible, the areas will also be deep ripped to alleviate compaction and watered to minimise dust generation, prior to stripping. Following these activities, vehicle movement will be kept to a minimum on areas/soils proposed to be stripped.

Topsoil and subsoil will be stripped and salvaged to maximise its value for re-use in rehabilitation, this process will be guided by soil mapping and the suitable soil stripping depths described in Table 3-8.

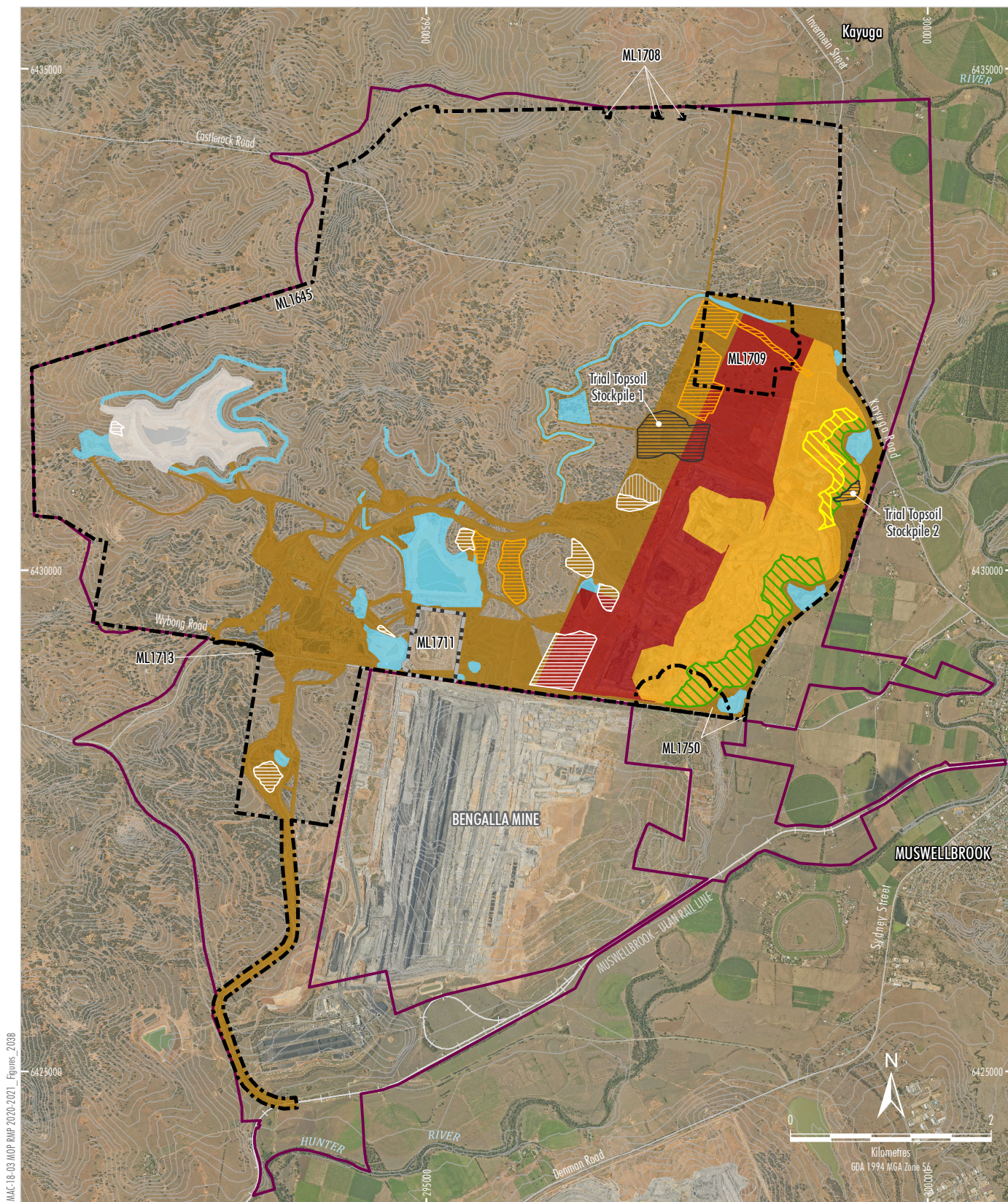
Where practicable, soil will be stripped when moist (but not saturated) to reduce air quality impacts, and where possible, will be transported directly to areas available for rehabilitation.

### **Soil Stockpile Management**

Where direct placement of topsoil on rehabilitation areas is not possible, soil will be stockpiled away from active transport corridors and on level or gently sloping ground, where available, to minimise erosion and potential soil loss. Topsoil and subsoil (including alluvial soils) will be stockpiled separately where practical. Topsoil stockpiles will be limited to a height of 3 m (except for two trial topsoil stockpiles, described in Section 8.2 and shown on Figure 3-2, which will be limited to a height of 5 m). Subsoil stockpiles (including alluvial soil stockpiles) will be limited to 5 m in height. Indicative locations of existing and proposed topsoil and subsoil stockpiles are shown on Figure 3-2. Both short-term and long-term topsoil and subsoil stockpiles will be managed to minimise soil loss and maintain the viability of the soil. Long-term topsoil and subsoil stockpiles (i.e. stockpiles that will remain for longer than 6 months) will be managed to maintain soil viability, seed reserves and microbial soil associations. Measures will include:

- constructing stockpiles with a “rough” surface condition to reduce erosion hazard, improve drainage and promote revegetation;
- deep-ripping to encourage infiltration, seed set and aerobic conditions;
- seeding with a species mix including sterile pasture species and native grass, shrub and tree species associated with the BC Act and EPBC Act listed White Box EEC;
- weed management with appropriate herbicide as required; and
- installation of silt fencing around the perimeter of the stockpile to minimise soil loss from erosion prior to vegetation stabilisation as required.





#### LEGEND



Modified Development Consent Boundary\*  
Mount Pleasant Operation Mining Lease Boundary  
Bengalla Mining Lease Boundary  
Contour (5 m Interval)

#### Primary Domains

- 1 Infrastructure Area
- 2 Fines Emplacement Area
- 3 Water Management Area
- 4 Active Void
- 5 Overburden Emplacement Area

#### Rehabilitation Phase

- Landform Establishment
- Ecosystem and Land Use Establishment

- Existing Topsoil Stockpile (3 m)
- Existing Subsoil Stockpile (3 - 5 m)
- Proposed Topsoil Stockpile (3 m)
- Proposed Trial Topsoil Stockpile (5 m)

\* Appendix 1 of Development Consent DA 92/97

Source: MACH Energy (2020); NSW Spatial Services (2019)  
Orthophoto: MACH Energy (Jan 2020)

**MACH Energy**  
MOUNT PLEASANT OPERATION  
Indicative Locations of Existing and Proposed  
Topsoil and Subsoil Stockpiles

**Figure 3-2**



Soil stockpiles will be sign-posted to identify the stockpile and to minimise accidental disturbance. The sign will identify the date of stockpiling and the source and nature of the soil (e.g. subsoil). Following construction, soil stockpiles will be surveyed and incorporated into the MPO mine plan and Topsoil Register, along with the stockpile volume.

### **Soil Replacement on Rehabilitation Areas**

At the time of soil replacement on rehabilitation areas, soil conditioning activities will be undertaken with the aim of increasing moisture and organic content and to buffer surface temperatures to improve germination. Activities will involve the application of dust suppressant to minimise dust generation and the application of soil ameliorants (as required) such as gypsum, or organic materials such as wood and hay mulch (see Plate 2). Soil testing will be undertaken prior to soil replacement to inform amelioration requirements, including the required rate of application. Soil ameliorants will be incorporated by ripping, plough or rotating hoe.

In addition to the above, replaced soil sourced from stockpiles greater than 3 m in height, will be inoculated with Mycorrhizal fungi and rhizobia bacteria to ameliorate any anaerobic conditions that may have developed during storage. Topsoil stockpiles will also be mixed during spreading to redistribute nutrients which may have leached to the base of the stockpiles (Nussbaumer, *et. al.*, 2012).

Symbiotic microbes can have a dramatic influence on plant establishment, growth and survival. For example, Mycorrhizal fungi are instrumental in soil aggregation, which leads to better soil structure with all its benefits of increased water infiltration and holding capacity, seedling emergence, root penetration and gas exchange. There are two main types of mycorrhizae, ectomycorrhizae and endomycorrhizae (also known as arbuscular mycorrhizae) (Nussbaumer, *et. al.*, 2012).

MACH Energy will also conduct microbial sampling to understand the current diversity within stockpiled topsoil and soil respread on rehabilitation areas (prior to resspreading) to understand possible microbial losses and inoculation requirements. The nutrient cycling soil microbes which *“naturally build nutrient pools, especially for nitrogen and phosphorus, in both the standing vegetation and the soil”* (Nussbaumer, *et. al.*, 2012), will be introduced, as required, into the rehabilitation areas to assist with maintaining long-term sustainability of the topsoil resource at the MPO.

Soil will either be dumped at the top of the slope and spread down the slope or dumped at the base of the slope and spread up-slope. The soil will then be spread at a minimum depth of 100 mm across the contour of the slope. Replaced soil, and any applied ameliorants, will then be deep-ripped (see Plate 1) to a depth of approximately 500 mm to alleviate any soil compaction during landform construction and create a rough surface tilth for vegetation establishment.

Soil re-spreading will not be undertaken during excessively wet days, to avoid compaction of the landform surface from machinery movement, or on excessively windy days, to minimise dust generation and soil loss

### **Topsoil Budgeting**

Rehabilitation planned during this MOP/RMP term is described in Section 7.2. The estimated topsoil budget for the MOP/RMP term is provided in Table 3-9.

**Table 3-9**  
**Estimated Topsoil Budget**

<b>Topsoil Budget</b>	<b>MOP/RMP Term (1 July 2020 to 30 June 2021)</b>
Topsoil stockpiled at start of MOP/RMP term (m <sup>3</sup> )	1,466,655
Stripped Topsoil during MOP/RMP term (m <sup>3</sup> )	207,325
Topsoil used for Rehabilitation during MOP/RMP term (m <sup>3</sup> )	44,749
Topsoil stockpiled at end of MOP/RMP term (m <sup>3</sup> )	1,629,231

m<sup>3</sup> = cubic metre.

Topsoil is collected and stored on-site with an aim to stockpile sufficient topsoil to rehabilitate the entire final landform. MACH Energy currently estimates that 1,431,000 cubic metres (m<sup>3</sup>) of topsoil is required for final landform rehabilitation and therefore, MACH Energy is aiming to directly apply or stockpile this amount prior to mine closure. Sufficient soil resources are available for final landform rehabilitation.

'Inadequate or insufficient topsoil to create/enhance the desired ecological communities in mine rehabilitation areas' was assessed as a medium risk to successful rehabilitation at the MPO, with 'Inappropriate topsoiling techniques resulting in a failure of rehabilitation' assessed as posing a low risk to successful rehabilitation at the MPO.

MACH Energy maintains a Topsoil Register at the MPO to track stockpile volumes, locations, stockpile type and treatments applied to the stockpiles (e.g. whether a stockpile has been seeded). This Register is updated regularly to reflect stockpile use and management actions undertaken. As shown above, sufficient soil resources are available for final landform rehabilitation.

### **3.2.8 Biodiversity**

The floristics and vegetation structure across the site and the surrounding areas have been extensively modified since European settlement. Grassland is the most common vegetation community on the site (Plan 1B-1) and is used for beef cattle grazing (Plan 1B-2). Other than grassland, the landscape includes scattered patches of open woodland of various sizes, ages and condition (Plan 1B-1).

Updated vegetation mapping of the MPO area (Plan 1B-1) was undertaken by Hunter Eco in 2018 (Hunter Eco, 2018), following approval of MOD 3. This mapping was undertaken in order to align vegetation communities with contemporary Plant Community Type (PCT) definitions, as well as to inform target woodland ecosystems and species selection for rehabilitation. The updated vegetation mapping has been supplemented in areas by earlier vegetation mapping, undertaken by Cumberland Ecology in 2010 (Cumberland Ecology, 2010).

The vegetation communities presented on Plan 1B-1 have been reconciled against contemporary PCT definitions in Table 3-10.

Analysis of this vegetation mapping indicates that the most widespread PCTs being disturbed by the MPO are the following:

- PCT 483 - Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley (representative of the White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community listed under the EPBC Act and NSW BC Act).
- PCT 1604 - Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.
- PCT 1605 - Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter.

**Table 3-10**  
**Vegetation Community/Plant Community Type Reconciliation**

Vegetation Community Name (Plan 1B-1)	PCT	PCT Name
White Box – Narrow-leaved Ironbark – Blakely's Red Gum <sup>1</sup>	1606	White Box – Narrow leaved Ironbark – Blakely's Red Gum shrubby open forest of the central and upper Hunter.
Spotted Gum – Narrow-leaved Ironbark Woodland <sup>1</sup>	1602	Spotted Gum – Narrow-leaved Ironbark shrub – grass open forest of the central and lower Hunter.
Spotted Gum – Grey Box x White Box Woodland/Forest <sup>1</sup>	1604	Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass woodland of the central and lower Hunter.
Slaty Box Woodland (DNG)	1655	Grey Box – Slaty Box shrub – grass woodland on sandstone slopes of the upper Hunter and Sydney Basin.
Narrow-leaved Ironbark – Grey Box Grassy Woodland <sup>1</sup>	1691	Narrow-leaved Ironbark – Grey Box grassy woodland of the central and upper Hunter.
Narrow-leaved Ironbark Shrubby Forest <sup>1</sup>	1605	Narrow-leaved Ironbark – Native Olive shrubby open forest of the central and upper Hunter.
Grey Box x White Box Grassy Woodland <sup>1</sup>	483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley.
Forest Red Gum Grassy Open Forest <sup>1</sup>	618	White Box x Grey Box – Red Gum – Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley.

Source: OEH (2018) *Bionet Vegetation Classification*. Accessed 31 October 2018.

<https://www.environment.nsw.gov.au/NSWVCA20PRapp/search/pctsearch.aspx>

Note: DNG = Derived Native Grassland.

<sup>1</sup> Including the DNG component of the vegetation community.

The eastern face of the final landform will be targeted for revegetation using the species characteristic of these PCTs as conceptually shown on Plan 4A (i.e. Domain D – Native Woodland/Grassland). These PCTs are proposed to provide potential habitat (in the long-term) for threatened flora and fauna that have been previously recorded in the area, including:

- Woodland birds:
  - Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).
  - Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*).
  - Speckled Warbler (*Chthonicola sagittata*).
  - Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*).
  - Diamond Firetail (*Stagonopleura guttata*).
  - Varied Sittella (*Daphoenositta chrysoptera*).
- Mammals:
  - Squirrel Glider (*Petaurus norfolcensis*).
  - Spotted-tailed Quoll (*Dasyurus maculatus*).
  - Eastern Freetail-bat (*Mormopterus norfolkensis*).
  - Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*).
  - Eastern Bentwing-Bat (*Miniopterus schreibersii oceanensis*).
  - Grey-headed Flying-fox (*Pteropus poliocephalus*).
  - Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).
  - Southern Myotis (*Myotis macropus*).
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*).

- Eastern Cave Bat (*Vespadelus troughtoni*).
- Flora:
  - Tiger Orchid (*Cymbidium canaliculatum*) – Endangered Population in the Hunter Catchment.

A summary of the PCT communities targeted for revegetation and associated upper, middle and ground stratum species is provided in Table 7-2 in Section 7.2.4. It is anticipated that the list of PCTs will be further augmented and refined over the life of the MPO based on the results of on-site investigations, on-site rehabilitation trials and consultation with key stakeholders.

### ***Biodiversity Management Strategies***

The impacts of the MPO on biodiversity are summarised in the 1997 EIS, the MOD 1 to MOD 4 environmental assessments.

MACH Energy currently manages impacts to biodiversity by implementing the following management plans, programs and strategies:

- MPO Biodiversity Management Plan, which includes Vegetation Clearance Protocol and a Ground Disturbance Permit system (as described below);
- weed and pest control programs (refer Section 3.2.9);
- this MOP/RMP, including rehabilitation monitoring program;
- the overarching MPO Rehabilitation Strategy; and
- the approved EPBC Act Offset Management Plan (required by MPO's EPBC Act Approval 2011/5795).

#### ***Vegetation Clearance Protocol***

A Vegetation Clearance Protocol (VCP) will be implemented at the MPO to minimise impacts on threatened species during native vegetation clearing at the MPO. The VCP is described in detail in the MPO's Biodiversity Management Plan.

The VCP includes the following components:

- Delineation of disturbance areas.
- Pre-clearing procedures, including:
  - a Ground Disturbance Permit process;
  - Pre-clearance Surveys; and
  - salvaging of habitat features for re-use in native vegetation rehabilitation areas.

Pre-clearing surveys will be undertaken (in conjunction with the ground disturbance permit process) to identify potential habitat features (and active threatened fauna) prior to commencing clearing works in any given area and determining appropriate management (i.e. depending on the habitat feature or threatened species identified). The pre-clearance survey would also target the identification of weed infestations that may need treatment prior to, or during disturbance, and/or pest species that may require control prior to disturbance. The pre-clearance survey will be conducted by an appropriately trained and suitably qualified ecologist. Further details of the VCP are provided in the Biodiversity Management Plan.

Management actions for identified potential habitat features or active threatened fauna will be determined on a case by case basis, but may include selective clearing of non-habitat features/vegetation to encourage self relocation. Where necessary, an appropriately trained and suitably qualified ecologist will be used to attempt removal of remaining fauna from the area should they not leave of their own accord.

As part of the mine plan, vegetation clearing and topsoil stripping activities will be undertaken throughout the year, however, they may be undertaken on a campaign basis.

Proposed use of felled timber will follow current leading practice and may include salvaging habitat features such as hollows, harvesting of brush material that is laden with fruit/seed, mulching and incorporating understorey and saplings into stripped topsoil, collection of timber for fencing, the installation of stag trees and respreading coarse timber residue onto re-contoured land.

### ***MPO Woodland Rehabilitation***

Rehabilitation of woodland at the MPO will focus on flora species endemic to the local area, while acknowledging that seed supply may be a limiting factor. In this case, other appropriate native species that have performed well in the region will also be considered. Subject to seed and seedling supply availability and suitability, flora species to be used in rehabilitation will aim to include those typical of the NSW BC Act and EPBC Act listed *White Box Yellow Box Blakely's Red Gum Woodland* endangered ecological community.

Where relevant, management practices described in the *National Recovery Plan – White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Department of Environment, Climate Change and Water [DECCW], 2011) will be used as the basis for the re-establishment of Grassy Woodland areas on-site. This plan has been considered in the development of the completion criteria and performance indicators for Ecosystem and Land Use Establishment and Ecosystem and Land Use Sustainability for the Native Woodland/Grassland Domain areas (Domain D) as described in Section 6.

The MPO EPBC Act Approval 2011/5795 requires development of a Mine Site Threatened Ecological Community Rehabilitation Plan to guide the re-establishment of White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community listed under the EPBC Act across MPO disturbed areas and rehabilitated mine landforms. A draft version of the Mine Site Threatened Ecological Community Rehabilitation Plan has been submitted to the Commonwealth Department of Agriculture, Water and the Environment (DAWE). Once approved, this MOP/RMP would be reviewed and revised if necessary, to ensure alignment of the plans.

Further detail regarding reinstating native woodland ecosystems for threatened flora and fauna is provide in Section 7.2.4.

The rehabilitation program at the MPO will focus on research and management practices that are designed to enhance rehabilitation success. As described in Sections 3.2.1 to 3.2.3, overburden material management and soil management at the MPO will include material characterisation and selective placement strategies to manage materials (e.g. saline, acidic and sodic materials) that may affect native ecosystem re-establishment. Exotic grass species may also be used to provide early groundcover while native woodland species develop. Highly competitive exotic grasses (e.g. Rhodes Grass) and non-local Australian species (e.g. *Acacia saligna*) will not be used anywhere on-site. Use of exotic grass species would be undertaken in consultation with a suitably qualified ecologist/specialist.



