WHITEHAVEN COAL

ABN: 69 107 169 102

Werris Creek Coal Pty Limited

Mining Operations Plan

for the

Werris Creek Coal Mine

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

December 2015

This page has intentionally been left blank

WHITEHAVEN COAL

ABN: 69 107 169 102

Werris Creek Coal Pty Limited

Mining Operations Plan

for the

Werris Creek Coal Mine

Prepared for:

Werris Creek Coal Pty Limited
ABN: 69 107 169 102
PO Box 125
WERRIS CREEK NSW 2341

Telephone: (02) 6768 7071
Facsimile: (02) 6768 7072
Email: mhammond@whitehavencoal.com.au

Prepared by:

R.W. Corkery & Co. Pty. Limited
Geological & Environmental Consultants
ABN: 31 002 033 712

Brooklyn Office:
1st Floor, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Telephone: (02) 9985 8511
Facsimile: (02) 6361 3622
Email: brooklyn@rwcorkery.com

Orange Office:
62 Hill Street
ORANGE NSW 2800

Telephone: (02) 6362 5411
Facsimile: (02) 6361 3622
Email: orange@rwcorkery.com

Brisbane Office:
Suite 5, Building 3
Pine Rivers Office Park
205 Leitchs Road
BRENDALE QLD 4500

Telephone: (07) 3205 5400
Facsimile: (02) 6361 3622
Email: brisbane@rwcorkery.com

Ref No. 623/18

December 2015

R.W. CORKERY & CO. PTY. LIMITED

TITLE BLOCK

Name of Mine	Werris Creek Coal Mine
MOP Commencement Date	30 November 2015
MOP Completion Date	30 November 2022
Mining Authorisations	ML1563, 1671 & 1672
Name of Authorisation holders	ML 1563: Creek Resources Pty Ltd and Betalpha Pty Ltd ML 1671 / ML 1672: Werris Creek Coal Pty Limited
Name of Mine Operator (if different)	Werris Creek Coal Pty Limited
Name and Contact Details of the Mine Manager (or equivalent)	Rod Hicks – 0417 715 712
Name and Contact Details of Environmental Representative	Mark Hammond – 0488 497 701
Name of Representative(s) of the Authorisation Holder(s)	Nigel Wood
Title of Representative(s) of the Authorisation Holder(s)	Director/General Manager – Gunnedah
Signature of Representative(s) of the Authorisation Holder(s)	MWood
Date	8.1.2016
Version	Final

CONTENTS

Page

CONTENTS

Page

CONTENTS

Page

FIGURES

TABLES

CONTENTS

Page

PLANS

LIST OF ACRONYMS

ABS	Australian Bureau of Statistics
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
BOA	Biodiversity Offset Area
BOMP	Biodiversity and Offset Management Plan[1]
BOS	Biodiversity Offset Strategy
DPE	Department of Planning & Environment
DPI	Department of Primary Industries
DRE	Division of Resources & Energy (within NSW Trade & Investment, Regional Infrastructure & Services)
EA	Environmental Assessment
EPA	Environmental Protection Authority
EPL	Environment Protection Licence
LDSDP	Leading Practice Sustainable Development Program for the Mining Industry
LFA	Landscape Function Analysis
LOM	Life of Mine
ML	Mining Lease
MOP	Mining Operations Plan
NSW T&I	NSW Trade & Investment, Regional Infrastructure & Services
OCE	Open Cut Examiner
PA	Project Approval
ROM	Run-Of-Mine
RWC	R.W. Corkery & Co. Pty Limited
SWMP	Site Water Management Plan
WCC	Werris Creek Coal

[1] The Biodiversity and Offset Management Plan is currently being reviewed, updated and renamed the Werris Creek Coal Mine Biodiversity Management Plan. Any reference to the BOMP throughout the MOP may be considered a reference to the Biodiversity Management Plan on approval of this updated document.

This page has intentionally been left blank

1. INTRODUCTION

1.1 SCOPE AND FORMAT

1.1.1 Scope

This *Mining Operations Plan* (MOP) for the Werris Creek Coal Mine ("the Mine") has been prepared by R.W. Corkery & Co. Pty. Limited (RWC) and Werris Creek Coal Pty Ltd ("the Company" or "WCC") and represents the fourth MOP prepared for the Mine. The Mine comprises Mining Leases (ML) 1563, 1671 & 1672, approximately 1.5km south of Werris Creek and 11km north-northwest of Quirindi, at their closest points, within an area defined as the Gunnedah Coalfield (**Figure 1.1**). It is noted ML 1671 occurs as four discrete units, with the three MLs together forming a concurrent area of 925.15ha.

A MOP is required to be submitted and approved by the Secretary of NSW Trade and Investment, Regional Infrastructure and Services (NSW T&I)[2] in accordance with *Condition 2* of ML1563 and *Condition 3* of MLs 1671 and 1672. This MOP replaces the existing MOP dated 01 November 2011 to reflect approval of a modification to Project Approval [PA] 10_0059 issued by the Department of Planning & Environment (DPE) on 3 November 2015 (PA 10_0059 MOD2), amendments to the proposed sequence of mining, and to update content to comply with *ESG3: Mining Operations Plan (MOP) Guidelines* ("the Guidelines"), released by NSW T&I – Division of Resources and Energy (DRE) in September 2013.

This MOP seeks approval for the maximum seven years operation (until 30 November 2022) and incorporates minor construction activities, extensions to mine infrastructure and ongoing mining activities. As noted above, the mining and rehabilitation activities reflect the marginal extension of the out-of-pit component of overburden emplacement to the west and in-pit component to the north approved by PA 10_0059 MOD2 and amended mining sequence.

This MOP provides for a continuation of mining of the Werris Creek coal resource, however, final decommissioning, landform preparation, rehabilitation and relinquishment will be the subject of a Closure MOP to be prepared closer to the date of MOP completion.

This MOP also incorporates the requirements for a *Rehabilitation Management Plan*, in accordance with *Condition 3(43)* of PA 10_0059.

1.1.2 Format of this Document

This MOP has been prepared in accordance with the Guidelines and provides detailed information on mining, processing and rehabilitation operations within MLs 1563, 1671 & 1672. This MOP also provides information to demonstrate the environmental risks associated with mining operations on MLs 1563, 1671 & 1672 are being appropriately managed and mitigated. **Table 1.1** provides a summary of where the required tables, figures and plans are presented in this MOP.

[2] Replacing the Director-General of the relevant NSW department at the time of granting of mining lease.