### ***Biodiversity Risks Related to Rehabilitation***

There were five biodiversity related risk to rehabilitation identified in the risk assessments undertaken to date (Section 3.1). The identified risks and their risk score/level include:

- Failure of revegetation due to sustained drought conditions, overgrazing, flood, fire, weed or pest invasion, inappropriate access, use of inappropriate machinery, which leads to failure to rehabilitate the site to committed standards – moderate risk;
- Failure to establish required habitats for fauna – low risk.
- Not implementing rehabilitation activities in accordance with MPO rehabilitation requirements leading to inability to landform and biodiversity goals – moderate risk.
- Inadequate or insufficient (including incorrect species mix/quality) seed/seedlings for rehabilitation works – moderate risk.
- Incompatible neighbouring landowner practices (including interactions with Bengalla Mine) leading to failure of rehabilitation and revegetation works – moderate risk.

The mitigation measures/management controls relevant to these risks are described in the TARP provided in Table 9-1 of Section 9.2.

#### **3.2.9 Weeds and Pests**

The key weed and pest species on the MPO landscape include: African Boxthorn (*Lycium Ferocissimum*); St John's Wort (*Hypericum perforatum*); feral dogs; foxes; and feral pigs. Ongoing management activities are undertaken to control the presence of these species.

Weed management at the MPO will be undertaken in accordance with advice from the Upper Hunter Weeds Authority, and in accordance with the *Biosecurity Act 2015*. The MPO also has a weed management procedure which will be implemented across the MPO area. The procedure includes a description of the Weeds of National Significance, priority and environmental weed species which pose a threat to the site. Monitoring of weed presence, extent and other factors which may contribute to growth/decline of populations will occur regularly.

As described in the Biodiversity Management Plan, weed management measures that may be undertaken at the MPO include (but are not limited to):

- Regular inspections of MACH Energy-owned lands to identify areas requiring the implementation of weed management measures.
- Regular inspections and maintenance of topsoil stockpiles.
- Management of cattle movement to mitigate the risks associated with the control of weeds in manure, around stockyards, and key access corridors.
- Consultation with neighbouring land owners and the relevant government stakeholders, such as the Upper Hunter Weeds Authority, regarding regional weed management strategies.
- Implementation of appropriate weed management measures, which may include mechanical removal, application of approved herbicides and biological control.
- Control of noxious weeds, or plants identified as key threatening processes on MACH Energy-owned land in accordance with the relevant DPI control category and the regional Weed Management Plan.
- Identification of weed infestations adjacent to or within the proposed disturbance area during pre-clearance surveys.

- Follow-up inspections to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.

The outcomes of these weed and pest management activities will be reported in the Annual Review (Section 10.1).

The risk of failure of MPO rehabilitation due to weed and/or pest infestation has been assessed as moderate and is mitigated by implementation of the MPO's existing management practices and controls, as described above.

### **3.3 MANAGEMENT OF OTHER ENVIRONMENTAL RISKS**

#### **3.3.1 Air Quality**

Air quality management and monitoring will be conducted in accordance with the Air Quality and Greenhouse Gas Management Plan.

Air quality monitoring results will be documented in the Annual Review.

#### **3.3.2 Surface Water**

A WMP has been developed in accordance with Condition 28(c) of Development Consent DA 92/97. The WMP includes information on surface water management and erosion and sediment control requirements.

The MPO site water management system generally aims to separate clean water from water that has been in contact with coal.

The WMP includes details of MPO's requirements under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002* which regulates the releases of saline water during periods of high flow in the Hunter River such that specific salinity targets at various points in the river are not exceeded.

#### **3.3.3 Groundwater**

Potential impacts on groundwater are managed in accordance with the Groundwater Management Plan, developed in accordance with Condition 28(d) of Development Consent DA 92/97.

#### **3.3.4 Contaminated Land**

Land contamination is managed through the MPO site contamination prevention and control procedure and non-mineral waste management procedures.

After cessation of mining activities, an assessment will be undertaken to determine whether potential contamination issues exist on-site and if remediation is required. Issues expected to be addressed by this assessment will include, but not be limited to, decontamination of areas such as those impacted by carbonaceous material (e.g. coal spillage, coal storage), by hydrocarbon spillage (e.g. workshops, fuel storage areas) or by sedimentation (e.g. dams that have directly received pit water).

### 3.3.5 Hazardous Materials

Hazardous substances will be managed through the MPO Environmental Management System procedures for site contamination prevention and control. Additionally, the MPO will register all chemicals used on-site in a central database. The central database will contain all information in the Safety Data Sheets (SDS) and an inventory of chemicals held on-site. The information will be accessible at any computer terminal within the MPO, and will provide guidance on storage, use and disposal.

Hazardous and explosive materials will be transported and stored on-site in accordance with the NSW *Work Health and Safety Act 2011* and supporting *Work Health and Safety Regulation 2017*, the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and the supporting *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*, as well as the NSW *Explosives Act 2003* and supporting *Explosives Regulation 2013*.

The procedures and controls will minimise the potential for land and water contamination from the handling, storage and disposal of hazardous substances. These controls will include storage within properly sealed containers and controlled areas, and bunding areas used for medium to long-term storage requirements. These storage and waste receival areas will be isolated from clean water catchments to minimise the risk of land or water pollution should an unplanned spill occur.

The response to any accidental spills or ground contamination will be assessed on a case-by-case basis, and remediated using biodegradable spill absorbent, and in accordance with any requirements of the SDS for the material. Emergency response procedures will also be enacted as required in accordance with the relevant environmental procedures. Hydrocarbon or chemical spills will also be reported in the mine site incident reporting and management system with corrective and preventative measures taken as appropriate, in accordance with the MPO's Pollution Incident Response Management Plan.

Hydrocarbon spills will be managed using bioremediation of the contaminated soils within a bioremediation facility located adjacent the open cut pit, or taken offsite for bioremediation at an appropriate facility. Following a spill, the contaminated soil is transported to the facility (generally via loader) and the details of the incident are recorded in the MPO Bioremediation Tracking Spreadsheet. Routine testing is undertaken on contaminated soils stored within the facility, until the soils reach a level where they are deemed safe for storage. The soils are then disposed of in-pit (with placement to target areas as low in the pit as possible).

Notwithstanding the above, the treatment of hydrocarbon spills is assessed on a case-by-case basis and is dependent upon the nature and scale of the spill. Should bioremediation not be an appropriate treatment for a spill, other options may include land farming (in accordance with the EPA's *Best Practice Note: Landfarming* [EPA, 2014]) or transporting the contaminated soils off-site for treatment at a treatment facility.

### 3.3.6 Greenhouse Gases, Methane Drainage and Venting

In accordance with Condition 19, Schedule 3 of Development Consent DA 92/97, MACH Energy implements all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site. These measures are detailed in the Air Quality and Greenhouse Gas Management Plan.

Methane drainage and venting is not applicable to the MPO.

### **3.3.7 Blasting**

Blasting activities commenced in late 2017, and have been undertaken in accordance with the approved Blast Management Plan, prepared in accordance with Condition 17, Schedule 3 of Development Consent DA 92/97.

Blast monitoring results are documented in the Annual Review.

### **3.3.8 Noise**

Noise management and monitoring will be conducted in accordance with the Noise Management Plan.

Noise monitoring results are documented in the Annual Review.

### **3.3.9 Visual and Lighting**

Visual amenity at the MPO will be managed in accordance with the VIMP, which includes details of the measures that will be implemented at the MPO to address potential visual impacts that may affect local and regional visual receptors.

### **3.3.10 Heritage**

#### ***Aboriginal Cultural Heritage***

Aboriginal archaeology and cultural heritage at the MPO is managed in accordance with AHIP #C0002053 and AHIP #C0002092 and the MPO's AHMP. All works described in this MOP/RMP will be undertaken in accordance with these AHIPs and the AHMP.

Consultation with the Aboriginal community in relation to the management of Aboriginal archaeology and cultural heritage at the MPO is undertaken through the Aboriginal Heritage Management Plan, conditions within Development Consent DA 92/97, the *NSW National Parks and Wildlife Regulation, 2009* and the OEH policy *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010).

#### ***Historic Heritage***

In 2014, detailed recording of historic heritage sites on the MPO MLs was undertaken and, where warranted, specific archaeological management measures for specific sites were developed. Where appropriate, these works will be conducted with the participation of interested community members, such as representatives from local historical societies.

### **3.3.11 Bushfire Management**

The main objectives of bushfire management within the MPO Development Consent boundary and on MACH Energy owned land are to minimise the risk of bushfires and to rapidly control any outbreaks that might occur. A Bushfire Management Plan has been developed and is implemented at the MPO (and for all MACH Energy-owned lands). The Plan includes control measures to protect people, property, assets, places of heritage value, threatened flora and fauna and to minimise the potential spreading of bushfires in and around the MPO.

The control measures implemented to prevent and manage bushfires focus on minimising the amount of fuel available at the MPO and its surrounding land. These measures include:

- slashing of vegetation along roads and internal tracks which are used as fire trails and assist in dividing the site into control zones;
- the use of livestock to reduce pasture-based fuel loads on land suitable for grazing; and
- a network of water supply points to assist the NSW Rural Fire Service (RFS) with logistical support.

In the event of a bushfire at the MPO, the MPO's Bushfire Management Plan and emergency response procedures will be enacted. Trigger events relevant to a fire/bushfire on-site affecting rehabilitation areas are addressed in the TARP in Section 9.2.



## 4 POST-MINING LAND USE

### 4.1 REGULATORY REQUIREMENTS

Regulatory requirements relevant to post-mining land use and rehabilitation at the MPO are provided in the following MPO approval documents:

- Development Consent DA 92/97;
- the MPO's MLs; and
- EPBC Approval 2011/5795.

The Development Consent and ML Authority conditions relevant to post-mining land use and rehabilitation are detailed and reproduced in full in Table 1-1 in Section 1.1. Table 1-1 includes section references to where the Development Consent and ML conditions are addressed in this MOP/RMP.

The requirements of EPBC Approval 2011/5795 relevant to post-mining land use and on-site rehabilitation include the following:

#### **EPBC Approval 2011/5795 Condition 19**

*The person undertaking the action must, within 3 years of the commencement of construction, submit to the Minister for approval a Mine Site Rehabilitation Plan for the progressive rehabilitation and revegetation of no less than 1000 ha of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and derived Native Grassland Ecological Community on the project area (as identified in Appendix A).*

MACH Energy commenced construction of the Action associated with EPBC Approval 2011/5795 on 25 November 2016. Accordingly, MACH Energy submitted a Mine Site Threatened Ecological Community Rehabilitation Plan to the DAWE on 25 November 2019. Following approval of the Mine Site Threatened Ecological Community Rehabilitation Plan, this MOP/RMP will be reviewed and revised if necessary.

#### **EPBC Approval 2011/5795 Condition 21**

*The person undertaking the action must submit to the Minister for approval the Mine Closure Plans, at least 6 months prior to the mine closure. The approved Plan must be implemented.*

In accordance with Condition 21 of EPBC Approval 2011/5795, a Mine Closure Plan for the MPO will be submitted to the DEE at least 6 months prior to the closure of the MPO. This timeframe is outside the scope of this MOP/RMP term.

### 4.2 POST-MINING LAND USE GOAL

#### 4.2.1 Final Land Use

The final land use goals for the MPO are based on the following:

- successful design and rehabilitation of landforms to ensure structural stability, revegetation success and containment of wastes; and
- post-mining land use compatible with surrounding land uses.

MACH Energy has undertaken a preliminary assessment of potential post-mining land uses (e.g. nature conservation, agriculture) taking into account relevant strategic land use objectives of the area in the vicinity of the MPO and the potential benefits of the post-mining land use to the environment, future landholders and the community. This has included consultation with MSC who has indicated a preference for the inclusion of some intensive agricultural/industrial post-mining land uses that provide employment for the local community.

Accordingly, proposed final land uses for the MPO area include permanent water infrastructure and storage areas, agricultural land, native woodland and grassland areas and the final void (Plan 4A and Figure 4-1). The Secondary Domains described in Section 5.1 reflect these final land uses.

#### **4.2.2 Final Landform**

MACH Energy is aware of the level of local interest with respect to the shape and form of MPO final mine landforms. MACH Energy has therefore developed the following design principles for the MPO final landform:

- The emplacement landform will be designed to look less “engineered” when viewed from Muswellbrook (i.e. incorporation of macro-relief to avoid simple blocky forms).
- Surface water drainage from the waste emplacement landform will incorporate micro-relief to increase drainage stability and avoid major engineered drop structures where practical.
- The final void (and associated drainage network) will be shaped to reflect a less engineered profile that is more consistent with the surrounding natural environment.

The following subsections provide further discussion of how these principles will be applied.

##### ***Design Integration of Macro and Micro Relief***

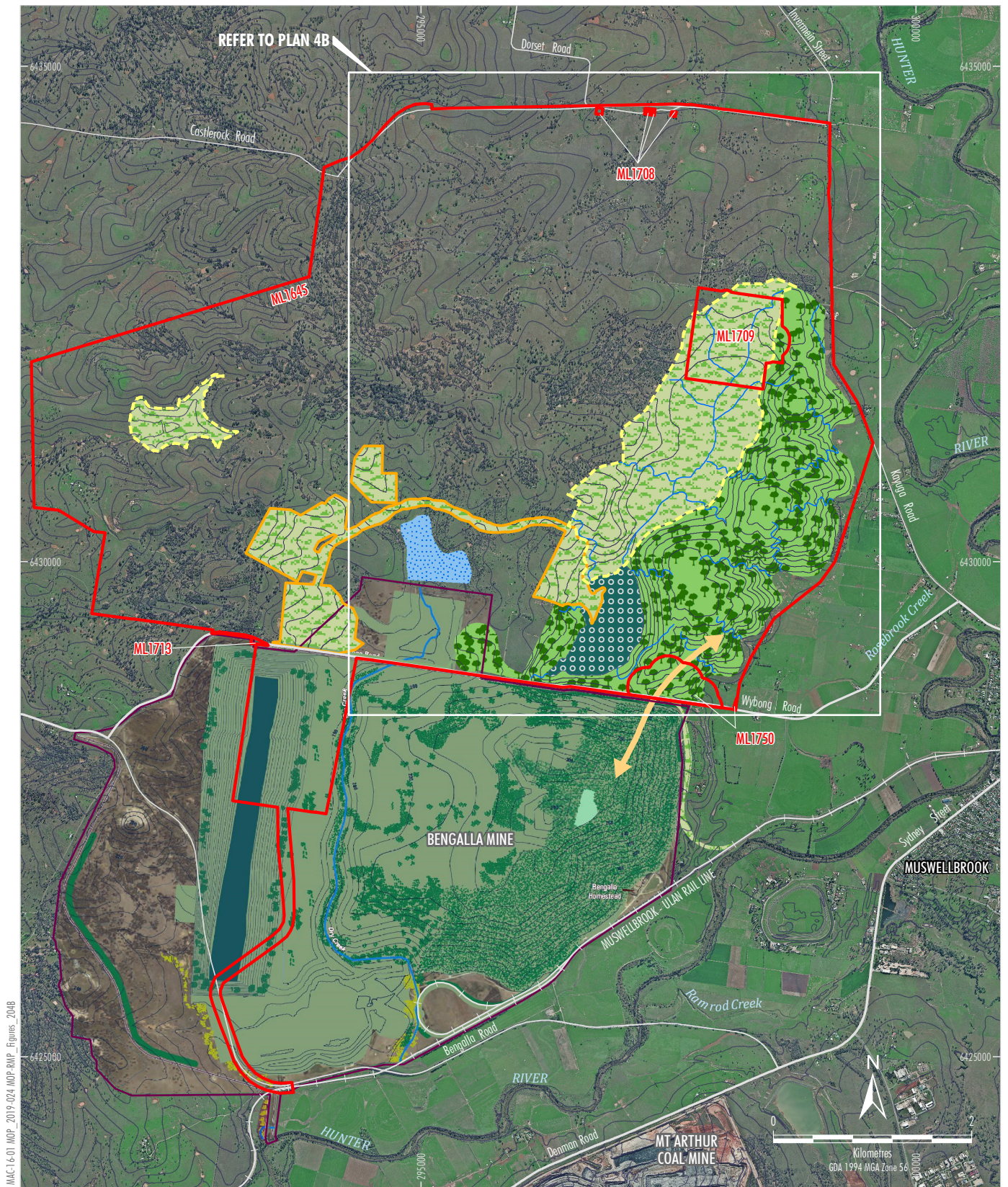
The emplacement extension and other proposed changes to the final landform that were approved as part of MOD 3 were intended to improve the overall appearance of the MPO landform by incorporating the following concepts:

- The final landform surface of the upper lifts on the eastern side of the emplacement will be varied to break up the horizon line when viewed from the east.
- The toe of the emplacement will be extended in plan to form a more complex shape that better aligns with the underlying topography.

These elements of macro-relief on the eastern face of the final landform create a number of spurs and valleys, with the high points on the landform aligning with the spurs to further improve the more natural appearance of the landform from viewpoints to the north-east and south-east. Plan 4A provides a conceptual view of MPO final rehabilitation. The inset area on Plan 4A is reproduced on Plan 4B which provides a plan view of the final landform and includes contour and elevation detail and shows the spurs and valleys of the modified landform.

The objective of the final landform is to develop drainage features in the post-mine landform that mitigate erosion potential. This will be achieved by incorporating micro-relief into the drainage design.





#### LEGEND

- Mount Pleasant Mining Lease Boundary
- Secondary/Post-mining Land Use Domains
- Domain A - Final Void
- Domain B - Water Infrastructure and Storage
- Domain C - Agricultural Land
- Domain D - Native Woodland/Grassland
- Potential Low Intensity Agriculture Area
- Potential High Intensity Agriculture Area
- Wildlife Corridor

#### Bengalla Mine Conceptual Final Landform \*

Project Boundary (Appendix 2 of Development Consent SSD-5170)  
(Dated 23 December 2016)

\* Digitised from Appendix 9 of Development Consent (SSD-5170)  
and amended in the Mount Pleasant Operation CHPP area.

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2019); Department of Planning and Environment (2016); MACH Energy (2018)  
Orthophoto: MACH Energy (Aug 2016)

Note: Light vehicle access roads and upslope diversions associated with minimising the catchment of the final void and fines emplacement area are not shown.

**MACHEnergy**  
MOUNT PLEASANT OPERATION  
Indicative Final Rehabilitation and  
Post-mining Land Use Domains

Figure 4-1



The NSW Mineral Council's (2007) *Rehabilitation by Design Practice Notes* and Department of Environment & Climate Change's (DECC's) (2008) *Managing Urban Stormwater Soils and Construction Volume 2E Mines and Quarries* provide principles for the construction of stable batter slopes. These principles include:

- Use of a combination of convex and concave outer batters to convey runoff (i.e. as opposed to fixed slope batters).
- Appropriately spaced benches to reduce the velocity of runoff.
- Gentler slope gradients.

MACH Energy has considered these principles in developing the conceptual final landform shown on Plans 4A and 4B. These plans show the flattened slopes have been incorporated into the landform.

In particular, MACH Energy will implement the following measures to increase the stability of the final landform:

- Establish bench drains where necessary to convey runoff from batter slopes to sub-catchment drainage lines and investigate opportunities to develop small ephemeral wetlands.
- Maximise the number of sub-catchments to reduce the catchment area of individual constructed drainage lines.
- Establish meandering drainage lines that increase the total drainage length and therefore result in gentler stream bed gradients.
- Where practical, design drainage lines to generally produce a convex and concave stream bed profile.
- Establish diverse and variable density native tree cover on the outer face of the Eastern Out of Pit Emplacement and in final landform drainage features to promote stability of the final landform.

The final landform drainage lines will be designed to accommodate natural erosive processes. This will be achieved through consideration of key erosional and geomorphic characteristics such as nature of bed material (e.g. particle size), presence of rock outcrops, bed features (such as cascades, pool and riffle zones) as well as bed and bank vegetation.

Geomorphic features will be incorporated into the design of the relevant final landform drainages. This will also be informed by investigation into the physical characteristics of waste rock and soil materials at the MPO for provision of appropriate rock, sub-soil and topsoil material for use on outer batters and in drainage features.

Further refinement of the conceptual final landform has been undertaken and has involved GeoFluv™ modelling and other similar catchment/drainage review and landform design software to incorporate micro-relief and drainage/erosion control to limit the need for bench drains on the outer batters of the Eastern Out of Pit Emplacement.

Throughout the life of the MPO, the conceptual final landform may be revised to reflect the outcomes of the ongoing investigations, in consultation with MSC and relevant NSW Government agencies.

### ***General Design Concepts – Outer Batters of Eastern Out of Pit Emplacement***

The design improvement work conducted by MACH Energy to date for the outer batters of the Eastern Out of Pit Emplacement has maintained an average outer emplacement slope of approximately 10 degrees, to be generally consistent with the approved final landform of the MPO.

In order to develop a more natural looking landform, MACH Energy has incorporated significant areas of the outer emplacement batters at slopes of less than 10 degrees (lower slopes), and more limited areas of slopes up to approximately 14 degrees (upper slopes), to provide visually important slope variation, while also maintaining waste rock emplacement capacity.

In practice, significantly steeper slopes than 14 degrees in post-mining landforms can be sufficiently stable in the long term (as in the natural Hunter Valley environment), provided that they are utilised in positions in the final landform that have minimal upslope catchment (e.g. upper slopes) and are part of an integrated geomorphologically robust landform design that reflects the composition of the waste rock material.

MACH Energy will continue to refine the design of the proposed final landform, and where relevant, will justify areas to be constructed at steep grades (including slopes greater than 14 degrees) on the basis of maintaining waste emplacement capacity and how this is acceptable due to its hydrological/drainage position and/or geomorphically robust design in the final landform.

### ***External Drainage***

It is noted that the final landform is representative of the final landform that will remain if the MPO does not obtain suitable future authorisations to continue mining beyond 2026. In the event that mining did not proceed past 2026, the final landform will involve a range of earthworks to push down areas of the final highwalls and low-walls; the outcome being a single void remaining in the south with a relatively natural looking shape (Plans 4A and 4B).

In the final landform (Plans 4A and 4B) MACH Energy has sought to minimise the catchment area that reports to the eastern face of the Eastern Out of Pit Emplacement, to minimise the volume of water reporting to drainage features on the outer batters, and therefore minimise the need for highly visible traditional engineered linear drop structures.

The southern and eastern batters of the rehabilitated emplacement final landforms will drain externally to local tributary streams and ultimately to the Hunter River.

### ***Internal Drainage***

To minimise the area of steep slopes and the land sterilised by the final void, MACH Energy has designed the final landform to provide for gently sloping areas to the west of the Eastern Out of Pit Emplacement. These areas can potentially be utilised for productive agricultural industries (Section 4.2).

This includes a central area where incident rainfall will report to the final void, in part because there is a natural ridgeline to the immediate west of the open cut that remains as a topographic constraint to potential off-site site drainage of the central area if mining were to cease in 2026. It is noted that this ridgeline would be mined through in the originally approved 21 year mine life.

The design of the final void will be refined as required to ensure that the final void will not spill to the environment and will provide a groundwater sink (MACH Energy, 2017b). Final void modelling will be re-evaluated when revised groundwater inflow estimates are available from the MPO contemporary groundwater model (in preparation by HydroSimulations).

### ***Out of Pit Emplacement – Outer Batters Construction Methodology***

To facilitate the more rapid establishment of the final landform profiles, MACH Energy will generally construct the outer batters of the eastern face of the overburden emplacement in 10 metre (m) lifts that also facilitate the construction of more variable compound final landform slopes.



To maximise the topographic shielding of the evening and night-time mining operations, daytime only construction and final shaping of the outer parts of the Eastern Out of Pit Emplacement will be prioritised. This approach has the advantage of providing a visual and noise attenuation barrier between the open cut operations and the town of Muswellbrook, as well as facilitating the rapid establishment of initial rehabilitation on the lower portions of the emplacement.

### **4.3 REHABILITATION OBJECTIVES**

The overarching rehabilitation objectives for the MPO are formalised in Table 11, Condition 53, Schedule 3 of the Development Consent DA 92/97 (refer Table 1-1 of Section 1.1 of this MOP/RMP). These rehabilitation objectives have been incorporated into the rehabilitation objectives for each MPO domain which are detailed in Section 5.2. Section 6 of this MOP/RMP also aligns the MPO domain rehabilitation objectives with performance indicators and completion criteria to enable the performance of MPO rehabilitation to be evaluated, and for remedial action to be triggered (Section 9.2).

## 5 REHABILITATION PLANNING AND MANAGEMENT

### 5.1 DOMAIN SELECTION

The provisional primary and secondary domains for the MPO are outlined in Table 5-1.

**Table 5-1  
Provisional MPO Domains**

Code	Primary Domains	Code	Secondary Domain
1	Infrastructure Area	A	Final Void
2	Fines Emplacement Area	B	Water Infrastructure and Storage
3	Water Management Area	C	Rehabilitated Area – Agricultural Land
4	Active Void	D	Rehabilitated Area – Native Woodland/Grassland
5	Overburden Emplacement Area		

Based on the above, the final MPO domains will include:

- Domain 1C – Infrastructure Area rehabilitated to Agricultural Land;
- Domain 1D – Infrastructure Area rehabilitated to Native Woodland/Grassland;
- Domain 2C – Fines Emplacement Area rehabilitated to Agricultural Land;
- Domain 3B – Water Infrastructure and Storage retained post-mining;
- Domain 3D – Water Management Area rehabilitated to Native Woodland/Grassland;
- Domain 4A – Final Void;
- Domain 5C – Overburden Emplacement Area rehabilitated to Agricultural Land; and
- Domain 5D – Overburden Emplacement Area rehabilitated to Native Woodland/Grassland.

Plan 2 shows the MPO primary operational domains at the start of the MOP/RMP term, and Plan 3 shows the progression of development of the primary operational domains over the MOP/RMP term. Plan 4A provides a conceptual view of MPO final rehabilitation and the secondary post-mining land use domains.

### 5.2 DOMAIN REHABILITATION OBJECTIVES

The rehabilitation objectives for the provisional domains identified in Section 5.1 are described in Table 5-2.

**Table 5-2**  
**Domain Rehabilitation Objectives**

Code	Domain	Objectives
<b>All Domains</b>		
N/A	All primary domain areas	<p>Final landforms are safe, stable and non-polluting.</p> <p>Final landforms are stable and sustainable for the intended post-mining land use/s.</p> <p>Final landforms are integrated with surrounding natural landforms.</p> <p>Ensure public safety.</p>
<b>Primary Domains</b>		
1	Infrastructure Area	<p>Surface infrastructure not required for future use post-mining is decommissioned and removed (as agreed with relevant regulatory authorities).</p> <p>Area to be rehabilitated in accordance with relevant Secondary Domain rehabilitation objectives.</p>
2	Fines Emplacement Area	<p>Decommission and remove Fines Emplacement Area infrastructure (e.g. pumps, pipelines).</p> <p>Area to be rehabilitated in accordance with relevant Secondary Domain rehabilitation objectives.</p>
3	Water Management Areas	<p>Clean water will be diverted around operational areas, where practical.</p> <p>Mine water dams and sediment dams are to be decontaminated and decommissioned and removed from the final landform (except for permanent water management structures and storages agreed to be retained in the final landform).</p> <p>Sediment dams and associated water management structures will remain in place until the catchment is rehabilitated and discharge water quality is suitable for receiving waters and fit for aquatic ecology and riparian vegetation.</p> <p>Area to be rehabilitated in accordance with relevant Secondary Domain rehabilitation objectives.</p>
4	Active Void	<p>Backfilled open cut pit voids are safe, profiled for long-term stability and non-polluting.</p>
5	Overburden Emplacement Area	<p>Overburden Emplacement Areas are safe, stable, and non-polluting.</p> <p>Constructed slopes (low walls, ramps and drainage structures) to be limited to 10 degrees or lower as standard. Exceptions may include areas of local steepening required for drainage.</p> <p>Mining plant and equipment associated with the construction of the Overburden Emplacement will be dismantled, decommissioned and removed from site.</p> <p>Incorporate micro-relief and drainage lines that are consistent with surrounding topography, to the greatest extent practicable.</p> <p>Maximise surface water drainage to the natural environment (excluding final void catchment).</p>

**Table 5-2 (Continued)**  
**Domain Rehabilitation Objectives**

Code	Domain	Objectives
<b>Secondary Domains</b>		
A	Final Void	<p>Final void is safe, stable and non-polluting.</p> <p>Final void design to ensure the final void does not spill.</p> <p>Final void land use to be developed in consultation with relevant stakeholders.</p> <p>Final void shaped to be consistent with the surrounding natural environment and to avoid an engineered profile.</p> <p>Establish exotic pasture species on the final void, endwalls and highwalls.</p> <p>Final void designed as long-term groundwater sink to maximise groundwater flows across back filled pits to the final void.</p> <p>Minimise to the greatest extent practicable:</p> <ul style="list-style-type: none"> <li>- the size and depth of final voids;</li> <li>- the drainage catchment of final voids;</li> <li>- any high wall instability risk; and</li> <li>- the risk of flood interaction.</li> </ul>
B	Water Infrastructure and Storage	<p>Clean water diversion banks on overburden emplacements will be retained to divert water away from fill areas.</p> <p>Permanent water management structures will be designed and constructed prior to disturbance, in accordance with best practice guidelines, including Landcom (2004) <i>Managing Urban Stormwater: Soils and Construction Volume 1, 4<sup>th</sup> Edition</i> and DECC (2008) <i>Managing Urban Stormwater: Soils and Construction Volume 2</i>.</p> <p>Water retained on the site is fit for the intended post-mining land use/s, including potential long-term source of water for nearby intensive land uses (subject to obtaining relevant regulatory approvals).</p> <p>Water discharged from the site is suitable for receiving waters and fit for aquatic ecology and riparian vegetation.</p>
C	Rehabilitated Area – Agricultural Land	<p>Landform is functional and indicative of a landscape on a self-sustaining trajectory.</p> <p>Infrastructure would be decommissioned and removed (unless the NSW Resources Regulator agrees otherwise).</p> <p>Establish/restore grassland areas to support sustainable agricultural activities.</p> <p>Achieve the nominated land capability classification.</p>
D	Rehabilitated Area –Native Woodland/ Grassland	<p>Establish native vegetation comparable to suitable reference/analogous sites.</p> <p>Landform is functional and indicative of a landscape on a self-sustaining trajectory.</p> <p>Habitat features are salvaged and re-used in rehabilitation areas to provide fauna habitat resources.</p> <p>Restore self-sustaining native woodland ecosystems characteristic of vegetation communities found in the local area.</p> <p>Establish areas of self-sustaining:</p> <ul style="list-style-type: none"> <li>• riparian habitat, within any diverted and/or re-established creek lines and retained water features;</li> <li>• potential habitat for threatened flora and fauna species; and</li> <li>• wildlife corridors, as far as is reasonable and feasible, and as shown conceptually on Plan 4A.</li> </ul>

### 5.3 REHABILITATION PHASES

Rehabilitation works at the MPO commenced during the previous MOP/RMP term, on the Eastern Out of Pit Overburden Emplacement.

Consistent with the MOP Guidelines, the status of the rehabilitation phases for the MPO's domains at the end of the MOP/RMP term are summarised below and progress is shown diagrammatically in Table 5-3:

- Phase 1 – Decommissioning – removal of hard stand areas, buildings, contaminated materials, hazardous materials.
- Phase 2 – Landform Establishment – incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology.
- Phase 3 – Growing Media Development – incorporates physical, chemical and biological components of the growing media and ameliorants that are used to optimise the potential of the media in terms of the preferred vegetative cover.
- Phase 4 – Ecosystem and Land Use Establishment - incorporates revegetated lands and habitat augmentation; species selection, species presence and growth together with weed and pest animal control/management; and establishment of flora.
  - Areas at the Ecosystem and Land Use Establishment phase at the MPO reflects lands where habitat features have been placed, and the area has been topsoiled, deep ripped and revegetated with species relevant to the post-mining land use of the area (e.g. native woodland/grassland species or select pasture species). For MPO Overburden Emplacement areas (as shown on Plans 2 and 3) this includes land that has been seeded with stabilising cover crop species and native grass, shrub and tree species representative of the BC Act and EPBC Act listed White Box EEC.
- Phase 5 – Ecosystem and Land Use Sustainability – Incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function, which are the key elements of a sustainable landscape.
- Phase 6 – Relinquished Lands – land use and landscape is deemed as suitable to be relinquished from the Mining Lease.

**Table 5-3**  
**Status of Rehabilitation Phases for MPO Domains at end of MOP/RMP Term**

Rehabilitation Phases	1C – Infrastructure Area to be Rehabilitated to Agricultural Land	1D – Infrastructure Area to be Rehabilitated to Native Woodland/Grassland	2C – Fines Emplacement Area to be Rehabilitated to Agricultural Land	3B – Water Infrastructure and Storage to be Retained Post-Mining	3D – Water Management Areas to be Rehabilitated to Native Woodland/Grassland	4 – Active Void	5C – Overburden Emplacement to be Rehabilitated to Agricultural Land	5D – Overburden Emplacement to be Rehabilitated to Native Woodland/Grassland
Active	✓	✓	✓	✓	✓	✓	✓	✓
Decommissioning	✗	✗	✗	✗	✗	✗	✗	✗
Landform Establishment	✗	✗	✗	✗	✗	✗	✗	✓ <sup>1</sup>
Growing Media Development	✗	✗	✗	✗	✗	✗	✗	✓
Ecosystem and Land Use Establishment	✗	✗	✗	✗	✗	✗	✗	✓
Ecosystem and Land Use Sustainability	✗	✗	✗	✗	✗	✗	✗	✗
Rehabilitation Complete	✗	✗	✗	✗	✗	✗	✗	✗

<sup>1</sup> At the end of the MOP/RMP term, areas of the Eastern Out of Pit Overburden Emplacement will include areas at the Landform Establishment and Ecosystem and Land Use Establishment phases.

A detailed description of the rehabilitation activities proposed to be undertaken during the MOP/RMP term is provided in Section 7.2. Rehabilitation performance at the MPO will be reported in the Annual Review (Section 10).



## 6 REHABILITATION OBJECTIVES, PERFORMANCE INDICATORS AND COMPLETION CRITERIA

Condition 56 (h), Schedule 3 of Development Consent DA 92/97 requires performance indicators and completion criteria to be developed for evaluating the performance of the rehabilitation of the site, and for triggering remedial action (if required).

Accordingly, rehabilitation performance indicators and completion criteria have been developed and are detailed in Tables 6-1 to 6-5. The performance indicators and completion criteria reflect the MPO's overarching rehabilitation objectives provided in Condition 53, Schedule 3 of the Development Consent (Section 1.1) and the MPO domain rehabilitation objectives (Section 5.2).

The MOP Guidelines require that detailed rehabilitation performance indicators and completion criteria be prepared for each rehabilitation domain according to the following key rehabilitation phases:

- Decommissioning phase;
- Landform Establishment phase;
- Growth Media Development phase;
- Ecosystem and Land Use Establishment phase; and
- Ecosystem and Land Use Sustainability phase.

Therefore, consistent with the requirements of the MOP Guidelines, Tables 6-1 to 6-5 include performance indicators and completion criteria for each MPO domain for each of the rehabilitation phases listed above.

For the domains where the final rehabilitation and post-mining land use objectives include alternative options that are still subject to consultation and agreement (e.g. decommissioning water management infrastructure or retaining for future use post-mining), the performance indicator will be to undertake the relevant consultation to determine the final rehabilitation and post-mining land use objective. The relevant completion criteria will then be updated in future MOP/RMPs once the post-mining land use is agreed for these domains.

The following rehabilitation performance indicators and completion criteria are considered generally consistent with the six principles of the *National standards for the practice of ecological restoration in Australia* developed by the Society for Ecological Restoration Australasia (SERA) (2018), in particular Principle 3 '*Recovery of ecosystem attributes is facilitated by identifying clear targets, goals and objectives*'.

The rehabilitation performance indicators and completion criteria will be reviewed and may be updated during the Annual Review and MOP/RMP revision process (Section 10) or as a result of monitoring and research (Sections 8.1 and 8.2) to align with any changes to the MPO or incorporate any recommended measures to improve the environmental performance of the development. This iterative process for rehabilitation at the MPO, whereby the results of monitoring results and research will be used to refine the MPO's rehabilitation program, is also considered consistent with Principle 5 '*Restoration science and practice are synergistic*' of the *National standards for the practice of ecological restoration in Australia* (SERA, 2018).

**Table 6-1**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Decommissioning Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
Primary Domain 1 – Infrastructure Area						
Surface infrastructure not required for future use post-mining is decommissioned and removed (as agreed with relevant regulatory authorities).	Decommission and remove infrastructure.	Relevant surface infrastructure has been demolished and removed from the site, including buildings and fixed plant, ROM and product stockpiles, bitumen carparks, waste oil/lubricant storage areas, rail load-out facility and rail loop.	Development Consent – Schedule 3, Condition 53	No	N/A	Not Commenced
		All demolition work has been carried out in accordance with AS2601-2001: <i>The Demolition of Structures</i> or its latest version.		No	N/A	Not Commenced
		Internal haul roads, access tracks and hardstands have been removed when no longer required.		No	N/A	Not Commenced
Primary Domain 2 – Fines Emplacement Area						
Decommission and remove Fines Emplacement Area infrastructure (e.g. pumps, pipelines).	Decommission and remove infrastructure.	Pipelines, pumps and related Fines Emplacement Area infrastructure removed.	Development Consent – Schedule 3, Condition 53	No	N/A	Not Commenced
Primary Domain 3 – Water Management Areas						
Mine water dams and sediment dams are to be decontaminated, decommissioned and removed from final landform (except for permanent water management structures and storages agreed to be retained in the final landform).	Hazardous materials.	Sediments accumulated in mine water and sediment dams are removed from the dam floor and emplaced in the final void.	Development Consent – Schedule 3, Condition 53	No	N/A	Not Commenced
		Mine water dams are emptied and discharge water disposed of in final void.		No	N/A	Not Commenced
	Mine water structures are decommissioned.	Water management structures that are not to be retained in the final landform have been decommissioned (i.e. dam walls removed, drained and decontaminated).		No	N/A	Not Commenced

**Table 6-1 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Decommissioning Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Primary Domain 5 – Overburden Emplacement Area</b>						
Mining plant and equipment associated with the construction of the Overburden Emplacement will be dismantled, decommissioned and removed from site.	Removal of plant and equipment.	Relevant plant and equipment has been dismantled, decommissioned and removed from the overburden emplacement area.	Development Consent – Schedule 3, Condition 53	No	N/A	Not Commenced
<b>All Domains</b>						
Final landforms are safe, stable and non-polluting.	Non-polluting landform.	Land Contamination Assessment undertaken and contaminated soils removed and area remediated in accordance with NSW <i>Contaminated Land Management Act 1997</i> and revegetated with relevant Secondary Domain plant species.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced

**Table 6-2**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Landform Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>All Primary Domains</b>						
Final landforms are safe, stable and non-polluting.  Final landforms are stable and sustainable for the intended post-mining land use/s.	Slopes.	Constructed slopes (low walls, ramps and drainage structures) to be limited to 10 degrees or lower as standard. Exceptions, where angles of 10 degrees will include: <ul style="list-style-type: none"> <li>the highwall, low wall, safety berm and top batter of the final void; and</li> <li>local steepening of areas for drainage on the Overburden Emplacement.</li> </ul>	Development Consent – Schedule 3, Condition 53	Ongoing	Section 9.2	Commenced
	Landform stability.	Revegetation and/or cover crop undertaken within six months of landform reconstruction and soil application.  Reconstructed landforms are stable with no evidence of slumping.		Ongoing	Section 9.2	Commenced
	Non-polluting landform.	Runoff from rehabilitated landforms is equivalent to runoff from pre-mining and/or analogous catchments (when considering the natural range of values).		No	N/A	Not Commenced
Ensure public safety.	Public safety.	Public access restricted to mine site and rehabilitation areas.		Yes	N/A	Complete
Final landforms are integrated with surrounding natural landforms.	Landform compatibility.	Avoidance of straight lines and angular corners in profiles of final landforms.  Drainage lines to be self-sustaining and predominantly constructed of natural materials.  Visual screens comprising mounding or bunding are established as per the VIMP.  Water management areas, drainage paths, contour drains, ridgelines, and emplacements are shaped, where possible, in undulating informal profiles in keeping with natural landforms of the surrounding environment.	Development Consent – Schedule 3, Condition 53	Ongoing	N/A	Commenced

**Table 6-2 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Landform Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Primary Domain 5 – Overburden Emplacement Area</b>						
Overburden Emplacement Areas are safe, stable and non-polluting.	Non-polluting landform.	Materials with a propensity to generate acid mine drainage (e.g. reject material and Wynn seam overburden material) are buried under inert material, with a minimum cover of 10 m.	Development Consent – Schedule 3, Condition 53	Ongoing	Section 9.2	Commenced
Constructed slopes (low walls, ramps and drainage structures) to be limited to 10 degrees or lower as standard. Exceptions may include areas of local steepening required for drainage.	Landform design.	Suitably qualified and experienced Geomorphologist confirms landform design incorporates micro-relief and drainage lines consistent with the surrounding topography.	Development Consent – Schedule 3, Condition 53	Ongoing	Section 9.2	Commenced
Incorporate micro-relief and drainage lines that are consistent with surrounding topography, to the greatest extent practicable.						