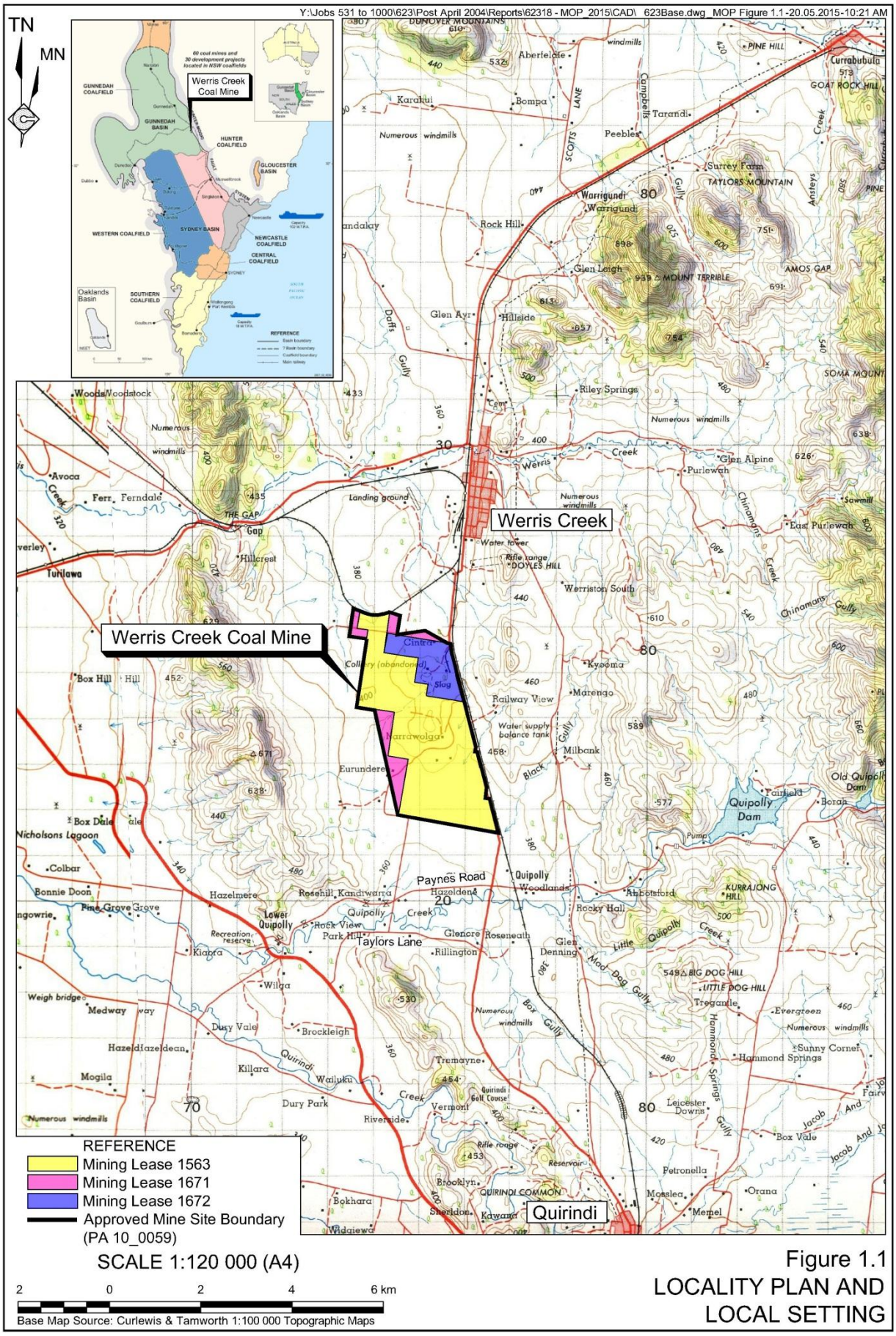


Figure 1.1
LOCALITY PLAN AND LOCAL SETTING

Table 1.1
Summary of Required Tables, Figures and Plans

Section of MOP	Table/Plan Reference	Source
Inside cover	MOP Title Block	
1.1.2	Table 1.1: Summary of Required Tables, Figures and Plans	
2.3	Table 2.1: Major Assets in Each Domain	WCC
2.4.15	Table 2.4: Material Production Schedule during the MOP term	Mine Schedule
5.3	Summary Rehabilitation Phases for end of MOP term	Mine Schedule
6	Table 6.1: Measurement of Rehabilitation Performance	Various
7.1	Table 7.1: Status of Rehabilitation at the Commencement of the MOP	
7.3	Disturbance and Rehabilitation Progression during MOP term	Mine Schedule
11	Plan 1A – Pre-mining Environment – Project Locality	Mine Planning and Environment Teams
11	Plan 1B – Pre-mining Environment – Natural Environment	
11	Plan 1C – Pre-mining Environment – Built Environment	
11	Plan 2 – Mine Domains at Commencement of MOP	
11	Plan 3A – Mining and Rehabilitation – End Year 1	
11	Plan 3B – Mining and Rehabilitation – End Year 2	
11	Plan 3C – Mining and Rehabilitation – End Year 3	
11	Plan 3D – Mining and Rehabilitation – End Year 4	
11	Plan 3E – Mining and Rehabilitation – End Year 5	
11	Plan 3F – Mining and Rehabilitation – End Year 6	
11	Plan 3G – Mining and Rehabilitation – End of MOP	
11	Plan 4 – Final Rehabilitation and Post-mining Land Use	
11	Plan 5 – Rehabilitation and Post-mining Land Use Sections	

The format generally complies with that provided under the heading '*Compiling a Mining Operations Plan'* in the Guidelines and by doing so also provides the *Rehabilitation Management Plan* for the mine, as required by *Condition 3(43)* of PA10_0059.

1.2 HISTORY OF OPERATIONS

The Former Werris Creek Colliery

Underground mining at the former Werris Creek Colliery commenced commercially in 1925, closing in 1963 due to the cancellation of railway contracts for coal. The operation, owned by Preston Coal Company was small, employing a total of 13 people in 1928 (Pratt, 1996). The former Colliery was predominantly a bord and pillar underground operation in which very few of the pillars have been removed (Pratt, 1996). The operation mined the lower 2.5m of what was referred to as the "Tunnel Seam" which corresponds to the E Seam of the Mine.

Development and Commencement of the Werris Creek Coal Mine

In 2002, Exploration License (EL) 5993 was granted to Creek Resources Pty Ltd and Betalpha Pty Ltd to undertake further exploration of the coal basin. Development Consent DA 172-7-2004 was approved on the 18 February 2005 and ML 1563 was granted on 23 March 2005. Construction for open cut operations commenced in April 2005.

Mining under Development Consent 172-7-2004 (Mining Operations Plans 1 and 2)

The original MOP, dated April 2005, covered the first 3 years of open cut coal mining being 1 April 2005 to 31 March 2008 (RWC, 2005). An amendment to the original MOP was approved by the Department of Primary Industries (DPI) on 27 March 2008 granting an extension of the MOP period to 31 August 2008 and a northerly extension to open cut mining. The second MOP was approved on 21 August 2008 for the period 1 September 2008 to 31 August 2012 (WCC, 2008). A modification to the second MOP was prepared allowing mining of the former Werris Creek underground workings, an increase in height and lateral extension to the overburden emplacement (reflecting a modification to the development consent) for the period 1 October 2009 to 31 December 2011.

Mining under Project Approval 10_0059 (Mining Operations Plan 3)

A third MOP was prepared in 2011 consistent with the approved operations under PA 10_0059 for the Werris Creek Coal Mine Life of Mine (LOM) Project. This MOP presented the open cut mining sequence as a series of east-west oriented benches, with access to the lower sections of the open cut obtained by haul ramps developed on the low wall of the open cut (where overburden is progressively placed within the mined out sections of the open cut).

Currently mining is approaching the deepest section of the open cut and is encountering the underground workings of the former Werris Creek Colliery. As a result of reduced coal recovery from some seams[3], the strip ratio is greater than the originally forecast (5.4:1). The volume of overburden requiring disposal is subsequently being generated at an accelerated rate to that originally forecast. In order to offset the higher overburden / interburden to coal strip ratios encountered at the Mine, it has been determined that the development of a north-south oriented bench targeting the shallow, low strip ratio coal along the western edge of the open cut will reduce the average strip ratio of the Mine. In order to offset the greater than anticipated volume of overburden, the minor extensions of the overburden emplacement (which were the subject of the application for modification to PA 10_0059) were required.

This (fourth) MOP has been prepared to account for the minor modifications approved by PA 10_0059 MOD2, as outlined within an *Environmental Assessment* that was prepared (RWC, 2015), to improve the operational flexibility of the Werris Creek Coal Mine and to continue mining efficiently and productively.

1.3 CURRENT CONSENTS, AUTHORISATIONS AND LICENSES

Table 1.2 presents the current consents, authorisations and licences held in relation to the Mine.

As a State Significant Development, the Werris Creek Coal Mine is a Level 1 Mine and the mining and rehabilitation schedule of the MOP (and Plans) have been prepared accordingly.

[3] Between the 2012/2013and 2013/2014 AEMR periods, the coal reserve of the Mine was reduced by approximately 4Mt (WCC, 2013, WCC, 2014).

Table 1.2
Tenements, Licences and Approvals

Issuing Authority	Type	Date of Issue	Expiry	Comments
Department of Planning & Environment	PA 10_0059[1]	25 October 2011	December 2032	Issued under the now repealed Part 3A of the EP&A Act.
	PA 10_0059 MOD1[1]	30 August 2012		Approving modification to the location of void water dams and explosives magazine.
	PA 10_0059 MOD2	3 November 2015		Approving minor extensions to the overburden emplacement, dry screening operations and off-site use of void water for agricultural activities.
Department of Primary Industries, Mineral Resources[2]	ML 1563	23 March 2005	23 March 2026	For the purpose of prospecting and mining for coal.
Department of Trade & Investment, Regional Infrastructure & Services – Division of Resources & Energy	ML 1671	9 March 2012	9 March 2033	For mining purposes of: • Construction maintenance and use of various mine infrastructure; • Stockpile management; • Equipment and/or materials storage; • Electrical power infrastructure; and • Ground works associated with drilling.
	ML 1672	9 March 2012	9 March 2033	For the purpose of prospecting and mining for coal.
Environment Protection Authority	Environment Protection Licence No. 12290	18 April 2005	Anniversary date: 01 April Review Date: 23 June 2019	
Department of Primary Industries – Water (DPI Water)	WAL29506 WAL32224 90WA822532 90WA828345	21 February 2013 19 June 2013 15 January 2010 15 June 2012	Continuing tenure Continuing tenure 15 January 2025 15 June 2017	Groundwater bore 50ML/year. Groundwater interception 211ML/year. Works approval for bore. Works approval for excavation.
Liverpool Plains Shire Council	Sewerage Management Systems • 04/06 • 05/06	 1 March 2006 1 March 2006		

Note 1: Approved by the former, Department of Planning & Infrastructure (DP&I)
Note 2: Now, Department of Trade & Investment, Regional Infrastructure & Services - Division of Resources & Energy (DRE)

WCC has in place a number of management plans which satisfy the conditional requirements of PA 10_0059. This MOP has been prepared to satisfy the requirements for a *Rehabilitation Management Plan* (Condition 43 of Schedule 3). Other management plans which form the basis of ongoing environmental management and monitoring at the Mine include:

- *Noise Management Plan* (including a *Rail Spur Management Plan*) prepared and implemented in accordance with Condition 5 of Schedule 3;
- *Blast Management Plan* prepared and implemented in accordance with Condition 13 of Schedule 3;
- *Air Quality and Greenhouse Gas Management Plan* prepared and implemented in accordance with Condition 19 of Schedule 3;

- *Water Management Plan* (including a *Surface Water Management Plan* and *Groundwater Management Plan*) prepared and implemented in accordance with Condition 23 of Schedule 3;
- *Biodiversity and Offset Management Plan* prepared and implemented in accordance with Condition 28 of Schedule 3; and
- *Heritage Management Plan* prepared and implemented in accordance with Condition 32 of Schedule 3.

Each management plan is hosted and can be viewed on the Werris Creek Coal Environmental Management page of the Whitehaven Coal Limited website.

1.4 LAND OWNERSHIP AND LAND USE

1.4.1 Land Ownership

Figure 1.2 identifies the land owned by the Company within and surrounding the Mine. **Figure 1.2** also identifies the locations of Company-owned and privately-owned residences immediately surrounding the Mine.

1.4.2 Land Use

Land use in the Werris Creek and Quipolly locality area can be described as smaller scale mixed farming, however, this trends to larger more intensive agriculture further west on the Liverpool Plains. To the south of the Mine, between Taylors Lane and Paynes Road, a number of landholders are dependent on irrigation to sustain relatively high intensity lucerne cropping with cattle grazing.