**Table 6-2 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Landform Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Primary Domain 5 – Overburden Emplacement Area (continued)</b>						
Maximise surface water drainage to the natural environment (excluding final void catchment).	Free draining landform.	Modelling of landform design indicates the landform is free draining (excluding the retained final void) to allow effective catchment contribution and yield to the Hunter River.	Development Consent – Schedule 3, Condition 53	Ongoing	Section 9.2	Commenced
<b>Secondary Domain A – Final Void</b>						
Final void is safe, stable and non-polluting.	The void surrounds are safe (for humans and stray stock).	Perimeter bund constructed, is stable and vegetated with self-regenerating and perennial cover crop.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		Void fenced and warning signs posted along the fence, in a manner satisfactory to the Resource Regulator.		No	N/A	Not Commenced
	Slopes.	Low walls have been battered back to slopes less than 18 degrees, unless otherwise agreed with Resources Regulator.		No	Section 9.2	Not Commenced
Final void is safe, stable and non-polluting.	Non-polluting landform.	No carbonaceous materials are exposed in the final void floor/walls.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		Size and depth of final void is in accordance with the approved final void design.		No	Section 9.2	Not Commenced
Designed as long-term groundwater sinks to maximise ground water flows across back filled pits to the final void.	Groundwater modelling.	Modelling indicates that final landform and void design is a groundwater sink.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Minimise to the greatest extent practicable the size and depth of final voids.	Final void design.	Final void design has reduced the size and depth of the void by backfilling and landform reconstruction works.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced

**Table 6-2 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Landform Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Secondary Domain A – Final Void (continued)</b>						
Minimise to the greatest extent practicable the drainage catchment of final voids.	Landform and surface water modelling.	Surface water modelling indicates final void catchment has been reduced to the greatest extent possible.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Minimise to the greatest extent practicable any high wall instability risk.	Geotechnical stability and design.	The final void highwalls and low walls are constructed in accordance with an approved Final Void Geotechnical Design.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		The final void highwalls and low walls have been assessed by a qualified geotechnical engineer to validate long-term stability.		No	Section 9.2	Not Commenced
Minimise to the greatest extent practicable the risk of flood interaction.	Flood modelling.	Modelling indicates that final landform and void design has minimal interaction with flooding from surrounding areas.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
<b>Secondary Domain B – Water Infrastructure and Storage</b>						
Final landforms are safe, stable and non-polluting.	Final landform drainage design.	Final landform water management structures and storages have been designed and constructed in accordance with 'Blue Book' (i.e. Landcom [2004] <i>Managing Urban Stormwater: Soils and Construction Volume 1 4<sup>th</sup> Edition</i> and DECC [2008] <i>Managing Urban Stormwater: Soils and Construction Volume 2</i> ) requirements and the approved final landform drainage design.	Development Consent – Schedule 3, Condition 53	Ongoing	N/A	Commenced
		Use of permanent drop structures is avoided where practical.		Ongoing	N/A	Commenced

**Table 6-3**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Growing Media Development Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>All Domains</b>						
Materials from areas disturbed under this consent (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	Topsoil and subsoil salvaging.	Topsoil and subsoils are stripped separately and re-spread or stockpiled for later use in accordance with soil stripping and stockpiling procedures provided in the MPO's Topsoil Stripping Management Plan.	Development Consent – Schedule 3, Condition 53	Ongoing	Section 9.2	Commenced
	Topsoil re-spreading	Topsoils re-spread at a minimum depth of 100mm.		Ongoing	Section 9.2	Commenced
		Re-spread topsoil is ripped along the contour.		Ongoing	Section 9.2	Commenced
	Habitat material salvaging and re-use.	Trees, logs, rocks salvaged during clearing activities and stockpiled for use in rehabilitation.		Ongoing	Section 9.2	Commenced
		Two habitat trees, two rock piles and two log piles or supplementary features (e.g. nest boxes) have been installed per hectare across Secondary Domain D areas (excluding inappropriate areas e.g. drainage features and water management structures) (Plates 1 and 2).		Ongoing	Section 9.2	Commenced
	Seed collection.	Seed collected during clearing when available and managed in Seed Harvesting Facility.		Ongoing	Section 9.2	Commenced
	Topsoil/subsoil characterisation	Physical properties (texture, structure and Emerson Aggregate assessment) of topsoils, topsoil substitutes and subsoils have been assessed for suitability for post-mining land use.		Ongoing	Section 9.2	Commenced
		Chemical properties (pH, salinity, nitrogen and phosphorus) of topsoils, topsoil substitutes and subsoils have been assessed for suitability for post-mining land use.		Ongoing	Section 9.2	Commenced
		Biological properties and organic content of topsoils, topsoil substitutes and subsoils have been assessed for suitability for post-mining land use.		Ongoing	Section 9.2	Commenced
	Soil amelioration	Appropriate soil ameliorants (e.g. gypsum, fertiliser, mulch, microbial resources) have been applied in accordance with specifications/recommendations of soil characterisation reports.		Ongoing	Section 9.2	Commenced

**Table 6-4**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>All Domains</b>						
Suitability of vegetation is fit for the intended post mining land use.	Vegetation characteristics.	Monitoring indicates vegetation (native woodland or pasture) is on a trajectory towards comparable analogue sites.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
<b>Secondary Domain C – Rehabilitation Area – Low Intensity Agriculture</b>						
Establish/restore grassland areas to support sustainable agricultural activities.	Pasture establishment.	Monitoring and trials indicate perennial pasture establishment is on a trajectory towards analogue grazing sites as determined by a suitably qualified Agronomist.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Achieve the nominated land capability classification.	Land Capability Class.	Monitoring indicates that areas developing Land Suitability Class 4, 5 or 6 as determined by a suitably qualified Agronomist.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
<b>Secondary Domain D – Rehabilitation Area – Native Woodland/Grassland</b>						
Restore self-sustaining native woodland ecosystems characteristic of vegetation communities found in the local area.	Species composition.	Monitoring results indicate overstorey species characteristic of surrounding native vegetation are present.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		Monitoring results indicate native ground cover species are on a self-sustaining trajectory towards equivalent data from analogue sites.		No	Section 9.2	Not Commenced
	Vegetation structure.	Monitoring results indicate that vegetation community structure (the density of trees, shrubs, grasses and forbs) is on a self-sustaining trajectory towards equivalent data from analogue sites.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced

**Table 6-4 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Establishment Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Secondary Domain D – Rehabilitation Area – Native Woodland/Grassland</b>						
Establish areas of self-sustaining riparian habitat, within any diverted and/or re-established creek lines and retained water features.	Species composition and vegetation structure.	Monitoring results indicate that vegetation community structure (the density of trees, shrubs, grasses and forbs), and species composition represents riparian habitat and is on a self-sustaining trajectory towards equivalent data from analogue sites.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Establish areas of self-sustaining potential habitat for threatened flora and fauna species.	Species composition and vegetation structure.	Monitoring results indicate that vegetation community structure (the density of trees, shrubs, grasses and forbs) and species composition is representative of habitat to support some threatened flora and fauna, and is on a self-sustaining trajectory towards equivalent data from analogue sites.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Establish areas of self-sustaining wildlife corridors, as far as is reasonable and feasible.	Vegetation cover and continuity.	Monitoring results and aerial imagery shows continuity of native woodland vegetation across the eastern slope which borders (up to Wybong Road) the proposed woodland rehabilitation at the Bengalla Mine to the south.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced



**Table 6-5**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Sustainability Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
Secondary Domain B – Water Infrastructure and Storage						
Water retained on the site is fit for the intended post-mining land use/s.	Water quality.	Water monitoring indicates onsite water is suitable for the post-mining land use (i.e. agriculture, native ecosystem).	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Water discharged from the site is suitable for receiving waters and fit for aquatic ecology and riparian vegetation.		Water monitoring indicates onsite water is comparable to surrounding analogue sites and suitable for receiving waters, aquatic ecology and riparian vegetation.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Secondary Domain C – Rehabilitation Area – Agriculture land						
Establish/restore grassland areas to support sustainable agricultural activities.	Pasture establishment.	Monitoring and trials indicate suitable perennial pasture establishment for grazing purposes has been achieved compared to analogue sites as determined by a suitably qualified Agronomist.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Achieve the nominated land capability classification.	Land Capability Class.	Monitoring indicates that areas have developed Land Suitability Class 4, 5 or 6 as determined by a suitably qualified Agronomist.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
Self-sustaining native woodland ecosystems established characteristic of vegetation communities found in the local area.	Long-term species composition.	Monitoring results indicate overstorey species characteristic of surrounding native vegetation are present.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		Monitoring results indicate native ground cover species are on a self-sustaining trajectory towards equivalent data from analogue sites (e.g. evidence of seed set).		No	Section 9.2	Not Commenced

**Table 6-5 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Sustainability Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Secondary Domain D – Rehabilitation Area –Native Woodland/Grassland</b>						
Self-sustaining native woodland ecosystems established characteristic of vegetation communities found in the local area (continued)	Long-term vegetation structure. <sup>1</sup>	Monitoring results indicate that vegetation community structure (the density of trees, shrubs, grasses and forbs) is on a self-sustaining trajectory towards equivalent data from analogue sites.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
	Long-term vegetation Functionality.	Monitoring results indicate that vegetation is on a self-sustaining trajectory including many species setting seed.		No	Section 9.2	Not Commenced
	Interim native plant species richness. <sup>2</sup>	For PCT 483, the rehabilitation will achieve >6 species for the native plant species richness.		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >9 species for the native plant species richness.		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >11 species for the native plant species richness.		No	Section 9.2	Not Commenced
	Interim Over-storey cover. <sup>2</sup>	For PCT 483, the rehabilitation will achieve >1% of the native over-storey cover.		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >3% of the native over-storey cover.		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >2% of the native over-storey cover.		No	Section 9.2	Not Commenced

**Table 6-5 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Sustainability Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Secondary Domain D – Rehabilitation Area –Native Woodland/Grassland (continued)</b>						
Self-sustaining native woodland ecosystems established characteristic of vegetation communities found in the local area (continued)	Interim Mid-storey cover. <sup>2</sup>	For PCT 483, the rehabilitation will achieve >1% of the native mid-storey cover.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >2% of the native mid-storey cover.		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >1% of the native mid-storey cover.		No	Section 9.2	Not Commenced
	Interim Native groundcover (grasses). <sup>2</sup>	For PCT 483, the rehabilitation will achieve >1% of the native ground cover (grasses).		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >1% of the native ground cover (grasses).		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >3% of the native groundcover (grasses).		No	Section 9.2	Not Commenced
	Interim Native groundcover (shrubs). <sup>2</sup>	For PCT 483, the rehabilitation will achieve >1% of the native groundcover (shrubs).		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >1% of the native groundcover (shrubs).		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >1% of the native groundcover (shrubs).		No	Section 9.2	Not Commenced
	Interim Native groundcover (other). <sup>2</sup>	For PCT 483, the rehabilitation will achieve >1% of the native groundcover (other).		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >1% of the native groundcover (other).		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >2% of the native Groundcover (other).		No	Section 9.2	Not Commenced

**Table 6-5 (Continued)**  
**Rehabilitation Objectives, Performance Indicators and Completion Criteria Ecosystem and Land Use Sustainability Phase**

Domain Objective	Performance Indicator	Completion Criteria	Justification Source	Complete	Link to TARP	Progress
<b>Secondary Domain D – Rehabilitation Area –Native Woodland/Grassland (continued)</b>						
Self-sustaining native woodland ecosystems established characteristic of vegetation communities found in the local area (continued)	Interim Exotic plant cover. <sup>2</sup>	For PCT 483, PCT 1605, and PCT 1604, exotic plant cover will be <60%.	Development Consent – Schedule 3, Condition 53	No	Section 9.2	Not Commenced
	Interim Total length of fallen logs. <sup>2</sup>	For PCT 483, the rehabilitation will achieve >12.5 m of total length of fallen logs.		No	Section 9.2	Not Commenced
		For PCT 1605, the rehabilitation will achieve >18.25 m of total length of fallen logs.		No	Section 9.2	Not Commenced
		For PCT 1604, the rehabilitation will achieve >1.25 m of total length of fallen logs.		No	Section 9.2	Not Commenced
	Bare ground	Landscape Function Analysis – Soil Surface Assessment indicators demonstrate a comparable coverage and/or trajectory towards it.  Areas and functionality of bare ground are equivalent to areas of bare ground at analogue sites.		No	Section 9.2	Not Commenced

<sup>1</sup> In the absence of quantitative data from relevant analogue monitoring sites located within local PCT areas, appropriate stem densities would be guided by Gibbons et. al. (2010) *Benchmark stem densities for forests and woodlands in south-eastern Australia under conditions of relatively little modification by humans since European settlement*.

<sup>2</sup> In the absence of quantitative data from relevant analogue monitoring sites located within local PCT areas, interim completion criteria for each PCT have been included which have been developed using the methodology provided in Table 6 of the OEH (2014) *Framework for Biodiversity Assessment* and the relevant OEH vegetation condition benchmarks for each PCT (OEH, 2017). The 'Allowable increase in the site attribute condition score from zero' assigned in Table 6 of the *Framework for Biodiversity Assessment* (OEH, 2014) has been conservatively chosen as a minimum of 0.5. Table 6 of the OEH (2014) *Framework for Biodiversity Assessment* is provided as Attachment 4 of this MOP/RMP. Once a data set has been obtained from relevant analogue monitoring sites over a number of monitoring rounds, the completion criteria set will be revised to reflect the data from the analogue sites.

Notes:

PCT 483 – Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley.

PCT 1605 – Narrow-leaved Ironbark – Native Olive shrubby open forest of the central and upper Hunter.

PCT 1604 – Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass woodland of the central and lower Hunter.

## 6.1 MINE CLOSURE AND LEASE RELINQUISHMENT

Upon the cessation of mining operations, tenure of MLs will be maintained by MACH Energy until such a time when lease relinquishment criteria have been met and rehabilitation is to the satisfaction of relevant regulatory authorities including the Resources Regulator and the DPE. It is anticipated that lease relinquishment criteria would include:

- Rehabilitated landforms are stable and consistent with the nominated post-mining land use which has been developed in consultation with relevant regulatory agencies and key stakeholders.
- All rehabilitation and mine closure completion criteria have been met.
- All Mining Lease conditions (including public safety considerations) have been satisfied.
- Hard-stand areas and infrastructure have been removed (unless otherwise agreed with the ultimate landholder).

In accordance with Condition 21 of EPBC Approval 2011/5795, a Mine Closure Plan for the MPO will be submitted to the DEE at least 6 months prior to the closure of the MPO. The Mine Closure Plan would be prepared in consideration of the International Council on Mining and Metals (ICMM) (2018) *Integrated Mine Closure Good Practice Guide*. Mine closure concepts and management measures will continue to be developed via the MOP/RMP and MPO Rehabilitation Strategy revision process in consultation with the DPE, Resources Regulator and other relevant regulatory agencies.

A socio-economic study will be commissioned five years prior to expected mine closure, which will evaluate and address the following:

- developing a contemporary baseline of the MPO workforce and community profile;
- identifying potential socio-effects (positive and negative) of the mine closure on the MPO workforce, associated workforce (subcontractors, suppliers) and the broader community;
- proposing measures to minimise potential negative effects and maximise potential positive effects of mine closure, in consultation with stakeholders; and
- developing a draft implementation programme for the measures identified to address social effects.

The findings of the socio-economic study may inform the subsequent versions of the MPO Rehabilitation Strategy and the MOP/RMP. For example, consultation undertaken to date with MSC has identified a preference for intensive agricultural/industrial post-mining land uses that provide employment for the local community. This has been taken into consideration in the final landform design and rehabilitation domains with proposed areas nominated for such land uses. If this preference changes over time, the MPO Rehabilitation Strategy and this MOP/RMP will be updated, considering the progress of final landform established and economic factors.



## 7 REHABILITATION IMPLEMENTATION

Section 7.2 describes the proposed rehabilitation activities during the MOP/RMP term. Activities will focus on rehabilitation of completed areas of the Eastern Out of Pit Overburden Emplacement including native woodland/grassland vegetation, and ongoing progressive rehabilitation of construction and exploration areas and temporary stabilisation works. Section 7.2.4 specifically describes the process to reinstate native woodland and fauna habitat, and Section 7.4 describes the approach for reinstating agricultural grassland areas, in accordance with Condition 56(e), Schedule 3 of the Development Consent.

### 7.1 STATUS AT MOP/RMP COMMENCEMENT

Rehabilitation at the MPO commenced in mid 2018. Rehabilitation works commenced on the south-eastern extent of the Eastern Out of Pit Overburden Emplacement.

At the start of this MOP/RMP term, approximately 54 ha of the Eastern Out of Pit Overburden Emplacement has been rehabilitated to the Ecosystem and Land Use Establishment phase. Rehabilitation activities have included bulk landform shaping in accordance with geomorphic design principles that incorporates macro and micro relief, habitat feature installation (including stag/habitat trees, log piles and rock piles), topsoil and gypsum spreading, deep ripping along the contour, seeding with native grass, tree and cover crop species and native tubestock planting.