Other notable current or previous land uses within or immediately surrounding the Mine are as follows.

- Former gravel extraction quarries of Liverpool Plains Shire and Tamworth Regional Council which have been incorporated into the open cut of the Mine;
- A zeolite processing plant, operated by Zeolite Australia Pty Ltd, and servicing a zeolite mine west of the Mine.
- The former Werris Creek Colliery, remnants of which have been identified on the "Preston Park" property.
- A biodiversity offset area on lands of the Mine and surrounding properties.

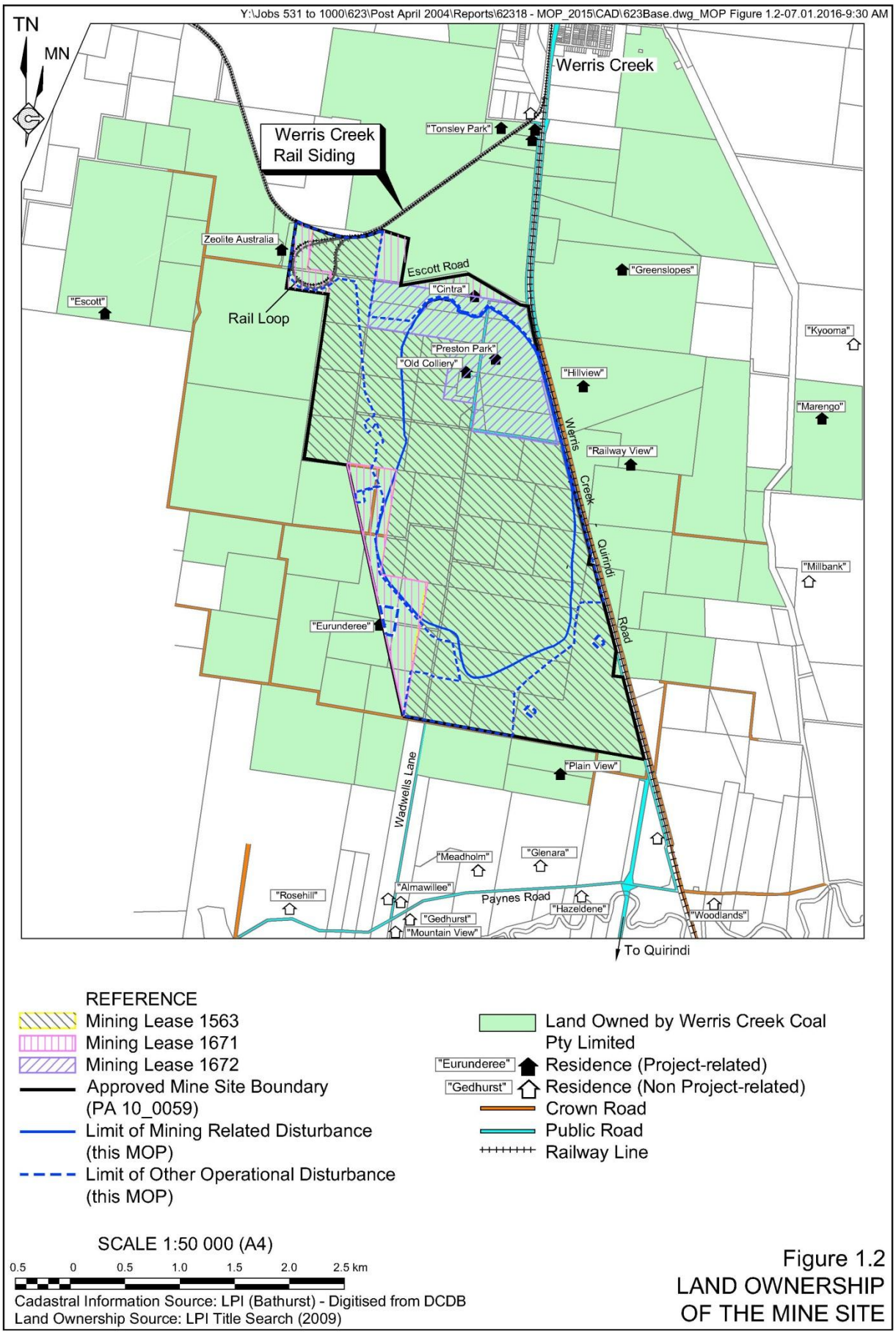


Figure 1.2
LAND OWNERSHIP
OF THE MINE SITE

The town of Werris Creek is situated to the north of the Mine. Referenced as the first railway town in Australia, the rail industry has historically been an important feature of the town. While less significant now, the railway station, railway museum and rail yards on the western side of town still represent a significant land use. The land within Werris Creek is, however, predominantly used for residential and commercial purposes.

1.5 STAKEHOLDER CONSULTATION

1.5.1 Community Consultation

The local community has been kept informed of the proposed minor changes to mining operations through the Mine's Community Consultative Committee (CCC), open community meetings, mine inspections and community newsletters. The following provides a summary of this consultation.

Werris Creek Community Consultative Committee

The planned minor modifications to mining operations was first raised at the September 2014 CCC Meeting, however, no specific issues were raised.

The proposed modifications to mining operations were again discussed at the February 2015 CCC Meeting and again no specific issues related to these operations were raised. It is noted a motion was carried by the CCC to support the Proponent's application to use void water for beneficial agricultural purposes.

Werris Creek Community Meetings

The Company also hosts 6 monthly meetings with the community, with attendance open to any interested parties. The proposed modification to mining operations were identified and discussed at the 17 September 2014 and 26 February 2015 meetings. No specific issues were raised, however, a motion was carried by the CCC to support the Proponent's application to use void water for beneficial agricultural purposes. The Proponent is cognisant of the community's general concerns over noise, blasting and dust emissions.

Werris Creek Coal Mine Open Inspection

The Company is conscious of maintaining transparency over operations with the local community. With this in mind, an inspection of the Mine, in the form of a bus tour, was held on 11 October 2014. A general overview of the operation was provided and an opportunity given to those attending to ask questions about operations and performance. The proposed modifications to mining operations were identified during the inspection, however, again no specific issues were raised.

Community Newsletters

The Company issues a quarterly newsletter to the Werris Creek community which outlines operations at the Mine and issues of relevance or interest to the community. In the Autumn 2015 Newsletter, the proposed modification to mining operations was discussed.

1.5.2 Government Agency Consultation

The following government agencies were contacted on 19 February 2015 to present the details of proposed modifications to operations at the Werris Creek Coal Mine, the catalyst for the preparation of this MOP.

- Department of Planning & Environment (DPE).
- Liverpool Plains Shire Council (LPSC).
- Environment Protection Authority (EPA).
- Department of Primary Industries - Water (DPI Water).
- Department of Primary Industries (Office of Agricultural Sustainability & Food Security) (OASFS).
- Division of Resources and Energy (DRE) (within the Department of Trade & Investment, Regional Infrastructure & Services).

The information presented to each government agency or authority included details on the modified open cut and overburden development sequence. With respect to matters relevant to the preparation of a MOP (incorporating a Rehabilitation Management Plan), only the DRE has provided formal feedback requesting consideration of overburden emplacement design to limit the area retained as an upper 'plateau' on the landform. While alternative overburden emplacement designs have been considered (as documented in the *Environmental Assessment* prepared to support the application for modification to PA 10_0059, RWC 2015), these would require an increase in the maximum height of the overburden emplacement by at least 10m. Such an increase in height would be non-compliant with commitments made with respect to Mine Layout approved by PA 10_0059. In keeping with the rehabilitation objectives of *Condition 3(41)* of PA 10_0057, the final overburden emplacement landform incorporates plateau sub-catchments with an average fall of 1 to 2 %. Additional micro-relief, in form of minor rises and swales, will be incorporated into final design to ensure this is sympathetic to the surrounding natural landforms. This is further discussed in Section 4.4.

2. PROPOSED MINING ACTIVITIES

2.1 INTRODUCTION

The following sections provide an outline to the proposed mining and related activities, e.g. exploration, processing, waste management and water management. The progressive development and rehabilitation of the Mine is illustrated in **Plans 3A** to **3G** of Section 11.

It is recommended **Plans 3A** to **3G** be referenced and viewed in conjunction with the information presented in Section 2.

2.2 PROJECT DESCRIPTION

The Mine has approval to mine in full the Werris Creek coal measures which occur as a synclinal (bowl-shaped) formation to the immediate south of Werris Creek. **Figure 2.1** provides the layout of the Mine, as approved by PA 10_0059 MOD2. The 'Active Mining Area' identified on **Figure 2.1** defines the approved disturbance boundary of PA 10_0059 MOD2 and which is referenced as the 'Limit of Other Disturbance (this MOP)' on **Plans 1** to **4**.

Overburden and interburden generated by the progressive exposure of the coal seams is placed within an overburden emplacement which in-fills the mined-out void of the open cut and extends around the southwestern, southern and western perimeter of the open cut. The overburden emplacement is limited in lateral and vertical extent by PA 10_0059 MOD2 (see **Figure 2.1**). The overburden emplacement of the Mine is progressively rehabilitated as each 10m lift of the structure is completed.

Coal mined is placed on a ROM Pad to the west of the open cut where it is crushed, screened and further beneficiated as required before being transferred to a Product Coal Stockpile Area adjacent to the Werris Creek Rail Siding. The majority of product coal is loaded into trains from a Rail Load-out Facility (RLF), with the train returning to the Werris Creek Rail Siding via a rail loop on the Mine. A small proportion of coal (<50,000tpa) is despatched from the ROM Pad off the Mine by road using road registered trucks.