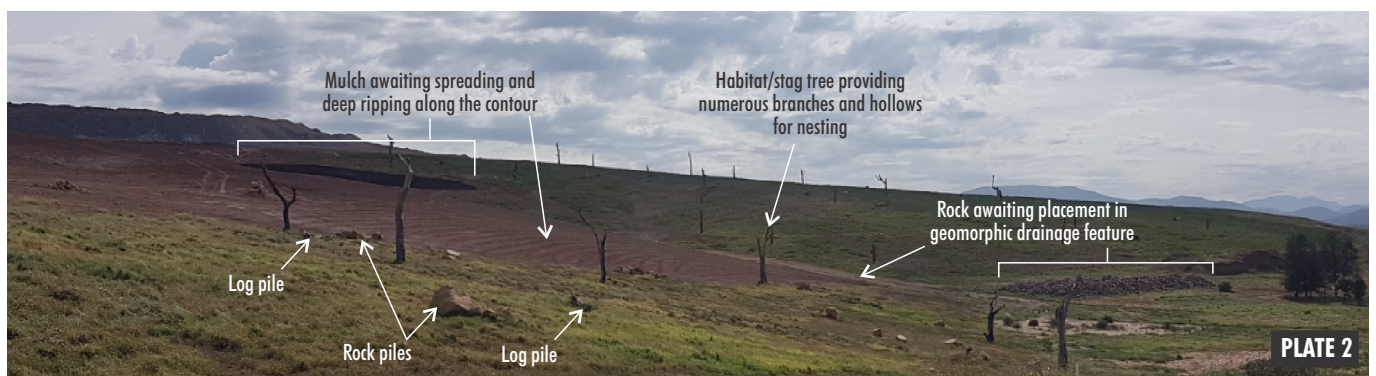
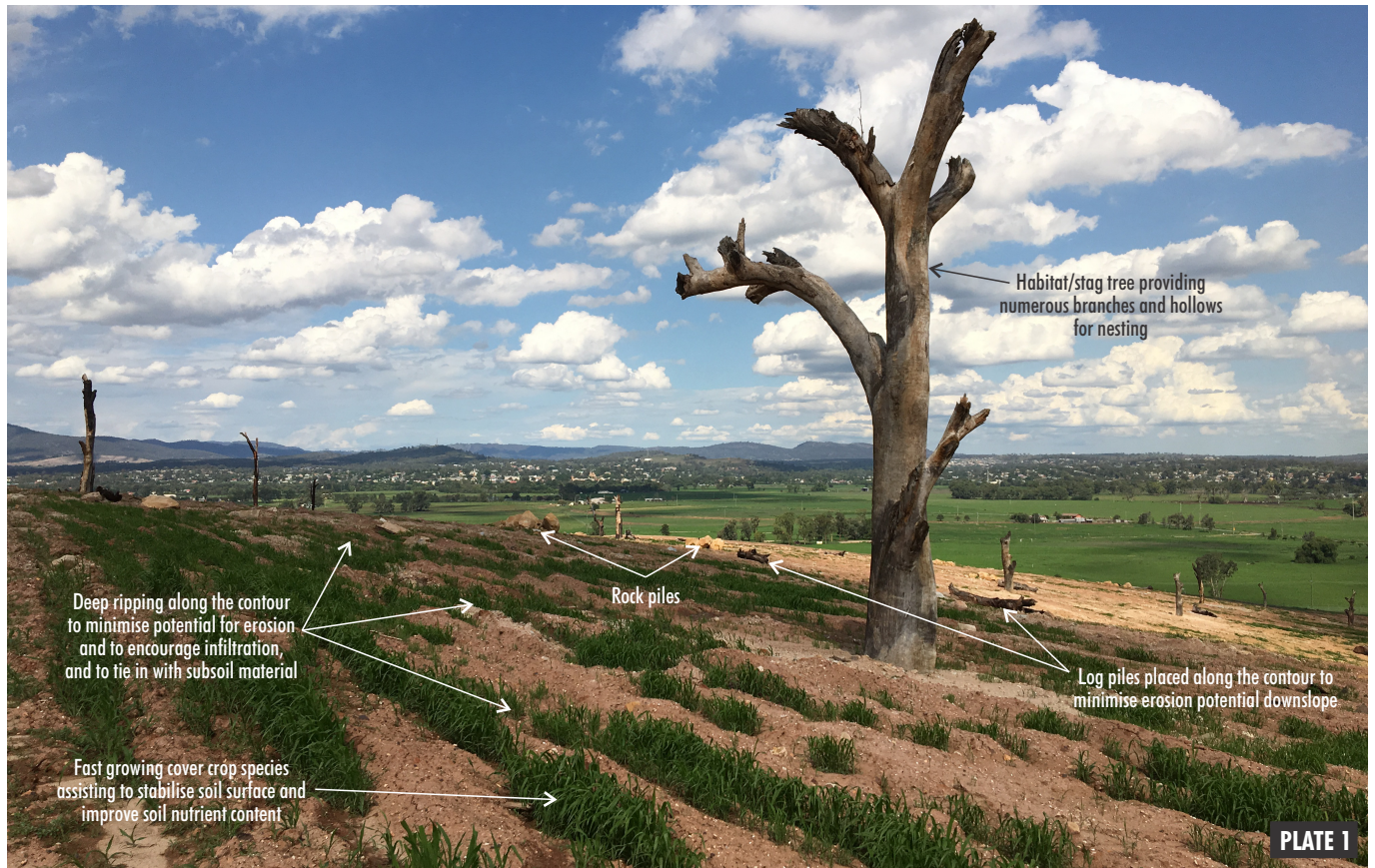
Plates 1 to 3 provide photographs of landform shaping that has been undertaken in accordance geomorphic design principles and habitat feature installation on outer batters of the Eastern Out of Pit Overburden Emplacement.

During the previous MOP/RMP term, MACH Energy also completed a number of rehabilitation activities outside of the mining area, including visual tree screen planting both within and outside of the Mining Lease boundary, nest box installation in the visual tree screen areas, planting of the ROM bund, harrowing and seeding of construction areas and seeding completed mine water management structures and embankments. Rehabilitation of construction areas, including shaping and seeding and/or planting activities and additional tree planting programs will continue throughout this MOP/RMP term.

A summary of the status of the MPO Primary and Secondary Domains at commencement of this MOP/RMP is provided in Table 7-1 below.

**Table 7-1**  
**Status of MPO Primary and Secondary Domains**

Domain	Status at MOP/RMP Commencement
<b>Primary Domains</b>	
Domain 1 – Infrastructure Area	This domain is currently active, with rehabilitation of completed construction areas undertaken
Domain 2 – Fines Emplacement Area	This domain is currently active and subject to ongoing operations. Seeding with cover crop species has been undertaken on the FEA embankments.
Domain 3 – Water Management Area	This domain is currently active and subject to ongoing operations. Seeding with cover crop species has been undertaken on embankments of completed water management structures.
Domain 4 – Active Void	This domain is currently active and subject to ongoing operations.
Domain 5 – Overburden Emplacement Area	This domain is currently active and subject to ongoing operations.



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**Table 7-1 (Continued)**  
**Status of MPO Primary and Secondary Domains**

Domain	Status at MOP/RMP Commencement
<b>Secondary Domains</b>	
Domain A – Final Void	Mining has not progressed to the location of the final void at commencement of the MOP/RMP term.
Domain B – Water Infrastructure and Storage	This domain is currently active and subject to ongoing operations.
Domain C – Rehabilitated Area – Agricultural Land	Areas proposed for Agricultural Land post-mining are currently active and subject to ongoing operations.
Domain D – Rehabilitated Area – Native Woodland/Grassland	Approximately 54 ha of Native Woodland/Grassland has been established as at commencement of this MOP/RMP.

## 7.2 PROPOSED REHABILITATION ACTIVITIES DURING THE MOP/RMP TERM

During the MOP/RMP term, rehabilitation of areas of the Eastern Out of Pit Overburden Emplacement will continue to be the focus of rehabilitation works (once the areas become available) (Plan 3).

Sections 7.2.1 to 7.2.5 provide a description of the rehabilitation materials used for MPO rehabilitation activities, the re-shaping and rehabilitation activities for overburden emplacement outer batters, rehabilitation activities for completed construction areas, the process for reinstatement of native woodland areas and a summary of MPO disturbance and rehabilitation areas.

The monitoring of rehabilitation performance is described in Section 8.1 and rehabilitation research trials are described in Section 8.2. MACH Energy proposes to build on industry rehabilitation research results by using the results of monitoring and trials to refine the rehabilitation program at the MPO.

### 7.2.1 Rehabilitation Materials

Consistent with the rehabilitation objectives within Table 11, Condition 53 of Schedule 3 of the Development Consent DA 92/97, MACH Energy will undertake measures to retain as much material as practicable from the pre-mining landform and surrounds to use during rehabilitation of the MPO. Such measures will include:

- Implementing a VCP which will identify and retain material for rehabilitation including habitat material (e.g. tree hollows, stag trees, coarse woody debris and rocks) and seeding vegetation for seed collection prior to clearing.
- Seed collection and propagation using the on-site Seed Harvesting Facility or external provider.
- Rehabilitation material characterisation in order to:
  - identify any physical or chemical deficiencies or limiting factors;
  - develop selective placement strategies or develop soil amelioration techniques;
  - identify material for use in the root zone, which is capable of supporting sustainable vegetation establishment;
  - identify materials that limit plant growth or which may contaminate surface or groundwater (e.g. salinity), and hence may require special handling, treatment or disposal; and
  - identify any propensity for spontaneous combustion.
- Topsoil and subsoil stripping (guided by soil mapping) and management in designated stockpiles.

Section 3.2.7 of this MOP/RMP outlines the soil management procedures that will be implemented at the MPO including the procedures for characterising the suitability of stored soil for rehabilitation use.

A detailed description of the MPO's VCP and seed collection and propagation procedures using the on-site Seed Harvesting Facility is provided in the MPO's Biodiversity Management Plan. A seed/seedling supply plan will be developed to ensure adequate quantities of seed/seedlings are available for each rehabilitation campaign for the MOP/RMP term, or if seed/seedlings will be required to be externally sourced.

### **7.2.2 Progressive Re-Shaping and Rehabilitation of Emplacement Outer Batters**

During the MOP/RMP term, MACH Energy will prioritise construction of the eastern outer batters of the Eastern Out of Pit Overburden Emplacement to the final landform profile (Plan 3). The emplacement landform would be developed in 10 m lifts to enable more rapid establishment of the final surface levels, as waste rock placement progresses more rapidly than the alternative of construction in 20 m emplacement lifts that takes significantly longer to develop, and also requires longer to reshape.

MACH Energy targets reshaping to final surface level and initial revegetation of all outer emplacement batter lifts of the Eastern Out of Pit Emplacement within 6 months of each subsequent dump panel lift being completed (subject to delays associated with climatic extremes).

The design concept, principles and construction methodology for the overburden emplacement is described in detail in Section 4.2.2, which includes reshaping the emplacement to include macro and micro relief and geomorphic features to develop a more natural looking and functional landform. Plan 4B provides a plan view of the final landform and includes contour and elevation detail and shows the spurs and valleys that will be incorporated into the final landform.

MACH Energy's ITP process will be conducted, firstly, during the landform design phase to confirm the design model has been developed in accordance with relevant specifications and, secondly, after landform construction to verify construction has been undertaken as per design.

In general, the rehabilitation methodology will involve:

- Spreading topsoil onto rehabilitation areas, at a minimum depth of approximately 100 mm, that is mixed with gypsum at a standard application rate of 10 tonnes per hectare. As described in Section 3.2.7, replaced soil sourced from soil stockpiles greater than 3 m in height will be inoculated with Mycorrhizal fungi and rhizobia bacteria to assist with alleviating potential problems with anaerobic conditions that may have developed within the soil during stockpiling.
- Deep ripping the rehabilitation area along the contour to a minimum depth of 500 mm to encourage infiltration. Where practicable, ripping will be undertaken immediately prior to seeding to assist root/vegetation establishment.
- Seeding the rehabilitation area with a native seed mix including native grass, shrub and tree species and temporary cover crop species.
- Installation of habitat features including habitat/stag trees, log piles and rock piles across the rehabilitation area. Where practicable, a minimum of two habitat/stag trees, two log piles and two rock piles will be installed per hectare. Additional information regarding the installation of habitat features is provided in Section 7.2.4.
- Planting of tubestock including ground, middle and upper stratum species of the relevant target PCTs (as listed in Table 7-2 in Section 7.2.4) when suitable climatic conditions prevail (preferably in the cooler months of spring or autumn within 1 to 2 days after 25 mm of rainfall, where possible).
- Installation of signage denoting rehabilitation area to restrict access and minimise potential for disturbance to the area.

Planting of rehabilitation areas will be undertaken by qualified ecologist, and in accordance with the revegetation rationale (Section 7.2.4), with plant placement varying depending on species, rehabilitation area and aspect, timing and research and/or trial results.

A Rehabilitation Procedure has been developed to guide rehabilitation activities at the MPO and to ensure rehabilitation methods/practices are replicated during each rehabilitation campaign.

In accordance with the outcomes of the January 2020 Rehabilitation Risk Assessment (Section 3.1), MACH Energy will develop a training package for rehabilitation activities undertaken at the MPO, including visual aids and in-field practical demonstrations. The training package aims to facilitate consistent execution of rehabilitation activities at the MPO year after year. The training package would also mitigate against the loss of knowledge/skills/expertise should a change of MPO personnel occur.

### **7.2.3 Progressive Rehabilitation of Construction and Exploration Areas and Soil Stockpiles**

Completed construction areas will continue to be rehabilitated during the MOP/RMP term and would include harrowing to relieve soil compaction and then seeding with temporary cover crop species and native grass species to minimise exposed surfaces, and the potential for dust generation, soil erosion and weed incursion.

All exploration drill holes will be sealed and capped in accordance with the requirements of AUTH 459 and MPO ML Authorities. Decommissioning of each drill pad area would involve the complete removal of all equipment and any temporary fencing.

Rehabilitation measures would aim to return the drill pad area to its prior condition. As vegetation disturbance at drill pad areas would be limited, the area would either be allowed to regenerate or would be seeded with species characteristic of the area. Weed control would be conducted as necessary. An inspection of drill pad areas to review regeneration or rehabilitation performance would be undertaken as required.

As described in Section 3.2.7, long-term soil stockpiles (i.e. soil stockpiles that will be maintained for longer than 6 months) will be managed to maintain soil viability, seed reserves and microbial associations. Measures will include deep-ripping the stockpile, seeding with sterile pasture species and native grass, shrub and tree species associated with the BC Act and EPBC Act listed White Box EEC. Soil testing will be undertaken during placement to inform whether additional amelioration and/or organic material is required. Rehabilitation activities for new soil stockpiles constructed during the MOP/RMP term will be included in the rehabilitation program schedule for the MOP/RMP term.

### **7.2.4 Reinstating Native Woodland Ecosystems for Threatened Flora and Fauna**

In accordance with the rehabilitation objectives in Table 11 of Condition 53, of Schedule 3 of the Development Consent, the proposed native ecosystem areas would aim to restore self-sustaining native woodland ecosystems characteristic of vegetation communities found in the local area. In addition, MACH Energy is required to include development of:

- riparian habitat, within any diverted and/or re-established creek lines and retained water features;
- potential habitat for threatened flora and fauna species; and
- wildlife corridors, as far as is reasonable and feasible.

The following subsections provide a description of how MACH Energy will meet these objectives.

***Native woodland ecosystems and habitat for threatened flora and fauna***

Updated vegetation mapping of the whole MPO area was undertaken following approval of MOD 3 (Hunter Eco, 2018) in order to align vegetation communities with contemporary PCT definitions and inform target woodland ecosystems and species selection for rehabilitation (Plan 1B-1).

Analysis of this vegetation mapping indicates that the most widespread communities being disturbed by the MPO are the following:

- PCT 483 - Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley (represents White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community).
- PCT 1604 - Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.
- PCT 1605 - Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter.

These communities would be targeted for rehabilitation as ecosystems characteristic of vegetation communities found in the local area and also to provide potential habitat for threatened flora and fauna. A summary of the PCT communities targeted for revegetation and their associated upper, middle and ground stratum species is provided in Table 7-2. Provisional seed mixes including grass, shrub and tree species of these PCTs have been developed by MACH Energy for the MPO's rehabilitation program. These seed mixes will be subject to amendment due to availability from MPO's Seed Harvesting Facility and/or from external provider.

A revegetation rationale has been developed to guide where each PCT will be re-established on MPO final landforms (e.g. Ironbark communities would be more suited to upper slope areas and Grey Box – White Box communities would be more suited to lower slopes and flatter areas). It is anticipated that the PCTs targeted for rehabilitation and the revegetation rationale would be further augmented and refined over the life of the MPO based on the results of on-site investigations and rehabilitation trials, and consultation with key stakeholders.

Consistent with the MPO's Rehabilitation Strategy and MSC's recommendations, highly competitive exotic grasses (e.g. Rhodes Grass [*Chloris gayana*]) and non-local Australian species (e.g. Golden Wreath Wattle [*Acacia saligna*]) will not be used anywhere on-site.



**Table 7-2**  
**Plant Community Types Proposed for Native Ecosystem Rehabilitation**

PCT	PCT Name	Formation	Class	Applicable TEC	Upper stratum	Middle stratum	Ground stratum
483	Grey Box – White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Grassy Woodlands	Western Slopes Grassy Woodland	Listed BC Act, E: White Box Yellow Box Blakely's Red Gum Woodland; Listed EPBC Act, CE: White Box Yellow Box Blakely's Red Gum Woodland	<ul style="list-style-type: none"> <li>• <i>Eucalyptus moluccana</i></li> <li>• <i>Eucalyptus albens</i></li> <li>• <i>Brachychiton populneus</i> subsp. <i>Populneus</i></li> <li>• <i>Angophora floribunda</i></li> <li>• <i>Eucalyptus melliodora</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Notelaea microcarpa</i></li> <li>• <i>Maireana microphylla</i></li> <li>• <i>Sclerolaena muricata</i></li> <li>• <i>Pimelea curvifloa</i> var. <i>curviflora</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Austrostipa, bigeniculata</i></li> <li>• <i>Bothriochloa macra</i></li> <li>• <i>Boerhavia dominii</i></li> <li>• <i>Oxalis perennans</i></li> <li>• <i>Elymus scaber</i> var. <i>scaber</i></li> <li>• <i>Cynodon dactylon</i></li> <li>• <i>Chamaesyce drummondii</i></li> <li>• <i>Hibiscus trionum</i></li> <li>• <i>Einadia nutans</i> subsp. <i>nutans</i></li> <li>• <i>Austrostipa aristiglumis</i></li> <li>• <i>Aristida personata</i></li> <li>• <i>Asperula conferta</i></li> <li>• <i>Rumex brownii</i></li> <li>• <i>Mentha diemenica</i></li> <li>• <i>Cyperus gracilis</i></li> <li>• <i>Geranium solanderi</i> var. <i>solanderi</i></li> <li>• <i>Austrostipa nodosa</i></li> <li>• <i>Calotis lappulacea</i></li> <li>• <i>Glycine latifolia</i></li> <li>• <i>Chloris truncata</i></li> </ul>

**Table 7-2 (Continued)**  
**Plant Community Types Proposed for Native Ecosystem Rehabilitation**

PCT	PCT Name	Formation	Class	Applicable TEC	Upper stratum	Middle stratum	Ground stratum
1605	Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter	Dry Sclerophyll Forests (Shrub/grass sub-formation)	North-west Slopes Dry Sclerophyll Woodlands	Listed BC Act, E: Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions; Listed EPBC Act, CE: Central Hunter eucalypt forest and woodland	<ul style="list-style-type: none"> <li>• <i>Eucalyptus crebra</i></li> <li>• <i>Notelaea microcarpa</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Maireana microphylla</i></li> <li>• <i>Myoporum montanum</i></li> <li>• <i>Olearia elliptica</i></li> <li>• <i>Pittosporum undulatum</i></li> <li>• <i>Breynia oblongifolia</i></li> <li>• <i>Acacia paradoxa</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Microlaena stipoides</i></li> <li>• <i>Austrodanthonia racemosa</i></li> <li>• <i>Dichelachne micrantha</i></li> <li>• <i>Dichondra repens</i></li> <li>• <i>Daucus glochidiatus</i></li> <li>• <i>Cheilanthes sieberi</i></li> </ul>
1604	Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Grassy Woodlands	Coastal Valley Grassy Woodlands	Listed BC Act, E: Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions; Listed EPBC Act, CE: Central Hunter eucalypt forest and woodland; Listed EPBC Act, CE: White Box Yellow Box Blakely's Red Gum Woodland	<ul style="list-style-type: none"> <li>• <i>Eucalyptus crebra</i></li> <li>• <i>Eucalyptus moluccana</i></li> <li>• <i>Corymbia maculata</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Bursaria spinosa</i></li> <li>• <i>Olearia elliptica</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Eremophila debilis</i></li> <li>• <i>Cymbopogon refractus</i></li> <li>• <i>Aristida ramosa</i></li> <li>• <i>Aristida vagans</i></li> <li>• <i>Microlaena stipoides</i></li> <li>• <i>Austrodanthonia fulva</i></li> <li>• <i>Cheilanthes sieberi</i></li> <li>• <i>Lomandra multiflora</i></li> <li>• <i>Brunoniella australis</i></li> </ul>

Habitat features including habitat/stag trees, rock piles and log piles, will be installed to provide fauna habitat across MPO rehabilitation areas. Where practicable, a minimum of two habitat/stag trees, two log piles and two rock piles will be installed per hectare across Secondary Domain D – Native Woodland/Grassland areas (excluding inappropriate areas e.g. drainage features and water managements structures within Secondary Domain D). Where this is not possible, further augmentation of habitat will consider the use of supplementary features such as nest and bat boxes.

The habitat requirements of the fauna species outlined in Section 3.2.8 will be considered when selecting and placing features across the landscape. Habitat/stag trees will be selected based upon the presence of hollows, loose bark, height and branches for nesting. Rock for rock piles where possible will be of sandstone or similar material. Log piles will be used to recreate 'fallen timber' within the landscape, and will be placed parallel to the contour so minimise erosion potential downslope.

### **Riparian Habitat**

The main drainage feature within the vicinity of the MPO is the Hunter River, which flows in a southerly direction approximately 1 km to the east of the MPO area. The pre-mining environment of the MPO consists of a number of ephemeral drainage lines that drain into the Hunter River, however no perennial streams/creeks exist on-site. The final landform design therefore has not considered re-establishing creek lines. The only retained water features in the final landform will be the final void and potentially the Mine Water Dam on the southern boundary of ML 1645.

Revegetation of the final void will use species that are appropriate for its steepness and aspect, however this is not envisaged to create a riparian ecosystem, rather this vegetation will be used for stabilisation and aesthetic purposes.

The Mine Water Dam at the southern boundary of ML 1645 will potentially be retained for high intensity agriculture, and may potentially provide conditions for establishment of riparian habitat. If the water storage is retained, vegetation species occurring in riparian areas of the surrounds will be used for revegetation. Species that would be targeted for revegetation of this area may include:

- Upper stratum - *Eucalyptus camaldulensis*, *Casuarina cunninghamiana* subsp. *cunninghamiana*, *Angophora floribunda*.
- Middle stratum - *Melicetyus dentatus*, *Callistemon salignus*.
- Lower stratum - *Austrostipa verticillata*, *Austrodanthonia* spp., *Cynodon dactylon*, *Microlaena stipoides* var. *stipoides*, *Bothriochloa macra*, *Eleocharis sphacelata*, *Lomandra longifolia*, *Carex appressa*.

During the operational phase of the MPO, riparian vegetation (including sedge and rush species) would also be established around sediment dams to provide areas of riparian habitat.

### **Wildlife Corridor**

Consistent with MSC's recommendations for the Bengalla Mine final landform, the eastern face of the MPO final landform would be revegetated with native tree species as shown in Plan 4A and Figure 4-1. This would allow the landform to assimilate with the open woodland communities within the surrounding environment.

The revegetated eastern face would provide a contiguous wildlife corridor with the revegetated eastern face of the Bengalla Mine for native woodland bird species (Plan 4A). Given the close proximity of the revegetated woodland areas, bird species could utilise both areas for habitat establishment and foraging. In addition, the vegetation on the eastern face of the MPO Eastern Out of Pit Overburden Emplacement would develop a contiguous wildlife corridor with the Bengalla Mine rehabilitation and surrounding remnant woodland, and also be visually consistent with the revegetation of the eastern face of the Bengalla Mine landform.

### 7.2.5 Progressive Disturbance and Rehabilitation during the MOP/RMP Term

In accordance with the MOP Guidelines, Table 7-3 provides a summary of the approximate total disturbance and rehabilitation areas at the start of the MOP/RMP term and the estimated approximate total disturbance and rehabilitation areas at the end of the MOP/RMP term.

**Table 7-3**  
**Progressive Disturbance and Rehabilitation during MOP/RMP Term**

Year	Approximate Total Disturbance Area (ha)	Approximate Total Rehabilitation Area (ha)	Comments/Explanation
Start of MOP/RMP Term (1 July 2020) (Plan 2)	1,365	54	Disturbance areas include Primary Domains (Plan 2). Rehabilitation commenced in the south-eastern extent of the Eastern Out of Pit Overburden Emplacement (lower batters).
End of MOP/RMP Term (30 June 2021) (Plan 3)	1,484	85	Continued development of Infrastructure Area to the west and north of the Active Void. Continued development of the Active Void to the north and west and continued placement overburden within In-Pit and Out of Pit Overburden Emplacement areas. Continued rehabilitation of eastern outer batters of the Eastern Out of Pit Overburden Emplacement (northern lower and mid batters).

## 7.3 SUMMARY OF REHABILITATION AREAS DURING THE MOP/RMP TERM

Table 7-4 summarises the changes in the size of rehabilitation areas in each domain for the duration of the MOP/RMP term. Table 7-4 reflects the following (as described in Sections 2.1 and 2.3.3):

- Construction of the Fines Emplacement Area is now complete and is an active operational landform.
- The Active Mine Void commenced in the south-east corner of the MPO area, and will continue to move north and west steadily throughout the MOP/RMP term.
- Continued placement of overburden within In Pit and Out of Pit Overburden Emplacement areas. Progressive rehabilitation of the Overburden Emplacement will also occur as areas become available for rehabilitation.

**Table 7-4**  
**Rehabilitation Data Table**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area Start of MOP/RMP (ha)	Area End of MOP/RMP (ha)
Infrastructure (1)	Native Woodland/ Grassland (D)	1C	Active	543	619
			Decommissioning	0	86 <sup>1</sup>
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	0	0
			Ecosystem Sustainability	0	0
			Rehabilitation Complete	0	0
Fines Emplacement Area (2)	Agricultural Land (C)	2C	Active	83	83
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	0	0
			Ecosystem Sustainability	0	0
			Rehabilitation Complete	0	0
Water Management Area (3)	Water Infrastructure and Storage (B)	3B	Active	134	136
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	0	0
			Ecosystem Sustainability	0	0
			Rehabilitation Complete	0	0
Active Void (4)	Final Void (A)	4A	Active	272	313
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	0	0
			Ecosystem Sustainability	0	0
			Rehabilitation Complete	0	0

<sup>1</sup> Decommissioning of the existing rail loop and train load out infrastructure would occur once the approved duplicated rail loop and train load out infrastructure has been constructed. These decommissioning activities may occur during or outside of this MOP/RMP term.



**Table 7-4 (Continued)**  
**Rehabilitation Data Table**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area Start of MOP/RMP (ha)	Area End of MOP/RMP (ha)
Overburden Emplacement (5)	Agricultural Land (C)	5C	Active	332	332
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	0	0
			Ecosystem Sustainability	0	0
			Rehabilitation Complete	0	0
	Native Woodland/ Grassland (D)	5D	Active	332	332
			Decommissioning	0	0
			Landform Establishment	0	19
			Growth Medium Development	0	0
			Ecosystem and Land Use Establishment	54	66
			Ecosystem and Land Use Sustainability	0	0
			Rehabilitation Complete	0	0

## 7.4 REINSTATING AGRICULTURAL GRASSLAND AREAS

Consultation with MSC indicated a preference for intensive agricultural/industrial post-mining land uses that provide employment for the local community. Consequently, rehabilitation of the MPO will consider both low and high intensity agricultural land uses.

Low intensity agriculture would consist of reinstating grazing country and high intensity agriculture may include feedlots, poultrys or agricultural produce processing facilities, however until such a time a proposal is developed for such uses, these areas would be rehabilitated to low intensity agriculture. Descriptions of currently proposed low and high intensity agriculture post mining land uses is provided below. These land uses may be refined through further consultation with MSC and other stakeholders (including the MPO's CCC) during the MPO mine life.

### ***Low Intensity Agriculture***

The areas proposed for low intensity agriculture are shown on Plan 4A and would be prepared to accommodate sustainable agricultural activities such as sustainable/managed livestock grazing. The objective will be to establish areas to be classified as Land Capability Class 4, Class 5 or Class 6 lands, which are suitable for grazing, but not cropping, forestry or other high intensity uses. The definitions of Land Capability Class 4, 5 and 6 lands (as defined by the OEH [2012] *The land and soil capability assessment scheme: second approximation - a general rural land evaluation system for New South Wales*) are provided in Table 7-5. It should be noted that although the definitions of Land Capability Class 5 and 6 lands include land uses such as forestry and nature conservation (in addition to grazing), MACH Energy does not propose to establish forestry on the rehabilitation areas proposed for low intensity or high intensity agriculture.

**Table 7-5**  
**Land Capability Classes Proposed for Low Intensity Agriculture Areas**

Class	Definition
4	<b>Moderate capability land:</b> Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised
5	<b>Moderate–low capability land:</b> Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
6	<b>Low capability land:</b> Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation

Source: OEH (2012).

Low intensity agricultural rehabilitation areas would be cultivated and then broadcast sown with pasture species. The species mix would be developed in consultation with an agronomist, and depend on the growth media available and environmental conditions at the time of rehabilitation. Species selection would also take into consideration its ability to encroach on rehabilitation areas proposed for native ecosystem re-establishment.

Improved pasture species commonly present in the surrounding grazing country that would be considered for rehabilitation of low intensity agricultural areas include:

- Subterranean clover (*Trifolium subterranean*).
- White Clover (*Trifolium repens*).
- Lucerne (*Medicago sativa*).
- Green Panic (*Panicum coloratum*).
- Kikuyu Grass (*Pennisetum clandestinum*).
- Perennial Rye (*Lolium perenne*).
- Phalaris (*Phalaris aquatica*).
- Oat (*Avena sativa*).

Native grass species will also be considered in pasture species such as *Cynodon dactylon* (Couch), *Austrodanthonia* spp. (Wallaby grasses) and *Austrostipa* spp. (Spear grasses) which have been shown to develop well in post mining landscapes of the Hunter Valley (Huxtable, Koen and Waterhouse, 2005).

Consistent with the MPO's Rehabilitation Strategy and MSC's recommendations, highly competitive exotic grasses (e.g. Rhodes Grass [*Chloris gayana*]) and non-local Australian species (e.g. Golden Wreath Wattle [*Acacia saligna*]) will not be used anywhere on-site.

### **Fines Emplacement Area Rehabilitation**

The overarching objective for rehabilitation of the Fines Emplacement Area is to establish a safe, stable and non-polluting landform with a sustainable surface cover that minimises erosion (to prevent exposure of the underlying fines material) and sustains grassland vegetation in the long-term.

Current rehabilitation concepts for the Fines Emplacement Area as described in the MPO EIS include capping fines with a layer of inert overburden material and then a layer of topsoil (ERM Mitchell McCotter, 1997). MACH Energy maintains capping and topsoil material proximal to the Fines Emplacement Area that would be sufficient to rehabilitate the area of fines to be emplaced within the Fines Emplacement Area during the MOP/RMP term. As described in Section 3.2.7, MACH Energy maintains a soil register to track soil stockpile volumes and soil usage on rehabilitation areas.

In accordance with Condition 52(c), Schedule 3 of the MPO's Development Consent DA 92/97, a Fines Emplacement Plan has been prepared and is provided in Appendix 1 of the MPO's Waste Management Plan. The Fines Emplacement Plan includes details of the FEA design and fine rejects disposal strategies and operating procedures.

MACH Energy operates the Fines Emplacement Area using sub-aerial deposition which involves an extended period of air drying that maximises in-situ tailings densities and in turn maximises the storage efficiency of the facility as well as providing a more competent fines surface for future rehabilitation purposes. Other advantages of sub-aerial deposition include earlier facilitation of final rehabilitation due to a more competent fines surface and rapid recovery of water for reuse in the plant process.

As fines emplacement in the Fines Emplacement Area only commenced in late 2019, detailed rehabilitation concepts for the final landform remain in preparation. MACH Energy will continue to develop the final landform rehabilitation concepts which will be informed by the results of future tailings characterisation testwork and research project results and will be guided by relevant industry guidelines, including ANCOLD's *Guidelines on Tailings Dams (July 2019)*. MACH Energy will provide in the next MPO MOP/RMP more detail on the rehabilitation concepts for the Fines Emplacement Area final landform.

#### **ACARP 'Tailings to Topsoil' Research Project**

MACH Energy has entered into a collaboration agreement with the University of Newcastle on the ACARP Project "Tailings to topsoil" (#C29042) which commenced in January 2020 and is anticipated to be completed by December 2022. The project involves collaboration between MACH Energy (and other NSW coal mining operations), University of Newcastle, Muswellbrook Shire Council, JORD International, and NSW Department of Primary Industries Soils Unit.

The project methodology involves four major processes:

1. Characterisation and pre-treatment of tailings;
2. Delivery of tailings slurry to the trial site via a high-efficiency solids separation mobile tailings handling plant;
3. De-watering of tailings via a mobile dewatering plant; and
4. Integrating the upgraded tailings with the existing soil profile at the trial site to improve soil resources for crop production or native vegetation establishment.

The project aims to optimise existing tailings processes and technologies and provide a commercially viable system for tailings utilisation. MACH Energy has committed cash contributions and in-kind support in addition to engaging a PhD student as part of the project. MACH Energy has also offered a trial site for the project to be established at the MPO.

As the research project progresses over the next two and a half years, and results from the research project become available, MACH Energy will update each MOP/RMP over this time with a description of the progressive results and how the results may be used to inform rehabilitation concepts for the MPO Fines Emplacement Area.

### ***High Intensity Agriculture***

High intensity agriculture areas have been proposed as a result of consultation with MSC who has indicated its preference for post mining land uses that may provide local employment. Activities that may be classed as high intensity include feedlots, poultries and glasshouse. Until such a time a proposal is developed for such uses, these areas would be rehabilitated to low intensity agriculture. Areas currently proposed for high intensity agriculture have been identified on Plan 4A, and have been nominally located at this stage due to their topography and proximity to a potential water storage dam for water supply.

High intensity agriculture areas will be refined in consultation with MSC and relevant stakeholders (including the MPO's CCC) throughout the life of the MPO, and will depend on such factors as commercial interest. Any development of high intensity agriculture will be subject to development approval with the relevant consent authority.

## **7.5 REHABILITATION OF EXISTING RAIL LOOP AND INFRASTRUCTURE CORRIDOR**

Under Condition 37, Schedule 3 of Development Consent DA 92/97, MACH Energy is required to remove all infrastructure associated with the development within ML 1645 south of Wybong Road (other than infrastructure which can remain in situ, with the agreement of Bengalla Mine) and transfer ownership to Bengalla Mine. MACH Energy is required to undertake interim rehabilitation on this area, prior to transfer of ownership, as required by Condition 55A, of Schedule 3 of the Development Consent DA 92/97. Following the transfer of ownership, it will be the responsibility of Bengalla Mine to operate and rehabilitate the area.

As soon as reasonably practicable following removal of the existing rail loop and associated infrastructure within the footprint of the Bengalla Mine, initial rehabilitation will be undertaken so the area does not pose an ongoing material source of dust emissions.

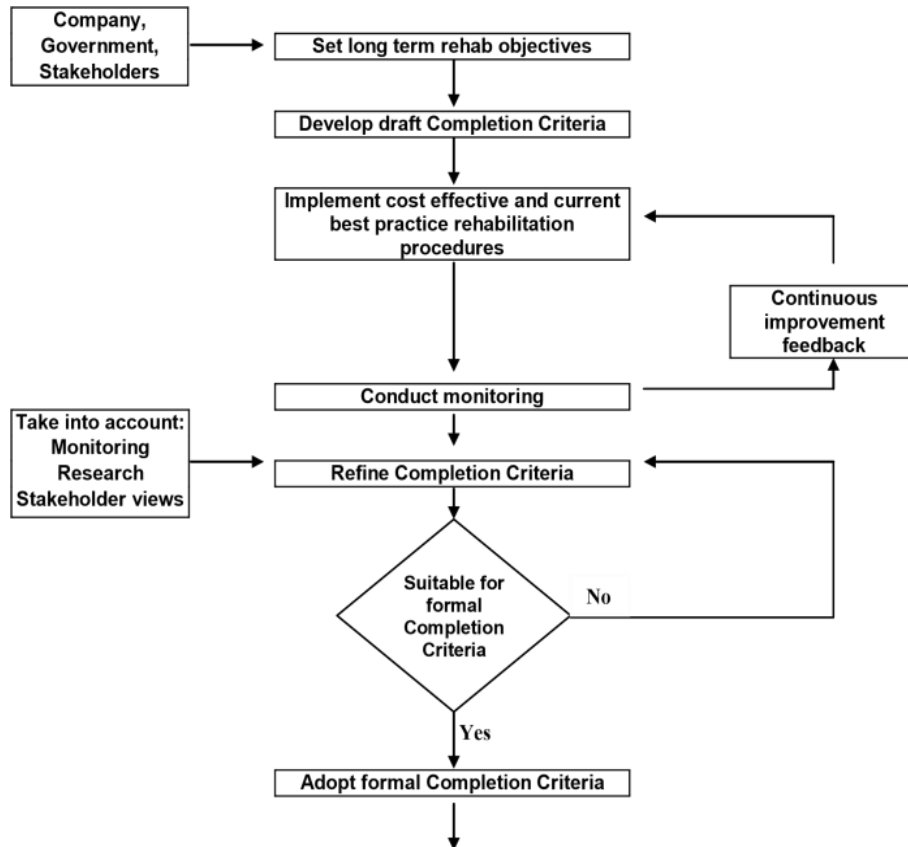
Initial rehabilitation will include levelling/reforming the infrastructure area, followed by sowing of a sterile cover crop and/or application of a dust suppressant. The MPO rail spur erosion and sediment control water management structures (e.g. sediment fences) within the footprint of Bengalla Mine will be left in place, subject to the agreement of Bengalla Mine.

## **7.6 RELINQUISHMENT PHASE ACHIEVED DURING MOP/RMP TERM**

No lands are proposed for relinquishment during the term of this MOP/RMP.

## 8 REHABILITATION MONITORING AND RESEARCH

Rehabilitation is an iterative process which allows activities to be defined and improved upon throughout the lifetime of the mine. Monitoring of rehabilitation successes and failures will enable lessons learnt in early years of rehabilitation to be applied in subsequent and later years. It will also assist with continuous improvement in the site's performance in terms of landscape and land use. An example of an iterative, continual improvement approach to mine site rehabilitation which may be implemented is shown in Figure 8-1 (based on Nichols, 2005).



**Figure 8-1: Continuous Improvement including Monitoring and Review Processes**  
(Source: after Nichols, 2005)

### 8.1 MONITORING

A rehabilitation monitoring program will be implemented based on the performance indicators and completion criteria described in Section 6. The monitoring program described in this MOP/RMP will be the responsibility of the Environmental Superintendent (Section 11.2). Details of rehabilitation performance will be reported in the Annual Review.

Where necessary, rehabilitation procedures will be amended based on the monitoring results, to continually improve rehabilitation standards.

The rehabilitation monitoring program will include:

- Ecosystem Function Analysis monitoring (Section 8.1.1);
- Rehabilitation Verification Inspections (Section 8.1.2);



- Visual Inspection Monitoring (Section 8.1.3); and
- Low intensity agriculture monitoring programme (Section 8.1.4).

### 8.1.1 Ecosystem Function Analysis

The objective of this component of the monitoring program is to evaluate the progress of rehabilitation towards fulfilling long-term land use objectives and completion criteria. Monitoring of rehabilitation areas will be undertaken annually<sup>1</sup> to:

- compare monitoring results against rehabilitation objectives, performance indicators and completion criteria;
- identify possible trends and areas for improvement;
- link to records of rehabilitation to determine causes and explain results;
- assess effectiveness of environmental controls implemented;
- where necessary, identify modifications required for the monitoring program, rehabilitation practices or areas requiring research;
- compare flora species present against original seed mix and/or reference sites;
- assess vegetation health;
- assess vegetation structure (density of upper, mid and lower storey); and
- where applicable, assess native fauna species diversity and the effectiveness of habitat creation for target fauna species.

Where necessary, rehabilitation procedures will be amended based on rehabilitation monitoring results to continually improve rehabilitation standards, or as more data becomes available regarding reference sites or the targeted vegetation community, completion criteria can be updated to ensure rehabilitation is improving on the right trajectory.

The methodology used to undertake this monitoring is Ecosystem Function Analysis (EFA). EFA consists of the Landscape Function Analysis (LFA) methodology and vegetation/ecological monitoring and assessment components.

LFA assesses the landscape's ability to retain water and nutrients within the system. In terms of LFA, a soil landscape that is on a self-sustaining trajectory toward (in context of vegetative cover and soil stability) will have (Tongway and Hindley, 2004):

- A high Landscape Organisation Indicator (LOI) (i.e. a low number of bare soil patches, referred to as inter-patches, between obstruction components, referred to as patches, in the soil landscape).
- High Soil Surface Assessment indices, indicating that the site had favourable Nutrient, Infiltration and Stability characteristics.