Water which accumulates in the open cut void, as rainfall runoff or groundwater seepage is currently pumped to six void water dams for storage and use for dust suppression. Void Water Dams 2, 5 and 6 are obscured on **Figure 2.1** by the final open cut / overburden emplacement landform. To accelerate evaporation from these void water dams, three misting evaporators are operated with the transfer to lands off the Mine for application to agricultural lands now also approved.

While the overall approval and approach to mining and rehabilitation does not vary from that described in the 2011 (third) MOP (WCC, 2011), several minor modifications have been incorporated into Mine operations and are highlighted as follows.

- A small lateral extension of the Out-of-Pit Overburden Emplacement to the west over an area designated for soil stockpiles (~6ha)[4].
- A northerly extension of the 400m to 445m AHD benches of the Overburden Emplacement by approximately 250m[5].

[4] The extension occurs over an area already disturbed for the purpose of soil stockpiling.
[5] The northerly extension of the in-pit component of the overburden emplacement does not require any additional extension of the Mine impact footprint.

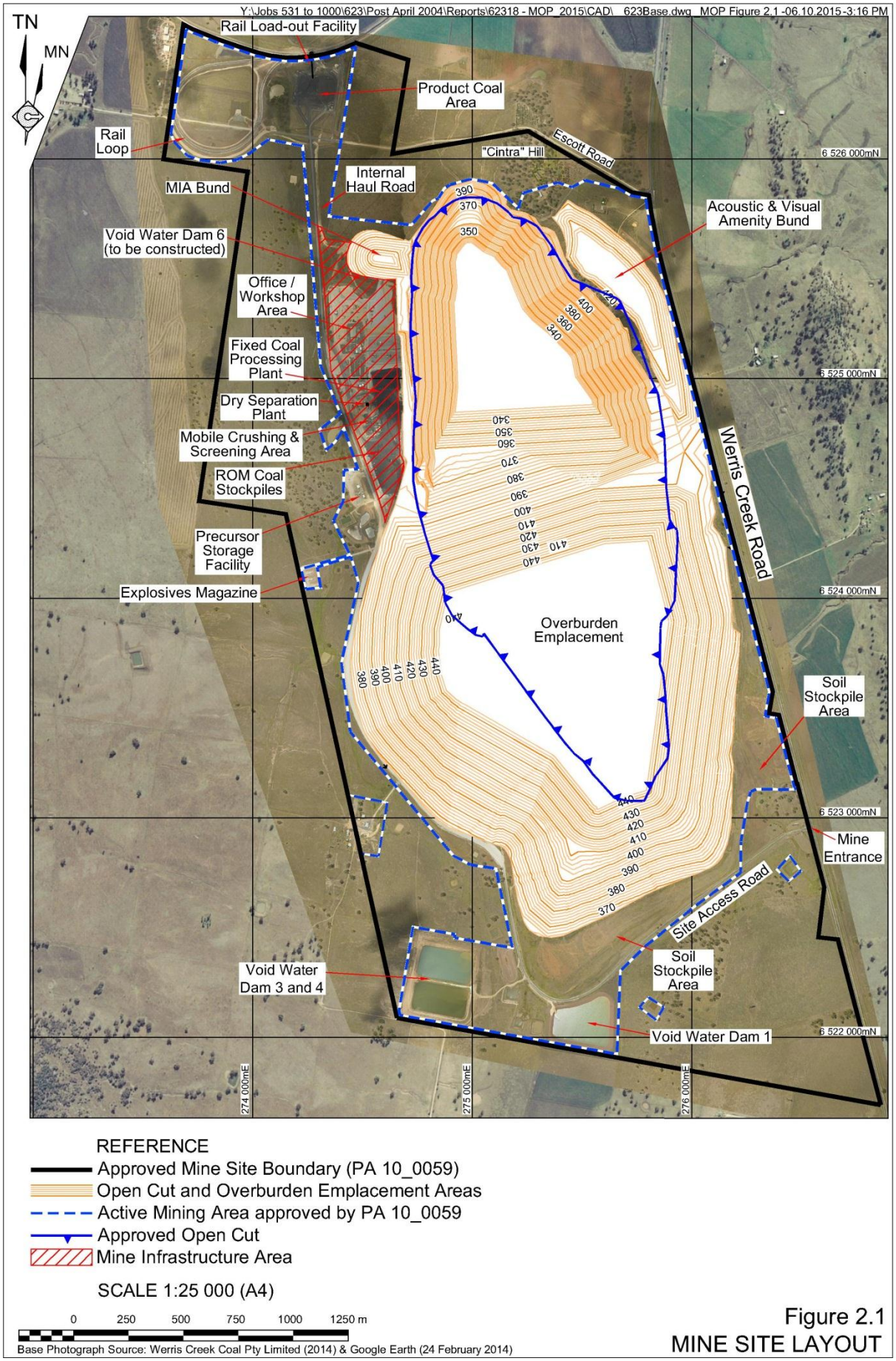


Figure 2.1
MINE SITE LAYOUT

- Incorporation of a new Dry Separation Plant to process coal with rock or other impurities. This coal is likely to be recovered initially from those seams previously mined by the Werris Creek Colliery.
- Provision for the supply of surplus void water for agricultural activities on and surrounding the Mine.

Section 2.4 provides a more detailed description of activities proposed over the term of this MOP.

2.3 ASSET REGISTER

Table 2.1 details the domains within the Mine, their size and major assets contained. Note that the areas detailed are based on maximum disturbance within the term of this MOP. A detailed description of each domain is provided in Section 5.1.

Table 2.1
Major Assets in each Domain

Domain (see Plan 2)	Area (ha)	Assets	Use and Details
1 – Infrastructure Area	85.5	Roads: Including haul and access.	Roads provide access to open cuts, site entry and inspection to site areas.
		Rail: Including Rail Load-out Facility and rail loop.	Rail provides route for the transportation of product coal.
		Buildings: Including administration, workshops and amenities.	For mine offices, contractor offices, personnel bathrooms and change rooms, and main workshop areas.
		Processing: Including crusher / screener, dry separator and ancillary infrastructure.	Processing plant to provide ongoing product coal for market.
		Explosives magazine: three securely fenced facilities.	For separate storage of components of explosives.
		Hydrocarbon storage: four 62 000L above ground tanks	For storage of fuel for mine fleet.
3 – Water Management Area	26.7	Includes: • Void Water Dams 1 to 6[1]; • Sediment Basins SB1 to SB18 and associated drainage infrastructure; • water storage dams; and • other pumping and pipework infrastructure.	Management of clean, dirty and mine water for diversion and use within the Mine / Company-owned land respectively.
4 – Overburden Emplacement Area	237.7	Includes an in-pit and out-of-pit overburden emplacements and incorporated acoustic and visual amenity bunds.	Store overburden materials to a maximum height of 445m AHD.

Table 2.1 (Cont'd)
Major Assets in each Domain

Domain (see Plan 2)	Area (ha)	Assets	Use and Details
5 – Stockpiled Material	28.3	Includes a ROM Coal and Product Coal stockpiles along with topsoil stockpiles.	Storage of materials prior to despatch or use.
6 – Void (Open Cut)	107.2	A single open void partially backfilled and rehabilitated.	Coal recovery.
9 – Biodiversity Offset Area	216.9	Includes the dedicated Biodiversity Offset Area.	Continue to rehabilitate to requirements of Biodiversity Offset Area.
10 – Rural Land	185.2	Rural fences and agriculture infrastructure.	Used for intermittent agricultural activity.
Source: Werris Creek Coal Pty Limited			

2.4 ACTIVITIES OVER THE MOP TERM

2.4.1 Exploration

It is anticipated that limited exploration activities will be undertaken within the Mine throughout the term of this MOP but will potentially include the following for coal quality purposes:

- Geochemical coal sampling.
- Geological mapping.
- Geophysics.
- Diamond, reverse circulation and percussion drilling.

Environmental management of exploration activities will continue to be implemented to ensure that the conditional requirements of PA10_0059 are achieved and that the final rehabilitation of the exploration areas is consistent with the rehabilitation objectives identified in Section 4.3.

Reporting of the environmental performance of the exploration activities will be included within the Mine's AEMR. Technical reporting of exploration activities will be undertaken in accordance with the requirements of the document *Exploration reporting: A guide for reporting on exploration and prospecting in New South Wales* published by Industry and Investment NSW – Minerals and Energy in October 2010.

2.4.2 Land Preparation and Soil Management

Soil stripping and stockpile management will continue to be undertaken as follows.

Soil Stripping Procedures.

- Brown Chromosol and Dark Brown Vertosol topsoil are stripped to depths of 30cm for use in rehabilitation. Stoney Brown Chromosol topsoils are not stripped but treated as overburden. No subsoil stripping is now undertaken as there is sufficient subsoil stockpiled to meet future rehabilitation requirements.
- Soil materials are not stripped when either excessively dry or wet.
- Soil is graded or pushed into windrows using graders or dozers for later collection by scrapers or loading into trucks by excavators.
- Soil materials are reused immediately in areas undergoing progressive rehabilitation. Where this is not practicable, soil is placed directly into storage stockpiles close to active rehabilitation areas.
- As is the current practice, the soils of each soil unit are stockpiled separately.