Vegetation monitoring components are the other component of the EFA monitoring tool. This component is limited to the woodland areas, as woody vegetation is typically not represented within pasture areas. The monitoring program for low intensity agricultural areas rehabilitated with pasture species is described in Section 8.1.4.

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<sup>1</sup> Post-closure, monitoring may be undertaken at an alternative frequency if a suitably qualified and experienced person considers that annual monitoring is not warranted due to the advanced/mature condition of the rehabilitation.

An assessment of woody species density, species richness and canopy cover all contribute to the findings of the LFA in terms of available nutrients, soil stability and water infiltration. In terms of vegetation dynamics, a soil landscape that is on a self-sustaining trajectory in the context of vegetative cover will generally have:

- high percentage ground cover vegetation and/or leaf litter components with a corresponding low percentage of bare soil areas;
- high percentage canopy cover;
- high density of woody species; and
- high species richness (particularly pertinent to habitat complexity components).

Soil testing at both rehabilitation monitoring sites and analogue sites will also be conducted for the following parameters:

- pH, Electrical Conductivity, and sulphate (SO<sub>4</sub>);
- Cation Exchange Capacity and Exchangeable Sodium Percentage;
- Emerson Dispersion Test; and
- Organic carbon.

Soil sampling will be undertaken at all monitoring sites in years 1 to 3 and then every 5 years to allow the detection of positive and negative changes in soil properties.

Diagnostic soil testing will also be undertaken at rehabilitation areas that exhibit persistent poor performance in groundcover, erosion and vegetative growth/vigour. Where soil test results are inconclusive in relation to the cause of poor rehabilitation performance, soil samples would be tested using an extractable elemental analysis method (e.g. Inductively Coupled Plasma Mass Spectrometry or Inductively Coupled Plasma Optical Emission Spectrometry) for detection of metals or other contaminants.

Utilising the EFA (including LFA and ecological monitoring components) method and soil testing, scientifically robust data is provided on the rehabilitation sites which, when compared to the data collected from analogue sites, will enable MACH Energy to accurately track if the rehabilitation site is on a self-sustaining trajectory. The interpretation of this data will enable the identification of those rehabilitation sites exhibiting lower EFA rankings and instigation of corrective actions to improve performance.

#### ***Analogue Monitoring Sites and MPO Rehabilitation Monitoring Manual***

Analogue monitoring sites will be established in areas of the relevant PCTs to be targeted for rehabilitation. The target PCTs relevant to Secondary Domain D – Woodland/Grassland rehabilitation areas include:

- PCT 483 - Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley (representative of the White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community listed under the EPBC Act);
- PCT 1604 - Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter; and
- PCT 1605 - Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter.

Four analogue monitoring sites were established in 2019 in sloped and eastern areas of PCT 483 within the MPO Development Consent boundary. Additional analogue monitoring sites in PCTs 1604 and 1605 will be established during this MOP/RMP term.

An additional two analogue monitoring sites were initially established in 2019 in PCT 1606 (White Box – Narrow leaved Ironbark – Blakely's Red Gum shrubby open forest of the central and upper Hunter). However, upon further assessment and scrutiny of this PCT 1606 patch, this vegetation is more associated with gullies/drainage areas and lower slopes. Therefore, these two analogue monitoring sites are considered inappropriate for use as analogue sites for Secondary Domain D – Woodland/Grassland rehabilitation areas, and will not be included in the rehabilitation monitoring program at this stage. These analogue sites may be included in the rehabilitation monitoring program once MPO rehabilitation include revegetation activities for gullies/drainage areas on lower slopes.

MACH Energy has collaborated with Ausecology Pty Ltd to develop a Rehabilitation Monitoring Manual (RMM) for the MPO. A preliminary version of the RMM has been developed, with a finalised version currently in preparation. The RMM aims to guide rehabilitation monitoring at the MPO so that the monitoring program can be consistently replicated year to year, and produces statistically robust and consistent data.

The RMM will describe MPO rehabilitation objectives, performance indicators and completion criteria, and the rehabilitation monitoring methodologies and monitoring parameters. The RMM will also include a Rehabilitation Verification and Inspection Checklists that will be used to track rehabilitation performance towards completion criteria and document whether a rehabilitation management unit area requires any corrective actions to improve performance. An EFA data collection form will also be included to enable efficient and complete data collection.

Permanent monitoring transects will continue to be established in MPO rehabilitation areas once rehabilitation activities have been completed.

### **8.1.2 Rehabilitation Verification Inspection**

In addition to EFA and ecological monitoring, MACH Energy will implement an annual<sup>2</sup> Rehabilitation Verification and Inspection to evaluate how successful rehabilitation works have been. The scope of the inspection is to include all existing and recently completed rehabilitation areas on-site.

As part of the MPO Rehabilitation Monitoring Manual (developed by Ausecology Pty Ltd), Rehabilitation Verification and Inspection Checklists have been developed relevant to whether a rehabilitation area is in the Growth Media Development phase (i.e. Phase 3), or in either the Ecosystem and Land Use Development or Sustainability phase (i.e. Phases 4 or 5). The checklist forms include the Phase 3, 4 and 5 rehabilitation criteria (Section 6), and check boxes as to whether the area is Not Compliant, Not Yet Compliant, Near Compliant or Compliant with the criteria.

The Rehabilitation Verification and Inspection Checklist form also requires evidence of, or a description of justification for, the level of compliance rating and notation of the level of corrective actions required to improve the compliance level (e.g. if the area requires rework, or rectifying measures, or to continue existing maintenance and monitoring measures).

The Rehabilitation Verification and Inspection information will then be combined with the annual EFA and ecological monitoring results, to provide a comprehensive description of the progress of MPO rehabilitation against the MPO rehabilitation completion criteria within the annual rehabilitation monitoring report.

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<sup>2</sup> Post-closure, monitoring may be undertaken at an alternative frequency if a suitably qualified and experienced person considers that annual monitoring is not warranted due to the advanced/mature condition of the rehabilitation.

### 8.1.3 Visual Inspection Monitoring

Visual Inspection Monitoring of existing and recently completed rehabilitation areas will be undertaken monthly. A Visual Inspection Monitoring form is currently being developed as part of the MPO Rehabilitation Monitoring Manual, and will be designed so that the monitoring can be undertaken by any MPO personnel.

The Visual Inspection Monitoring form is anticipated to include notation of:

- erosion presence, including type (e.g. rill, gully, tunnel), dimension and active state of the erosion;
- weed presence, including species, infestation area (m<sup>2</sup>), and cover (%) or count; and
- groundcover description; and
- comments and photo numbers to provide additional information on the status of the area, and if the area requires any remediation measures.

The Visual Inspection Monitoring process allows comparison between different rehabilitation sites and over time. It also allows the identification of areas requiring remediation.

### 8.1.4 Low Intensity Agricultural Land Monitoring

Monitoring of areas proposed for low intensity agricultural end land uses (i.e. grazing) would include a range of parameters including soil, water supply and pasture parameters and may include livestock parameters (when adequately advanced). Table 8-1 provides the proposed parameters to be measured for the Low Intensity Agricultural Land monitoring programme.

**Table 8-1**  
**Low Intensity Agricultural Land Monitoring Programme**

Agricultural Land Aspect	Parameter
Soil	pH, Phosphorus, Nitrogen, Sulphur, Potassium, Calcium, EC/Salinity, Sodicity, Cation Exchange Capacity, Organic Carbon, and some trace elements (e.g. Copper) on advice from Agronomist.
Water Supply	pH, EC/Salinity, and potentially toxic elements on advice from Agronomist (e.g. Iron, Magnesium and Nitrates).
Pasture	Dry matter yield, pasture quality (e.g. Protein, Digestibility, Metabolisable Energy), ground cover, species composition and LFA indices.
Livestock (when adequately advanced)*	Weight, health (i.e. blood testing).

\* Adequately advanced is when an Agronomist is satisfied that all other monitoring parameters indicate the landform is stable, pasture development is comparable to analogue sites, and the soil, water and pasture is safe for livestock.

## 8.2 RESEARCH

The rehabilitation program at the MPO will aim to incorporate management practices that have resulted from industry research into the establishment of woodland and grassland communities across mined landscapes, and in particular in the Hunter Valley region.

MACH Energy is collaborating with the University of Newcastle on several rehabilitation related research projects including:

- a research project that aims to integrate treated fines material with topsoil material to create a usable soil resource for crop production or native vegetation establishment (this project is being conducted by ACARP) (Section 7.4); and
- a research project that analyses MPO topsoil and subsoil characteristics for input into the SIBERIA software program that supports geomorphic landform design modelling.

Over the MPO life of mine, MACH Energy proposes to build on industry research results and conduct various research studies and trials to inform the most suitable practices that will enable the re-establishment of woodland and grassland areas on final mine landforms and disturbed areas of the MPO. Details of the research may include:

- Potential variables impacting on rehabilitation programs and causes of failure.
- Assessing rehabilitation strategies that have successfully reinstated woodland communities (or rehabilitation with species typical of various communities) on other mine sites, including:
  - establishing appropriate soil substrate: direct application of topsoil; stockpiled native topsoil; raw overburden and interburden material plus addition of biosolids/organic growth medium; addition of other organic material; rehabilitation trials on fines material;
  - establishment of the grassy understorey: grass species suitable for mine rehabilitation; low and high photosynthetic pathway species; establishing native herbs and forbs;
  - establishing the shrubby understorey;
  - establishing the overstorey;
  - seed distribution methods: hand-broadcasting; brush-matting; hydro-mulching; spreading seed-bearing hay; direct seeding; air seeding; and
  - progressive rehabilitation strategy: pre-stripping requirements; sequence of rehabilitation strategies.

There have been proven successes in rehabilitating mined lands using similar techniques to those described above within the industry.

As described in Section 3.2.1, MACH Energy will continue to conduct geochemical characterisation of soils and overburden materials as mining progresses to inform selective handling of materials.

Investigations (including soil testwork) will also be undertaken to assess the characteristics of replaced soil and assess its suitability for rehabilitation of Class 4, 5 and 6 Land Capability agricultural lands, in consultation with a Certified Professional Soil Scientist. Additionally, and as described in Section 3.2.7, MACH Energy will conduct microbial sampling to understand the current diversity within stockpiled topsoil and soil respread on rehabilitation areas (prior to resspreading) to understand possible microbial losses and inoculation requirements.



To facilitate the above investigations, MACH Energy will undertake a topsoil stockpile trial at two locations (refer Figure 3-2), i.e. Trial Topsoil Stockpile 1 (the Pit E stockpile) and Trial Topsoil Stockpile 2 (the Teardrop stockpile). These two topsoil stockpiles will be constructed to a height of 5 m and an approximate volume of 1,750,000 m<sup>3</sup> and 150,000 m<sup>3</sup> respectively. Total volumes will be confirmed in the next MOP/RMP once construction of the stockpiles has been completed. The two trial topsoil stockpiles will be subject to a trial that assesses the effectiveness of the 'Soil Stockpile Management' practices and the 'Soil Replacement on Rehabilitation Areas' practices, described in Section 3.2.7, and will include the soil testwork and microbial sampling as described above.

A detailed design for the trial will be developed during the MOP/RMP term in consultation with suitably qualified and experienced persons and the NSW Resources Regulator. The trial design will include a clearly defined trial aim and trial objectives, a monitoring program including parameters relevant to measuring the success of the management practices proposed and criteria against which success of the trial will be measured. Progress reports will be prepared detailing the monitoring program results and will include an analysis of the results against the trial criteria. Results from the trial will be progressively reported in the MPO's Annual Review. Rehabilitation irrigation trials may also be commissioned during the MOP/RMP term subject to weather conditions and water availability for the trial.

The outcomes of the rehabilitation trials will be used to refine the rehabilitation program at the MPO.

## **9 INTERVENTION AND ADAPTIVE MANAGEMENT**

### **9.1 THREATS TO REHABILITATION**

As described in Section 3.1, risk assessments have been conducted to identify and assess the environmental risks associated with the MPO, in particular the risks to successful rehabilitation of the MPO. Management of the key risks to rehabilitation is discussed in Section 3.2.

### **9.2 TRIGGER ACTION RESPONSE PLAN**

The following TARP in Table 9-1 identifies the proposed contingency strategies in the event of unexpected variations or impacts to rehabilitation outcomes. The TARP reflects the key risks to successful rehabilitation at the MPO identified by the risk assessments conducted to date, as described in Section 3.1. The Risk Assessment and Treatment Plan from the *Final Mount Pleasant Operation Rehabilitation Risk Assessment Report (April 2020)* is provided in Attachment 3 of this MOP/RMP and includes the full list of risks identified in the April 2020 risk assessment, along with a description of the causes/triggers and the MPO's risk controls and processes.

**Table 9-1**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Landform design	Geomorphic landform model	Trigger	Geomorphic landform model includes macro and micro relief and drainage features as per design (i.e. SIBERIA software) specifications.	ITP check process (undertaken by mine planning personnel) of geomorphic landform model indicates the model is not in accordance with design.	
		Response	No response required. Continue ITP check processes.	Correct specifications to ensure geomorphic landform model is in accordance with design.	
	Construction of geomorphic landform	Trigger	Landform constructed as per geomorphic landform model design.	ITP check process identifies that constructed final landform marginally deviates from the design.	ITP check process identifies that constructed final landform significantly deviates from the design, and the landform is unlikely to function as designed.
		Response	No response required.	Identified area outside of design is reworked to ensure alignment with design prior to ITP being signed off.	Identified area outside of design is reworked to ensure alignment with design prior to ITP being signed off. Re-train operator/contractor in design requirements, if determined to be necessary.
	Slope gradient	Trigger	Constructed slopes above 10° (i.e. of high walls low walls, safety berms, top batter of final void, and locally steepened areas of overburden emplacement for drainage) constructed in accordance with design gradient.	ITP check process identifies that the gradient of a constructed slope is marginally outside of the gradient design.	ITP check process identifies that the gradient of a constructed slope is significantly outside of the gradient design.
		Response	No response required. Continue ITP processes and monitoring program.	Identified area outside of design is reworked to ensure alignment with design prior to ITP being signed off.	Identified area outside of design is reworked to ensure alignment with design prior to ITP being signed off. Re-train operator/contractor in design requirements, if determined to be necessary.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Landform stability	Slump/Slip/ Movement	Trigger	Rehabilitation areas show no signs of slumping/slip/movement.	Monitoring indicates some minor slumping/slip or movement of rehabilitation area.	Monitoring indicates some significant slumping/slip or movement of rehabilitation area.
		Response	No response required. Continue monitoring program.	Monitor and assess stability of area. Undertake reprofiling and revegetate area if required.	Undertake a review of landform design. Confirm if any changes to landform design specifications required.  Remediate area including reprofiling and revegetation.
	Erosion	Trigger	No gully or tunnel erosion. No active rilling > 300mm deep.	Minor gully or tunnel erosion present and/or active rilling > 300 mm but < 600 mm deep.	Significant gully or tunnel erosion present and/or active rilling > 600 mm deep.
		Response	No response required. Continue monitoring program.	Assess options to remediate erosion, including consideration of slope and material type, and determine appropriate action. Implement action if determined necessary.	Implement MPO Erosion and Sediment Control Plan.  Undertake a review of landform drainage design, landform slope and material type. Review to include recommendations for remediation.  Remediate area as per review recommendation.
	Drainage feature/structure function	Trigger	Drainage feature/structure functioning as designed.	Drainage feature/structure exhibits some minor issues but functioning as designed and does not threaten to cause rehabilitation failure.	Drainage feature/structure not functioning as designed and is threatening or causing rehabilitation failure.
		Response	No response required. Continue monitoring program.	A suitably trained and experienced person within mine planning dept to inspect drainage feature/structure and assess appropriate action, if required. Implement action determined, if necessary	A suitably trained and experienced person within mine planning dept to inspect drainage feature/structure and assess appropriate action for remediation. Implement action determined for remediation of the feature/structure.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Soil	Soil stockpiles – weed presence	Trigger	Long-term soil stockpile (to be maintained for longer than 6 months) does not have weeds or weeds do not pose a threat to the viability of the soil.	Long-term soil stockpile observed during visual inspection or monitoring to have a weed infestation (up to 50% of stockpile area) that has potential to threaten viability of the soil if not controlled.	Long-term soil stockpile observed during visual inspection or monitoring to have a significant weed infestation (>50% of stockpile area) that is threatening the viability of the soil.
		Response	No response required. Continue monitoring program.	Implement appropriate weed control methods as soon as suitable conditions permit. Review soil stockpile weed control methods and frequency. Review appropriateness or suitability of herbicides used. Review soil source. Determine if changes to weed control program required.	Implement appropriate weed control methods as soon as suitable conditions permit. Review soil stockpile weed control methods and frequency. Review appropriateness or suitability of herbicides used. Review soil source. Increase frequency of weed control program and subsequent monitoring until weeds controlled.
	Soil stockpiles – lack of vegetation establishment and erosion incidence	Trigger	Long-term soil stockpile (to be maintained for longer than 6 months) has adequate vegetation cover and no or minimal erosion that does not pose a threat to stockpile stability.	Long-term soil stockpile observed during visual inspection or monitoring to have <50% vegetation cover and areas of erosion that has potential to threaten stockpile stability.	Long-term soil stockpile observed during visual inspection or monitoring to have <50% vegetation cover and areas of significant erosion that is threatening stockpile stability.
		Response	No response required. Continue monitoring program.	Investigate options to improve vegetation cover and minimise erosion potential, including additional seeding, re-ripping the stockpile, requirement for soil testing and additional ameliorant (e.g. gypsum) application.  Implement actions recommended from investigation, as soon as suitable conditions permit.	Investigate options for immediate return of vegetation cover and to remediate erosion (e.g. additional seeding, re-ripping the stockpile, requirement for additional gypsum application). Conduct soil testing to inform actions required.  Implement actions recommended from investigation, as soon as suitable conditions permit.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Soil (cont.)	Soil quality as plant growth medium	Trigger	Soil test results and vegetation growth performance results during annual rehabilitation monitoring program indicate that soil quality (chemistry/physical/biological properties) is not limiting plant growth.	Soil test results and vegetation growth performance results during annual rehabilitation monitoring program indicate that soil quality (chemistry/physical/biological properties) may be limiting plant establishment and growth over a rehabilitation stage area.	Soil tests results and vegetation growth performance results during annual rehabilitation monitoring program indicate that soil quality (chemistry/physical/biological properties) is likely to be significantly affecting plant establishment and growth (i.e. plant mortality > 75% of rehabilitation stage area).
		Response	No response required. Continue monitoring program.	Investigate additional soil amelioration options in consultation with suitably qualified person, and implement action recommended.	Review rehabilitation records for the area, including the source of soil used for rehabilitation area, and soil stockpiling management activities.  Consult a suitably qualified person to determine recommended action to remediate and re-plant area if necessary. Implement actions recommended.
	Soil availability	Trigger	Soil Register indicates sufficient soil resources for proposed rehabilitation over the MOP/RMP term and for life of mine.	Soil Register indicates a minor deficiency of soil resources for life of mine, but sufficient resources available for rehabilitation activities over MOP/RMP term.	Soil Register indicates a deficiency of soil resources significant enough to delay rehabilitation activities for MOP/RMP term.
		Response	No response required. Continue monitoring program.	Investigate options available in order to meet life of mine soil resource requirements, including undertaking review of soil stripping depths and amelioration of subsoil stocks.	Investigate options available in order to progress rehabilitation over MOP/RMP term, including options for amelioration of subsoil stocks. Undertake a review of soil stripping depths and re-application depths. Implement actions required to continue progressive rehabilitation.



**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Spontaneous combustion	Evidence of spontaneous combustion	Trigger	No evidence of spontaneous combustion in rehabilitation areas.	Isolated incident of spontaneous combustion in rehabilitation area.	Repeated or widespread incidences of spontaneous combustion in rehabilitation areas.
		Response	No response required. Continue monitoring program.	Initiate MPO Spontaneous Combustion Management Plan. Investigate reason for incident including a review of site records for the area including whether placement occurred at required depth (i.e. 5 m from emplacement surface). Review to determine requirement for rehabilitation remediation. Implement remediation if necessary.	Implement MPO Spontaneous Combustion Management Plan excavation procedures, re-cap and rehabilitate area.  Investigate reason for incident including a review of site records for the area including whether placement occurred at required depth (i.e. 5 m from emplacement surface). Determine if an increase to capping depth for carbonaceous material is required.
Acid forming material	Evidence of acid forming material	Trigger	No evidence of acid forming material in rehabilitation areas.	Rehabilitation monitoring (soil test) results and/or surface water monitoring results indicate acid forming material is close to the outer surface of overburden emplacement, resulting in a small/isolated area of revegetation failure.	Rehabilitation monitoring (soil test) results and/or surface water monitoring results indicate acid forming material is close to the outer surface of overburden emplacement, resulting in a widespread area (>50% of rehabilitation stage area) of revegetation failure.
		Response	No response required. Continue monitoring program.	Investigate extent of acid forming material, and review operational blending procedures and potential reason for incident. Determine requirement for change to blending procedures and a course of action for remediation. Implement outcomes from investigation.	Review operational blending procedures, and acid forming material emplacement procedures and implement more frequent geochemical testing of overburden material. Determine a course of action for remediation, including excavation requirements. Implement outcomes from investigation.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Agricultural Land	Pasture establishment	Trigger	Monitoring indicates perennial pasture establishment is on a trajectory towards analogue grazing sites as determined by a suitably qualified person.	Monitoring indicates perennial pasture establishment for a small area is on a stagnant trajectory compared with analogue grazing sites as determined by a suitably qualified person.	Monitoring indicates perennial pasture establishment for a significant area (>50% of rehabilitation stage area) is on a declining trajectory compared with analogue grazing sites as determined by a suitably qualified person.
		Response	No response required. Continue monitoring program.	Review grazing practices, weed presence and remediation requirements. Determine and implement appropriate course of action, e.g. reduce head of cattle to reduce grazing pressure, requirement for re-seeding, increased weed control effort.	Review grazing practices, revegetation seeding ratios, weed presence and remediation requirements. Determine and implement appropriate course of action. Remove cattle, and re-seed as soon as practicable (subject to suitable conditions) to minimise potential for weed incursion and erosion.
	Land Capability Class	Trigger	Monitoring indicates Agricultural areas are at or on a trajectory towards relevant Land Capability Classes 4, 5 or 6, as determined by a suitably qualified person.	Monitoring indicates a small area of Agricultural land is on a stagnant trajectory towards meeting its relevant Land Capability Class.	Monitoring indicates a significant area (>50% of rehabilitation stage area) of Agricultural land is on a declining trajectory towards meeting its relevant Land Capability Class.
		Response	No response required. Continue monitoring program.	Review grazing practices, weed presence and remediation requirements. Determine and implement appropriate course of action, e.g. reduce head of cattle to reduce grazing pressure, requirement for re-seeding, or other management/intervention measures.	Review grazing practices, revegetation seeding ratios, weed presence and remediation requirements. Determine and implement appropriate course of action. Remove cattle, and re-seed as soon as practicable (subject to suitable conditions) to minimise potential for weed incursion and erosion.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/ Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Native Woodland/ Grassland Areas	Revegetation species availability	Trigger	Seed/seedling supply for key native species available for rehabilitation activities over MOP/RMP term, including sufficient contingency supply.	A number of key native revegetation species (e.g. species typical of White Box EEC) are not available for proposed rehabilitation activities over MOP/RMP term from MPO Seed Harvesting Facility or from nursery supplier, however the majority of rehabilitation activities can be undertaken.	Due to unavailability of key native revegetation species (either from MPO Seed Harvesting Facility or from nursery supplier), other native species are required to be planted with key species planted once available.
		Response	No response required.	Investigate options available to source required seed/seedling stocks of key species to meet rehabilitation requirements e.g. instruct existing nursery supplier to source or grow more stock, or engage alternate nursery supplier.	Undertake a review of long-term revegetation species supply plan, including an assessment of likely seed supply volume from MPO seed collection campaigns, and capability of existing nursery supplier to supply volumes required. Investigate other alternate nursery suppliers available. Review timing for rehabilitation activities over MOP/RMP term.
	Species composition	Trigger	Monitoring results indicate native woodland/grassland rehabilitation area is on a timely trajectory for achieving the species composition completion criteria.	Monitoring results indicate native woodland/grassland rehabilitation area is on a stagnant trajectory towards achieving the species composition completion criteria.	Monitoring results indicate native woodland/grassland rehabilitation area is on an ongoing declining trajectory away from achieving the species composition completion criteria.
		Response	No response required. Continue monitoring program.	Review native species lists for the relevant target PCT and species ratios. Review ability of revegetation area to improve trajectory without intervention. Consider requirement for additional tubestock planting or patch seeding to achieve required target species richness.	Engage suitably qualified person to review native species list for the relevant target PCT, species ratios and monitoring results and inspect rehabilitation area. Review to recommend remediation options to achieve required target species richness. Implement recommended actions.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Native Woodland/ Grassland Areas (cont.)	Vegetation structure and density	Trigger	Monitoring results indicate native woodland/grassland rehabilitation area is on a timely trajectory for achieving the vegetation structure and density completion criteria.	Monitoring results indicate native woodland/grassland rehabilitation area is on a stagnant trajectory towards achieving the vegetation structure and density completion criteria.	Monitoring results indicate native woodland/grassland rehabilitation area is on an ongoing declining trajectory away from achieving the vegetation structure and density completion criteria.
		Response	No response required. Continue monitoring program.	Review density of key species in relevant analogue sites of the target PCT and review species ratios. Review ability of revegetation area to improve trajectory without intervention. Consider requirement for additional tubestock planting or seeding to achieve over-storey cover, midstorey cover and native groundcover percentages.	Engage suitably qualified person to review density of key species of the target PCT, species ratios and monitoring results and inspect rehabilitation area. Review to recommend remediation options to achieve to achieve over-storey cover, midstorey cover and native groundcover percentages. Implement recommended actions.
	Non-native plant cover	Trigger	Monitoring results indicate non-native plant cover percentage within native woodland/grassland rehabilitation areas is <60% as required by the completion criteria.	Monitoring results indicate non-native plant cover percentage within native woodland/grassland rehabilitation areas is on an increasing trajectory and is close to, but <60% cover.	Monitoring results indicate non-native plant cover percentage within native woodland/grassland rehabilitation areas is on an increasing trajectory and is >60% cover.
		Response	No response required. Continue monitoring program.	Review planting and seeding ratios. Review weed management program. Review capability of revegetation area to improve trajectory without intervention. Consider requirement for additional tubestock planting or seeding or other management actions to reduce non-native plant cover percentage.	Engage suitably qualified person to review cover and density of key species the target PCT, and planting and seeding ratios, and monitoring results to date and to inspect rehabilitation area. Review to recommend appropriate management actions and/or remediation options to achieve to reduce non-native plant cover percentage to <60%. Implement recommended actions from review.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Agricultural Land and Native Woodland/ Grassland Areas	Drought	Trigger	Despite dry conditions, rehabilitation performance monitoring results are comparable with analogue sites.	Monitoring results indicate that ongoing drought conditions are likely affecting revegetation performance, but results continue to be trending towards completion criteria, yet on a slower trajectory.	Monitoring results indicates widespread revegetation failure as a result of drought conditions.
		Response	No response required. Continue monitoring program.	Review capability of revegetation area to improve trajectory without intervention.  Consider requirement for additional tubestock planting or seeding or other management actions including whether watering is required. Assess potential water source/supply options and trials.	Engage suitably qualified person to inspect drought affected rehabilitation area and recommend appropriate management actions including whether re-planting/ re-seeding feasible option considering drought conditions.
	Loss of revegetation due to frost/storm/flood/pest invasion event	Trigger	No damage to agricultural land and native woodland/grassland rehabilitation areas due to a frost/storm/flood/pest invasion event.	Damage to a small area of agricultural land and/or native woodland/grassland rehabilitation due to a frost/storm/flood/pest invasion event.	A significant area (>50% of rehabilitation stage area) of damage to agricultural land or native woodland/grassland rehabilitation due to a frost/storm/flood/pest invasion event.
		Response	No response required. Continue monitoring program.	Review capability of revegetation to improve trajectory without intervention.  Consider requirement for additional tubestock planting or seeding to replace revegetation loss or implement other management actions to remediate the area.	As soon as suitable conditions permit, replace revegetation loss by re-planting or re-seeding.  Review adequacy of pest management practices. Review adequacy of flood mitigation/drainage structures.  Implement any recommendations from reviews undertaken.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Agricultural Land and Native Woodland/ Grassland Areas (cont.)	Weed presence	Trigger	Weed presence is within range found at analogue sites and does not pose a risk to rehabilitation establishment or progression.	Weeds present a risk to rehabilitation establishment or progression.	Weeds are posing a significant threat to establishment of rehabilitation or rehabilitation progression.
		Response	No response required. Continue monitoring program.	Review weed management practices including timing that weed management is undertaken. Implement weed control measures to reduce threat, including follow-up weed control if required.  Determine requirement for other management actions, including requirement for remediation (e.g. re-seeding/re-planting) of rehabilitation area.	Review weed management practices including timing that weed management is undertaken.  Review rehabilitation records to identify source of topsoil. Inspect topsoil source area (i.e. soil stockpile or area soil stripped from) to determine weed presence.  Implement weed control measures at rehabilitation area and at topsoil source, if identified as likely source of weed issue, as soon as suitable conditions permit. Remediate (re-plant, re-seed) as soon as suitable conditions permit.  Investigate adequacy of revegetation planting and seeding ratios, and weed control practices on soil stockpiles or proposed soil stripping areas and any other management measures to assist native plant establishment in consultation with suitably qualified person.



**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Fauna habitat	Habitat feature presence	Trigger	Various fauna habitat features including stags, logs, rock piles have been incorporated in rehabilitation areas that are representative of habitat capable of supporting relevant threatened fauna species, or is equivalent to relevant analogue site. Fauna observed utilising habitat features.	Various fauna habitat features including stags, logs, rock piles have been incorporated in rehabilitation areas that are representative of habitat capable of supporting relevant threatened fauna species, or is equivalent to relevant analogue site. Fauna not yet observed to be utilising habitat features.	ITP check process indicates that inadequate fauna habitat features including stags, logs, rock piles have been incorporated in rehabilitation areas (at the set rates defined in Section 7.2.4) and are not representative of habitat capable of supporting relevant threatened fauna species, or are not equivalent to relevant analogue site. Fauna not yet observed to be utilising habitat features.
		Response	No response required. Continue monitoring program.	Confirm habitat features have been installed as per set rate (as defined in Section 7.2.4).  Investigate whether sufficient habitat resources are available and with time whether fauna are likely to use the habitat features. Consider requirement for additional or more varied habitat features.	Install habitat features at set rates. Conduct ITP check process to verify installation as per set rate.  Investigate whether sufficient habitat resources are available and with time whether fauna are likely to use the habitat features. Consider requirement for additional or more varied habitat features.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Neighbouring landowner practices and wildlife corridors	Incompatible neighbouring landowner practices and wildlife corridor establishment	Trigger	Neighbouring landowner (including the Bengalla Mine and adjoining private landholders) practices are aligned with MPO practices and wildlife corridors have been or are likely to be successfully established.	Some key land management practices (e.g. weed control, pest control or inappropriate fencing) by neighbouring landowners (including the Bengalla Mine and adjoining private landholders) are impacting short-term rehabilitation performance at the MPO and may affect the establishment of wildlife corridors in the long term.	Land management practices (e.g. weed control pest control or inappropriate fencing) by neighbouring landowners (including the Bengalla Mine and adjoining private landholders) are incompatible with MPO land management practices and are impacting rehabilitation performance at the MPO and do not facilitate wildlife movement.
		Response	No response required. Continue monitoring program.	Communicate MPO rehabilitation and land use objectives, including wildlife corridor goals, with neighbouring landowners, and with the MPO CCC. Communicate details of MPO land management practices including timing and practices and propose implementation collaboration.	Implement required control measures to contain threats to MPO rehabilitation (e.g. weed control, pest control, re-seeding/re-planting).  Communicate MPO rehabilitation and land use objectives, including wildlife corridor goals, with neighbouring landowners (including key mine management team at Bengalla Mine if necessary), and with the MPO CCC and relevant regulatory authorities if necessary. Communicate details of MPO land management practices including timing and practices and propose implementation collaboration.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Bushfire	Fuel loads	Trigger	Fuel loads in rehabilitation areas are assessed and managed as required by MPO Bushfire Management Plan.	Fuel loads in rehabilitation areas are at a level that have the potential to risk rehabilitation.	A fire on site damages rehabilitation.
		Response	No response required. Continue monitoring program.	Implement Bushfire Management Plan procedures such as maintenance of fire breaks, auditing of fire fighting equipment, and looking into trials for mosaic or cool burning to reduce fuel loads.  Inspect water sources and assess adequate availability of water.	Re-plant/re-seed affected area with those species that do not naturally regenerate over a 2 year period post-fire (Pickup <i>et.al.</i> , 2012).
Surface water	Surface water quality	Trigger	Surface water quality monitoring results are outside of relevant trigger level ranges defined in the MPO Surface Water Management Plan (SWMP).	As per Section 6 'Surface Water Impact Trigger Levels' of the SWMP, an investigation is triggered when: <ul style="list-style-type: none"> <li>a water quality indicator at a downstream receiving water monitoring location is above (or outside the range) of trigger investigation level for three consecutive sampling events; and</li> <li>a water quality indicator at a downstream water monitoring location is above (or below in event of a trigger of the lower pH limit) the corresponding upstream monitoring location (where such a monitoring location exists) sampled on the same day.</li> </ul>	
		Response	No response required. Continue monitoring program.	Conduct Surface Water Investigation in accordance with 'Surface Water Quality Response Protocol' as described in Section 3.1 of the MPO Surface and Ground Water Response Plan (SGWRP), and implement response measures identified by investigation, if required.	

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Surface water (cont.)	Water retained on-site post-mining	Trigger	Water quality monitoring during post-mining phase indicates that water retained on-site is fit for relevant post-mining land use (i.e. agriculture or native ecosystem).	Water quality monitoring during post-mining phase indicates that water retained on-site is not yet fit for relevant post-mining land use (i.e. agriculture or native ecosystem), yet does not pose a risk to achieving completion criteria.	Water quality monitoring during post-mining phase indicates that water retained on-site is not fit for relevant post-mining land use (i.e. agriculture or native ecosystem), and requires remediation to achieve completion criteria.
		Response	No response required. Continue monitoring program.	Review trends of water quality monitoring results and review requirement for active management measures or remediation. Implement any recommendations from review.	Engage suitably qualified person to investigate possible reasons for poor water quality issues, and to provide recommendations for remediation. Implement remediation recommendation as soon as possible.
	Water discharged from the site post-mining	Trigger	Water quality monitoring during post-mining phase indicates water discharged from site is comparable to surrounding analogue sites and suitable for receiving waters, aquatic ecology and riparian vegetation.	Water quality monitoring during post-mining phase indicates that water discharged from site is not yet comparable to surrounding analogue sites and suitable for receiving waters, aquatic ecology and riparian vegetation, but does not pose a risk to achieving completion criteria.	Water quality monitoring during post-mining phase indicates that water discharged from site continues to show a declining trend in comparison to surrounding analogue sites and is not suitable for receiving waters, aquatic ecology and riparian vegetation and on-site intervention is required to achieve completion criteria.
		Response	No response required. Continue monitoring program.	Review trends of water quality monitoring results and review requirement for active management measures or remediation. Implement any recommendations.	Engage suitably qualified person to investigate possible reasons for poor water quality issues, and to provide recommendations for remediation. Implement remediation recommendation as soon as possible.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Groundwater	Groundwater level and quality	Trigger	Groundwater level and groundwater quality monitoring results are below relevant trigger levels defined in the MPO Groundwater Management Plan (GWMP).	<p>As per Section 7 'Groundwater Impact Trigger Levels' of the GWMP, an investigation is triggered when:</p> <ul style="list-style-type: none"> <li>A groundwater level measurement at a relevant alluvial monitoring bore falls below the trigger value specified within Table 10 of the GWMP.</li> </ul> <p>A monitoring bore records an EC or pH value above (or outside the range of) the trigger values specified in Table 12 of the GWMP at three successive monitoring rounds.</p>	
		Response	No response required. Continue monitoring program.	Conduct Groundwater Investigations in accordance with 'Groundwater Level Response Protocol' or 'Groundwater Quality Response Protocol' as described in Section 3.2 of the SGWRP, and implement response measure identified by investigation, if required.	
Fines Emplacement Area	Geotechnical stability	Trigger	Geotechnical monitoring results indicate Fines Emplacement Area (FEA) embankments are stable.	Geotechnical monitoring results indicates a small area of FEA embankment is compromised (e.g. slumped) or small/minor expression of water/seepage at toe of embankment observed.	Geotechnical monitoring results indicates a significant area of FEA embankment is compromised (e.g. slumped) or significant expression of water/seepage at toe of embankment observed.
		Response	No response required. Continue monitoring program.	MPO geotechnical and relevant mine design personnel to investigate possible causes and determine appropriate course of action. Implement determined action.	Suitably qualified person/consultant to be engaged to conduct geotechnical assessment of FEA with input from relevant MPO geotechnical and mine design personnel, and provide recommendations for options for remediation. Remediate as soon as possible.

**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Fines Emplacement Area (cont.)	Rehabilitation capping	Trigger	FEA rehabilitation capping is functioning as designed and is supporting target revegetation.	Monitoring of FEA revegetation indicates revegetation performance of a small area is stagnating.	Monitoring of FEA revegetation indicates a significant area of revegetation has failed or revegetation performance is on an ongoing declining trend.
		Response	No response required. Continue monitoring program.	Relevant MPO Environment and mine design personnel to investigate possible causes and determine appropriate course of action, if required. Implement determined action, if necessary.	Suitably qualified person/consultant to be engaged to conduct assessment of FEA rehabilitation performance/capping design and FEA drainage design with input from relevant MPO Environment and mine design personnel. Assessment to propose recommendations for remediation. Remediate as soon as possible.
Final void	Final void water balance	Trigger	Final void monitoring results confirm final void water balance modelling predictions.	Final void monitoring results indicate some minor inconsistencies with final void water balance modelling predictions, e.g. groundwater inflows or surface water runoff inflows marginally above predictions, and are continuing to trend marginally above predictions.	Final void monitoring results indicate significant inconsistencies with final void water balance modelling predictions, e.g. groundwater inflows or surface water runoff inflows significantly above predictions, and are continuing to trend above predictions, and may result in overtopping of final void.
		Response	No response required. Continue monitoring program.	Suitably qualified person to undertake a review of final void water monitoring results and final void water balance, and determine possible reasons for results, and if any ameliorative/management actions are required.	Suitably qualified person/s and key MPO mine design personnel to undertake a review of final void design and MPO final landforms (including final void catchment) and determine options for amending final void design and/or design of other final landforms to prevent final void overtopping. Implement recommended course of action as soon as possible.



**Table 9-1 (Continued)**  
**Rehabilitation Trigger Action Response Plan**

Aspect/ Category	Element of Aspect/Category	Trigger/ Response	Condition Green	Condition Amber	Condition Red
Final void (cont.)	Geotechnical stability post-mining	Trigger	Geotechnical monitoring results indicate ongoing stable trend and Geotechnical Assessment of final void post-mining verifies long-term stability of final void high walls and low walls.	Geotechnical monitoring results of final void post-mining indicates a marginal change to a Factor of Safety rating for a final void high wall or low wall, however the change does not pose a threat to the long-term stability of the final void.	Geotechnical monitoring results of final void post-mining indicates a significant change to a Factor of Safety rating for a final void high wall or low wall, and could pose a threat to the long-term stability of the final void.
		Response	No response required. Continue monitoring program.	Suitably qualified person/s and key MPO geotechnical and mine design personnel to review trend of monitoring results and determine whether any management actions required.	Engage suitably qualified person/consultant to conduct Geotechnical Assessment, including options for amending final void design. Implement recommended course of action as soon as possible.