Soil Stockpile Management

- The maximum depth of topsoil stockpiles will not exceed 3m.
- If soil is to be stockpiled for greater than 3 months, the stockpile will be shaped with a flat top and sides battered off and a seasonal cover crop will be sown. If soil is to be stockpiled for a longer period (greater than a year), native grass cover will be encouraged to establish on the stockpile.
- A soil sampling and testing program is undertaken annually including some soil stockpiles. This allows planning for soil amelioration if required during spreading.
- Signposts around stockpile perimeters are erected advising of the presence of the stockpiles.
- Vehicular access is restricted on soil stockpiles unless required for stockpile management purposes.
- An inventory of stockpiled soil is maintained based on survey pickup and adjusted as additional soil is stripped or removed.
- Weed control on soil stockpiles will be undertaken as required.

2.4.3 Construction

The majority of construction activities at the Mine have been completed.

During the term of the MOP a Dry Separation Plant will be constructed in the location identified on **Figure 2.1**.

It is noted that a proposed extension to the Product Coal Stockpile Area identified in the previous MOP, to enable a second train loading point for specific coal products, is not likely to proceed and has been removed from progressive mine and rehabilitation plans (refer to **Plans 3A** to **3G** – **Section 11**).

2.4.4 Mining Operations (Including Mining Purposes)

Mining will continue to be undertaken utilising the same conventional haulback mining methods that are currently implemented at the mine and outlined in previous MOPs. This method involves the following activities which will generally be undertaken in the following sequence.

1. Vegetation removal.
2. Drainage installation.
3. Soil stripping.
4. Blasting, excavating and overburden emplacement dumping (Section 2.4.5).
5. Coal recovery (Section 2.4.5).

As is the current approach, clearing of vegetation on the Mine will be undertaken on a campaign basis. This has the advantage of ensuring that the extent of clearing undertaken in each campaign is sufficient for the subsequent year of mine development, as well as ensuring that whenever practicable clearing is undertaken during periods when local fauna is unlikely to be nesting, roosting or over-wintering within the trees and shrubs to be cleared, i.e. autumn.

The pre-strip area at WCC is on the Old Colliery Hill upslope of the open cut pit and therefore contained within the void water catchment. Vegetation clearing does not disturb the ground cover and soil stripping is only undertaken incrementally as required for mining; therefore there is not a lot of disturbed runoff from soil stripping areas and is adequately managed within the void water system. Additional drainage or erosion and sediment control structures will only be installed on an as needs basis.

Soil stripping and stockpile management will continue to be undertaken as currently implemented and described in Section 2.4.2.

The mobile equipment operated at the Mine will remain equivalent to that of the existing mine fleet. **Table 2.2** identifies the indicative type, number, primary activity and duration of use for the mobile equipment to be operated over the term of the MOP.

The Company notes that the number of haul trucks will be greatest in the first years of the term of this MOP whilst mining occurs at the lowest elevations within the open cut. The number of haul trucks will progressively reduce over the life of the Mine as the mining progresses up dip of the synclinal coal seams. Should there be any significant change to the number or use of equipment on the Mine, the change will be documented through the AEMR process.

2.4.5 Mine Design and Sequence

In order to offset the higher overburden / interburden to coal strip ratios encountered at the Mine, the development of a north-south oriented bench targeting the shallow, low strip ratio coal along the western edge of the mining area is proposed (see Panel 1 for End Year 1 of **Figure 2.2**).

Table 2.2
Mining Equipment

Item	No. on Site	Function	Duration of Use
Excavator (540t)	1	Overburden Excavation/Loading	Full Time
Excavator (360t)	1		
Excavator (190t)	3	Overburden/Coal Excavation/Loading	Full Time
Haul trucks (Cat 785)[1]	9[3]	Overburden/Coal Haulage	Full Time
Haul trucks (Cat 793XQ)[2]	10		
Bulldozer (D11)	3	Overburden Prime Push, Overburden/Coal Rip/Push, Final Landform Development	Full Time
Bulldozer (D10)	4		Full Time
Bulldozer (D9)	1	Clearing, Overburden Emplacement/Road Maintenance, Coal Stockpile Maintenance	Full Time
Bulldozer (D6)	1	Campaign Rehabilitation	Campaign
Bulldozer (D5)	1		Campaign
Grader	1	Road/Overburden Emplacement Maintenance	Full Time
Fuel/Service Truck	1	Equipment Refuelling/Servicing	Full Time
Scraper	4	Topsoil/Subsoil Removal and Replacement	Campaign
Drill Rig	3	Blast hole Drilling	Full Time
Explosives Truck	3	Loading Blast holes (day shift only)	Full Time
Front-end Loader (FEL)	3	Screening Plant/Product Coal Loading	Full Time
Water Cart	4	Dust Suppression	Full Time

Note 1: Incorporates noise attenuation Note 2: XQ refers to Extra Quiet.

Note 3: Up to 3 additional operating trucks required when mining occurs at deepest point within open cut. Typically an extra two trucks are retained on the Mine as replacement for maintenance and repairs of operating trucks.

Source: Werris Creek Coal Pty Limited

As the open cut moves through the base of the synclinal coal measures, the north-south oriented bench and would merge with the east-west oriented benches creating an approximately 45° angled bench. Panel 2 (End Year 3) of **Figure 2.2** illustrates this merging of north-south, east-west benches along the western half of the open cut.

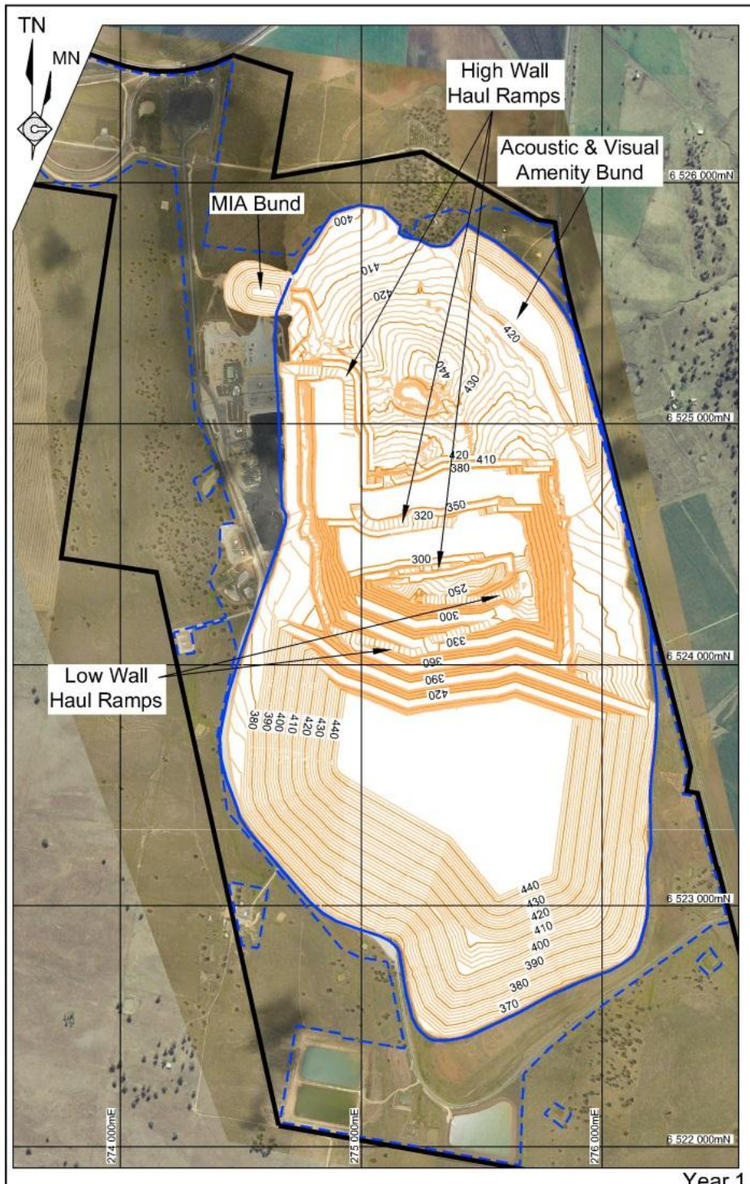
As the open cut progresses towards the northern perimeter, with all coal seams occurring closer to surface as the syncline dips up, the benches would again revert to an east-west orientation to allow for multiple coal seams to be mined concurrently, thereby keeping the coal quality and strip ratio consistent (see Panel 3 for End Year 6 of **Figure 2.2**).

Figure 2.2 also illustrates the change from haulage against the low wall to the high wall of the open cut. Panel 1 identifies the creation of haul ramps on the high wall to the upper benches with haul ramps on the low wall retained at lower elevations. By the end of 2016, all haul ramps are to be transferred to the high wall side and Panel 2 (of **Figure 2.2**) illustrates this (for the end of Year 3).

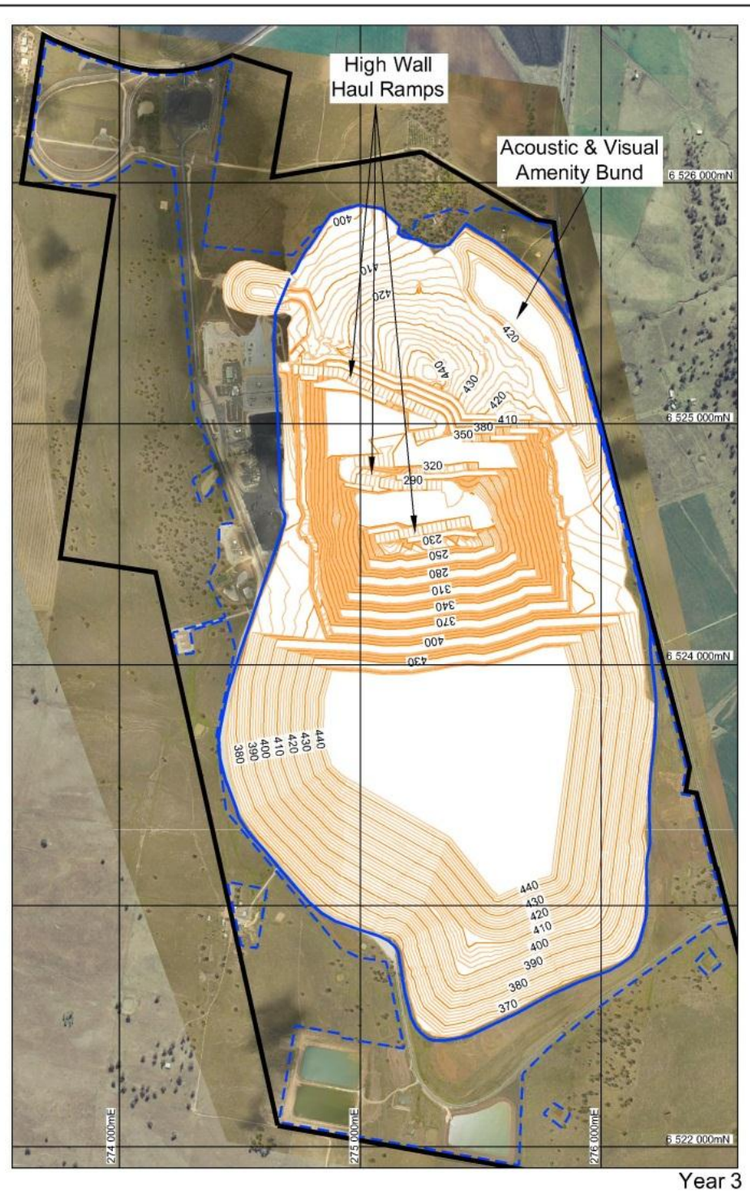
This is proposed as a method of increasing the active capacity of the overburden emplacements as well as to enable the design of a second egress from the open cut, in the unlikely event that the primary haul ramp is blocked or deemed unsafe at any time.

Annual mine plans and progressive rehabilitation are provided as **Plans 3A** to **3G** in Section 11.

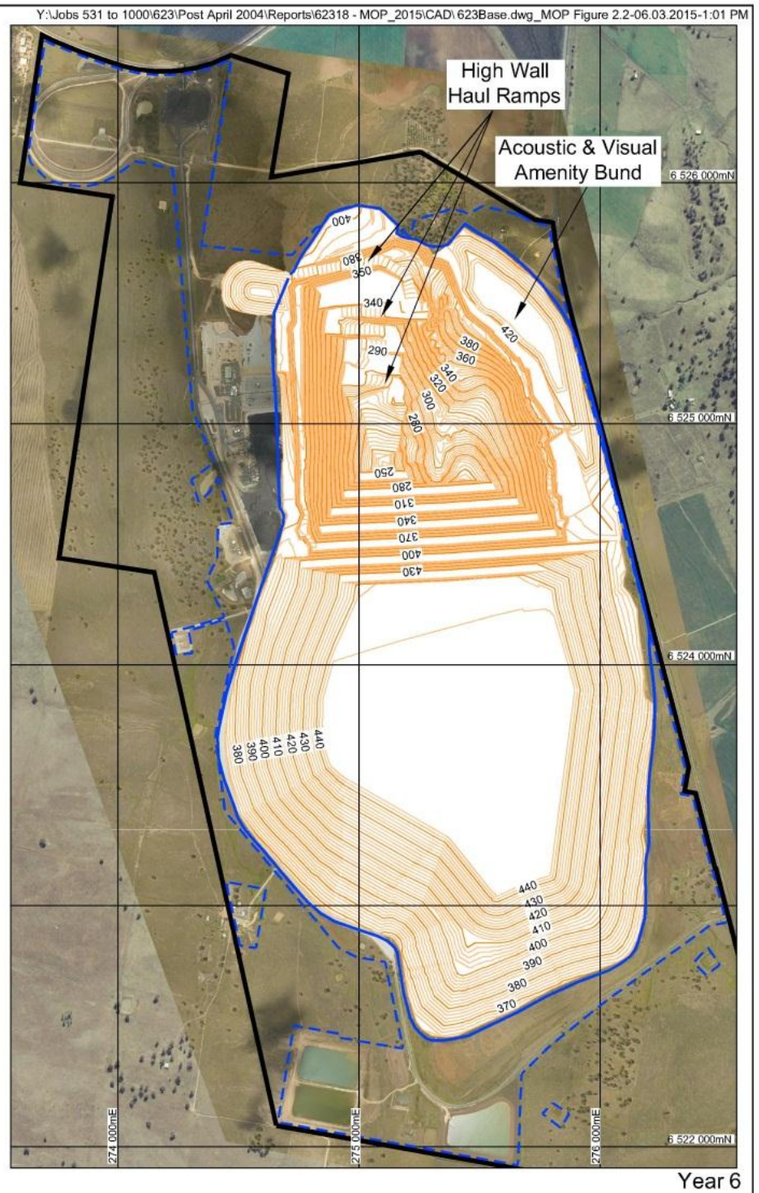
Y:\Jobs 531 to 1000\623\Post April 2004\Reports\62318 - MOP_2015\CAD\ 623Base.dwg_MOP Figure 2.2-06.03.2015-1:01 PM



Year 1



Year 3



Year 6

REFERENCE
- Approved Mine Site Boundary (DA 10-0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)
- 390 Proposed Contour (m AHD)

SCALE 1:25 000 (A3)

250 0 250 500 750 1000 1250 m

Base Photograph Source: Werris Creek Coal Pty Limited (2014)

Figure 2.2
MINE DEVELOPMENT SEQUENCE

This page has intentionally been left blank

2.4.6 Overburden Emplacement Areas

The progressive development (and rehabilitation) of the overburden emplacement is identified on **Plans 3A** to **3G** in Section 11. **Plan 4** provides the final landform of the overburden emplacement. Two key design features of the modified overburden emplacement, namely the western extension of the out-of-pit emplacement and northern extension of the 400m to 445m AHD section of the in-pit emplacement are outlined below.

Out-of-Pit Emplacement (Western Extension)

The out-of-pit emplacement will extend approximately 6ha over an area currently assigned to the stockpiling of soil. Existing contour banks on the rehabilitated landform will be extended to manage surface water runoff and assist in minimising erosion of these slopes.

In-Pit Emplacement (400m to 445m AHD Extension)

Located predominantly within and above the void created by the open cut, the 400m to 445m AHD section of the Overburden Emplacement will be extended by approximately 250m to the north to provide for an increased capacity of approximately 13.5Mbcm.

In line with current overburden design principles, the low wall of the advancing northern face of the in-pit emplacement will be constructed with slopes of 18º (1V:3H) or less. On the out-of-pit eastern and western slopes, the slopes of the overburden emplacement will be constructed with comparatively gentle slope of approximately 10°. On the outer slopes and final in-pit (northern) slope, existing contour banks will be extended to manage surface water runoff and assist in minimising erosion of these slopes.

While the volume of overburden/interburden requiring placement within the overburden emplacement is greater than previously predicted, there will be no change to the current method of haulage, placement and profiling of overburden and interburden.

2.4.7 Processing Operations

ROM coal mined from the open cut is delivered to the ROM Pad where it is stockpiled according to quality, i.e. ash content and other impurities. The ROM coal is fed into a breaker for primary size reduction (to <250mm) and subsequently to a crushing and screening plant to reduce the coal to <50mm size, this being the specification for export quality coal. Additional screens would enable a 30mm to 50mm product to be produced

No washing of the coal is undertaken or proposed, however, dry separation of higher ash or impurity coal will reduce the ash content of the coal to meet export coal requirements.

It is anticipated that up to 10% of ROM coal will be processed by the dry processing unit, i.e. up to 250 000tpa. Dry processing would be undertaken as sufficient stockpiles are generated, i.e. campaign based, and a unit with a throughput of 200t/hr is proposed.

2.4.8 Process Waste

Any process waste, e.g. overburden impurities removed through dry separation will be disposed as waste rock within the overburden emplacement. Disposal of process waste will involve mixing with waste rock at an active dump or other method assessed as suitable. Accumulations of process waste placed in the overburden emplacement will be covered with at least three metres of inert overburden material. Werris Creek Coal Mine does not produce any tailings waste stream.

2.4.9 Stockpile Management

ROM coal and product coal will be maintained in the areas identified on **Figure 2.1**. The ROM Pad provides storage capacity for up to 200,000t of coal over an area of approximately 4.0ha. An equivalent stockpile capacity is available at the Product Coal Stockpile Area. ROM coal may also be stored on the overburden emplacement on a temporary basis to manage demand from mining operations.

2.4.10 Void Water Management

Water which accumulates in the open cut void is collected at the base of the void and periodically pumped to surface void water dams for storage, used for Mine dust suppression and/or evaporated.

Based upon a recent update of the Mine Water Balance Model (ENVIRON, 2015), a volume of water surplus to surface storage capacity of between 200ML and 500ML could accumulate under high rainfall conditions. In accordance with a recent modification to PA 10_0059, the Company will either evaporate surplus water or irrigate the surplus water to agricultural lands external to the Mine in accordance with a *Pre-Agricultural Void Water Use Assessment* prepared for each individual irrigation program and approved by the NSW EPA and/or DPE[6].

2.4.11 Waste Management

In most cases, non-production waste generated during this MOP period will be collected on Mine and removed for disposal or recycling by a suitably qualified contractor. **Table 2.3** presents an estimate of the non-production waste and briefly describes how each class of waste is stored and subsequently removed from Mine.

Table 2.3
Waste Management

Page 1 of 2

Waste Type	Storage / Management	Removal / Disposal
General waste (including food scraps)	Covered bins or skips located within lunch rooms, offices, outside workshops and elsewhere as required. Where these bins are located in open areas they are fitted with animal proof lids.	Collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for disposal.
General Recyclables	Covered bins or skips located within lunch rooms, offices, outside workshops and elsewhere as required. Where these bins are located in open areas they are fitted with animal proof lids.	Collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for recycling.
Waste Oils and Greases	Placed within bunded tank(s) within the workshop area. Where required, smaller, temporary storage containers may be positioned close to work areas, with the contents of those containers transferred to a larger storage tank prior to collection.	Collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for recycling.

[6] Or as specified by PA 10_0059.

Table 2.3 (Cont'd)
Waste Management

Waste Type	Storage / Management	Removal / Disposal
Batteries	Placed within a covered and marked used battery storage area until removed from Mine.	Collected on a regular basis by a licensed contractor and transported to an appropriately licensed facility for recycling.
Tyres	Placed within a marked used tyre storage area until removed from site or used for another purpose.	Tyres are re-used on Mine for traffic control, etc. These tyres (at the end of use for that purpose) and others not used are disposed of within the overburden emplacement.
Scrap Metal	Stored in a specified area within the workshop area or elsewhere as required.	Collected on a regular basis by a scrap metal recycler.
Waste Water	Treated in the on-site septic treatment system within the Site Administration and Workshop area.	Treated waste water is discharged onto a licenced utilisation area. Solid waste will be periodically be collected by a licensed waste collection and disposal contractor as required.

2.4.12 Temporary Stabilisation

It is expected that only soil stockpiles will require temporary stabilisation during this MOP period with completed sections of the active rehabilitation area fully stabilised in accordance with the measures outlined in Section 7. Where possible, stripped soil is used for progressive rehabilitation rather than stockpiling. Temporary stabilisation and soil stockpile management includes the following practices.

- Minimising, as far as practicable, the operation of machinery on soil stockpiles to minimise compaction.
- Ensuring that subsoil stockpiles have a maximum depth of 5m and 3m maximum depth for topsoil stockpiles.
- Leaving the surface of the soil stockpile ripped along the contour to assist in erosion control and seed germination and emergence.
- Establishing appropriate seasonal crop cover on soil stockpiles that are older than three months.

2.4.13 Decommissioning and Demolition Activities

If production proceeds at the maximum approved rate, i.e. 2.5Mtpa, mining will approach completion by the end of this MOP period with the Werris Creek coal measures resource potentially exhausted during Year 7. Should this maximum mining and production rate proceed, some decommissioning and demolition activities may commence on the Mine towards the end of the term of this MOP. It is considered more likely, however, that at the end of this MOP period, there will remain some coal resource to be mined from the approved open cut area.

In light of the likely status of mine development at the completion of this MOP period, the following provides an overview of decommissioning and demolition activities, noting that further details will be provided in a Closure MOP to be developed following establishment of final land use, and submission to the DRE for approval prior to the commencement of any works.

Rail Load-out Facility and Rail Loop

It is anticipated that if not required by a future user of the land, the RLF and rail loop would be decommissioned and removed from the Mine. The approach to dismantling or demolishing the infrastructure will be reviewed as part of a Mine Closure MOP to be prepared closer to mine closure. Once the infrastructure is removed, however, the land will be rehabilitated to Class III agricultural land.

Coal Processing Plant Infrastructure

Similar to the RLF, if the re-use at another site or sale of the coal processing infrastructure (or component parts) does not eventuate, the structure will be separated into smaller sections with parts on-sold as scrap metal and any useable elements transported to a storage facility off site.

Miscellaneous Buildings and Structures

The majority of buildings and structures at the Mine are demountable and therefore will simply be dismantled, washed down with high powered water sprays and transported off site. The workshop and associated facilities will be dismantled with the structural components either reused elsewhere or recycled as scrap metals. Clean concrete footings and slabs will be broken up and disposed of in-pit as waste rock.

Hydrocarbon storage facilities will be pumped out. A thorough assessment of the soil directly below and surrounding the fuel storage facility and refuelling area will be conducted to ensure any contaminated soil would be identified. Any contaminated soil classified as "Restricted Solid Waste" (under NSW DECCW Waste Classification Guidelines 2009) will be excavated to be treated on site within a specific bioremediation area or disposed of at an appropriately licensed facility. The fuel storage facility will be on-sold or re-used at another site.

Roads

Discussion with LPSC will be undertaken closer to the date of mine closure to determine whether the Council will resume control of Escott Road or whether it will remain a private road for access to the "Escott" and other properties.

Mine roads not required to provide ongoing access post closure will be removed. The process to remove and rehabilitate these roads is likely to be as follows.

- The road will be closed with a lockable gate to prevent access from the Werris Creek Road and/or Escott Road.
- The bitumen seal will be ripped and removed by truck and disposed within the final open cut void.
- All compacted sub-base and base-course material will be ripped, excavated and disposed of in the final open cut void or recycled, if appropriate.
- Further ripping will be undertaken, topsoil respread and the former road location revegetated.

Other minor roads and tracks will be rehabilitated by ripping, respreading of topsoil and revegetated with pasture species or native tree and shrub species depending on the designated adjacent land use to the road.

2.4.14 Progressive Rehabilitation and Completion

Over the term of the MOP, and based on maximum mining and production rates, the majority of the overburden emplacements will be rehabilitated and that a portion of the final rehabilitation area will be suitable for relinquishment and a reduction in the rehabilitation security bond. **Plans 3A** to **3G** present the estimated progress of rehabilitation over the term of the MOP (based on maximum mining and production rates) with the following rehabilitation to be completed.

- Creation of the final void landform.
- Finalisation of the overburden emplacement landform.
- Final decommissioning and demolition of structures contained within infrastructure areas.
- Final landform creation within these infrastructure areas.
- Development of growth medium, establishment of vegetation and maintenance of the landform in accordance with the objectives described in Sections 5 to 8.

The status of mining and rehabilitation will be reviewed annually against that which is presented in this MOP (refer to **Plans 3A** to **3G** and **Table 7.2**). Ultimately a reduced mining and production rate will be reflected in the area of land available for rehabilitation and status at the completion of this MOP period. If production rates are less than the maximum approved, progress against the rehabilitation schedule presented in this MOP will be tracked by reviewing rehabilitation completed against cumulative production, if the predicted rehabilitation presented on **Plans 3A** to **3G** and **Table 7.2** are considered at incremental increases in production of 2.5Mt.

2.4.15 Material Production Schedule during MOP Term

Table 2.4 presents the material production schedule for the term of this MOP. It is noted that the annual progression of mining operations is reflected in the milestones identified as "End Year 1," "End Year 2" etc. in **Plans 3A** to **3G**. It is possible that the actual production rates may vary from the planned production rates. As a result, the actual timing of the milestones presented in this document may also vary.

Table 2.4
Material Production Schedule during the MOP term

Material	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Stripped soil	lcm	22,500	14,500	16,000	9,200	5,900	1,000	0
Overburden	Mbcm	17.8	17.8	17.8	16	15	15	10
ROM Coal	Mt	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Processing Waste[1]	Mt	0	0	0	0	0	0	0
Product	Mt	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M = million t = tonne Lcm = loose cubic metre bcm = bank cubic metre								
Note 1: The quantity of processing waste is minimal and managed as part of the overburden stream of the Mine.								
Source: Werris Creek Coal Pty Limited.								

3. ENVIRONMENTAL ISSUES MANAGEMENT

3.1 ENVIRONMENTAL RISK ASSESSMENT

A comprehensive Environmental Risk Assessment was conducted as part of the *Environmental Assessment* (RWC, 2011) process and is presented in Section 6.2.1 of that document. That assessment was undertaken generally in accordance with *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines*. A review of the risk rankings and associated identified controls has been conducted, including the minor modifications proposed within RWC (2015), with no major changes to the risk matrix. The specific risks detailed, remain as the key risks to the Mine, and as the focus of the Mine's Management Plans and controls.

Notwithstanding the above, a further risk assessment has been undertaken focusing on rehabilitation-specific risks. This assessment has also been undertaken generally in accordance with *AS/NZS ISO 31000:2009 Risk Management - Principles and Guidelines.* **Tables 3.1**, **3.2** and **3.3** present the consequence, likelihood and risk rating used during this analysis. **Table 3.4** presents the results of the risk analysis assuming that industry minimum standard mitigation measures only are implemented.

Table 3.1
Qualitative Consequence Rating

Level	Descriptor	Description
1	Negligible	No detrimental impact on the environment is measurable or envisaged.
2	Minor	An event which could have temporary and minor effects on the environment, such as a non reportable environment incident.
3	Moderate	An event which would create substantial temporary or minor permanent damage to the environment, such as a reportable incident not likely to result in prosecution.
4	Major	An event which could have a substantial and permanent consequence to the environment such as an environmental incident which would result in prosecution, adverse local publicity and community complaints.
5	Severe	A major event which could cause severe damage to the environment with actual or potential loss of credibility with key stakeholders, environmental liability, regulatory intervention, national publicity/complaints, or could close the operation prematurely.
Note:	Rating modified after AS/NZS ISO31000:2009 Risk Management - Principles and Guidelines	

Table 3.2
Qualitative Likelihood Rating

Level	Descriptor	Description	Indicative Frequency
A	Almost Certain	Is expected to occur in most circumstances	Once a year or more frequently
B	Likely	Will probably occur in most circumstances	Once every three years
C	Possible	Might occur at some time	Once every ten years
D	Unlikely	Could occur at some time	Once every thirty years
E	Rare	May occur only in exceptional circumstances	Once every 100 years
Note:	Rating modified after AS/NZS ISO31000:2009 Risk Management - Principles and Guidelines		

Table 3.3
Qualitative Risk Rating

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A (Almost Certain)	M	H	H	VH	VH
B (Likely)	M	M	H	H	VH
C (Possible)	L	M	H	H	H
D (Unlikely)	L	L	M	M	H
E (Rare)	L	L	M	M	H

Note: Rating modified after AS/NZS ISO31000:2009 Risk Management - Principles and Guidelines

3.2 ENVIRONMENTAL RISK MANAGEMENT

Management of those environmental risks classified as high or very high (see **Table 3.4**) are nominated below.

Air Pollution

Mining, coal processing and rehabilitation operations are managed in accordance with an approved *Air Quality and Greenhouse Gas Management Plan*.

Erosion/Sediment Minimisation and Surface Water Pollution

Mining, coal processing and rehabilitation operations area managed in accordance with a *Site Water Management Plan*.

Contaminated or Polluted Land

The following hazard reduction practices are implemented to ensure spills of fuels or other hydrocarbons are managed to minimise the potential for contamination or pollution of land or water.

- All water from wash-down areas and workshops is directed to oil/water separators and containment systems.
- All storage tanks are either self-bunded tanks or bunded with an impermeable surface and a capacity to contain a minimum 110% of the largest storage tank capacity.
- All hydrocarbon products are securely stored.

Table 3.4
Key Rehabilitation-related Risks during the MOP Term

	Exploration	Land preparation, vegetation & topsoil stripping	All construction activities including earth moving	Mine development and mining, surface and underground	Use/maintenance of roads, tracks and equipment	Overburden emplacement management	Coal processing facilities and infrastructure	Coal/product stockpiling and handling	Tailing impoundment management	Water management including storm event contingencies	Hazardous materials & fuel, handling/spills management	Sewerage	Rubbish disposal	Rehabilitation activities	Rehabilitated land and remaining features
Air pollution, dust/other	M	H	M	H	M	H	M	M	NA	L	L	L	L	H	L
Erosion/sediment minimisation	M	H	H	H	M	H	H	H	NA	H	M	M	M	H	M
Surface water pollution	M	H	H	H	M	H	H	H	NA	H	M	M	M	H	M
Groundwater pollution	L	L	L	M	L	L	L	L	NA	L	M	L	L	L	L
Contaminated or polluted land	L	L	M	M	L	L	M	M	NA	L	H	L	L	L	L
Acid Mine Drainage & Salinity	NA	NA	NA	L	NA	M	L	L	NA	L	NA	NA	NA	L	L
Threatened flora protection	M	H	H	H	H	H	L	L	NA	L	M	L	L	M	H
Threatened fauna protection	M	H	H	H	H	H	M	M	NA	L	M	L	L	M	M
Weed Control & Management	M	M	M	M	M	L	L	L	NA	L	L	M	M	M	H
Noise	L	L	M	H	M	H	H	H	NA	L	L	L	L	M	L
Vibration and air blast	L	L	L	H	L	L	L	L	NA	L	L	L	L	L	L
Visual amenity, stray light	L	H	M	H	M	H	L	M	NA	L	L	L	L	M	L
Aboriginal heritage	M	M	L	L	L	L	L	L	NA	L	L	L	L	L	L
Natural heritage conservation	L	L	L	L	L	L	L	L	NA	L	L	L	L	L	L
Spontaneous combustion	L	L	L	L	L	M	M	H	NA	L	L	L	L	L	L
Bushfire	M	M	M	L	M	L	M	M	NA	L	M	L	L	L	M
Hydrocarbon contamination	L	L	M	M	L	L	M	M	NA	L	H	L	L	L	L
Public safety	M	M	M	M	L	M	L	L	NA	L	L	L	L	M	M

Methane drainage / Venting, and Mine Subsidence have not been included as the Mine is an open cut not underground coal mine.

Threatened Flora / Threatened Fauna Protection

Mining, processing and rehabilitation operations area managed in accordance with an approved *Biodiversity and Offset Management Plan*.

Weed Control and Management

Management measures and procedures are provided in the approved *Biodiversity and Offset Management Plan*.

Noise / Vibration and Air Blast

Mining, processing and rehabilitation operations area managed in accordance with an approved *Noise Management Plan* and an approved *Blast Management Plan*.

Visual Amenity

The size, location, maximum height and extent, outer slope angle, and progressive development of the overburden emplacement, incorporating the Acoustic and Visual Amenity Bund, has been designed to reduce the visual impact of the Mine from vantage points surrounding the Mine Site. The progressive rehabilitation of the Mine Site described in this MOP is also critical to the minimisation of impact on local visual amenity by quickly reinstating vegetation on areas of the Mine no longer required for mining related activities.

Aboriginal Heritage

Mining, processing and rehabilitation operations area managed in accordance with an approved *Aboriginal Cultural Heritage Management Plan*.

Spontaneous Combustion

Based on the risk assessment undertaken for the Project (see **Table 3.4**), spontaneous combustion related incidents with a medium to high risk that may occur as a result of the following.

- Coal/product stockpiling and handling (high risk).

Incidents which have the potential to impact on mining operations and rehabilitation include:

- uncontrolled fire event; or
- odour and subsequent emission of sulphur dioxide.

Self Heating Temperature calculations identify the coal from the Mine in the medium to high spontaneous combustion potential range (RWC, 2010). Hazard reduction strategies currently implemented at the Mine are as follows.

- The length of time coal is held in stockpiles is minimised.
- The coal stockpiles are watered as required to reduce heat.
- The coal stockpiles are monitored for signs of spontaneous combustion.
- Incidents of spontaneous combustion are immediately reported.
- Extinguishment by excavation, spreading and saturation with water would be undertaken in the event of a spontaneous combustion event.

The above hazard reduction strategies have been successful to date at the Mine and there have only been relative minor incidences of spontaneous combustion outbreaks at the mine which were brought under control with bulldozers and water carts.

Bushfire

Management measures and procedures are provided in the approved *Biodiversity and Offset Management Plan*.

Hydrocarbon Contamination

Refer to *Contaminated or Polluted Land* above.

3.3 RISKS SPECIFIC TO REHABILITATION

Geology and Geochemistry

Geologically, the Mine is located in the Werrie Basin which extends from the Namoi River near Carroll, southwards to where it extends beneath the Tertiary basalts of the Liverpool Ranges in the Willow Tree – Wallabadah area to Blandford. The Mooki Thrust forms the western boundary of the Werrie Basin while Lower Carboniferous rocks known as the Currabubula Formation and comprising a bed of conglomerates over the top of a thin bed of tuffaceous limestones (Pratt, 1996) form the eastern boundary.

Several smaller basins and dome structures have been identified within the Werrie Basin (DMR, 1998). The Colliery Basin, which incorporates the Werris Creek outlier of the Greta Coal Measures deposit targeted by the Mine, is an example of the coal-bearing rocks of Permian age that occur in the centre of the Werrie Basin, and is the target of coal to be mined as part of this proposal. The Greta Coal Measures which comprise pebble and granular conglomerates, sandstones, mudstones and coal originating in a fluvial to deltaic environment, occur as a small elongate basin-shaped outlier of the Willow Tree Formation (Branagan, 1969). The general stratigraphic sequence of the local geology is presented in **Table 3.5**.

An investigation of the physical and chemical characteristics of the overburden and interburden of the Werris Creek coal resource completed by URS (2004) concluded that there is a low potential for both acid formation and soluble salt generation from the overburden and interburden material. As such, there are no specific handling and emplacement requirements for these materials and no specific risks to rehabilitation as a consequence.

Spontaneous Combustion

Spontaneous combustion is associated with the coal being mined, stockpiled and mined. While the overburden to be used in the construction of the final landform not having a self heating temperature likely to result in fire or heating of growth media, there remains a risk of fire generated from coal stockpiles spreading to areas of rehabilitation. It could also be possible, although unlikely, that at the end of Mine life, sufficient coal is retained on the ROM Pad which leads to spontaneous combustion.

The hazard reduction strategies nominated in Section 3.2 for Spontaneous Combustion would prevent heating within coal stockpiles which could result in fire events, or prevent spreading of fire to rehabilitation.

Table 3.5
General Stratigraphic Sequence

Age	Rock Type	Strata Type	Occurrence
Quaternary	Unconsolidated sediments	Sands and gravel.	Along Quipolly Creek 2.2km from the site.
Permian	Greta Coal Measures	Coal seams and interburden strata of sandstones/ siltstone and shales.	The proposed open cut Mine covers most of this strata.
	Werrie Basalt	Basaltic lava flows with a significant weathered profile of clay. Underlying the coal measures, the clay forms claystone.	Directly underneath the coal measures and completely surrounding them in all directions in most of the valley and lower lying areas.
	Acid Volcanics	Andesite, dacite and rhyolite.	This occurs in a limited zone and forms the ridges immediately to the east of the Mine and also occurs to the north.
	Conglomerates	Conglomerates and lithic sandstones.	These strata form the dominant N-S trending ridges to the east.
Carboniferous	Rossmore Formation (Quirindi Dome)	Conglomerates and sandstones, siltstones and mudstones.	These strata form the dominant N-S trending ridges to the west.
Source: Modified after RCA Australia (2004) – Table 1			

To ensure future heating of residual coal in the final landform is avoided, the Company would scrape up any remaining coal for sale, or if unable to be sold, blended with inert overburden before placement in the final landform, Accumulations of residual coal placed in the final landform will be covered with at least three metres of inert overburden material.

Erosion and Sediment Control

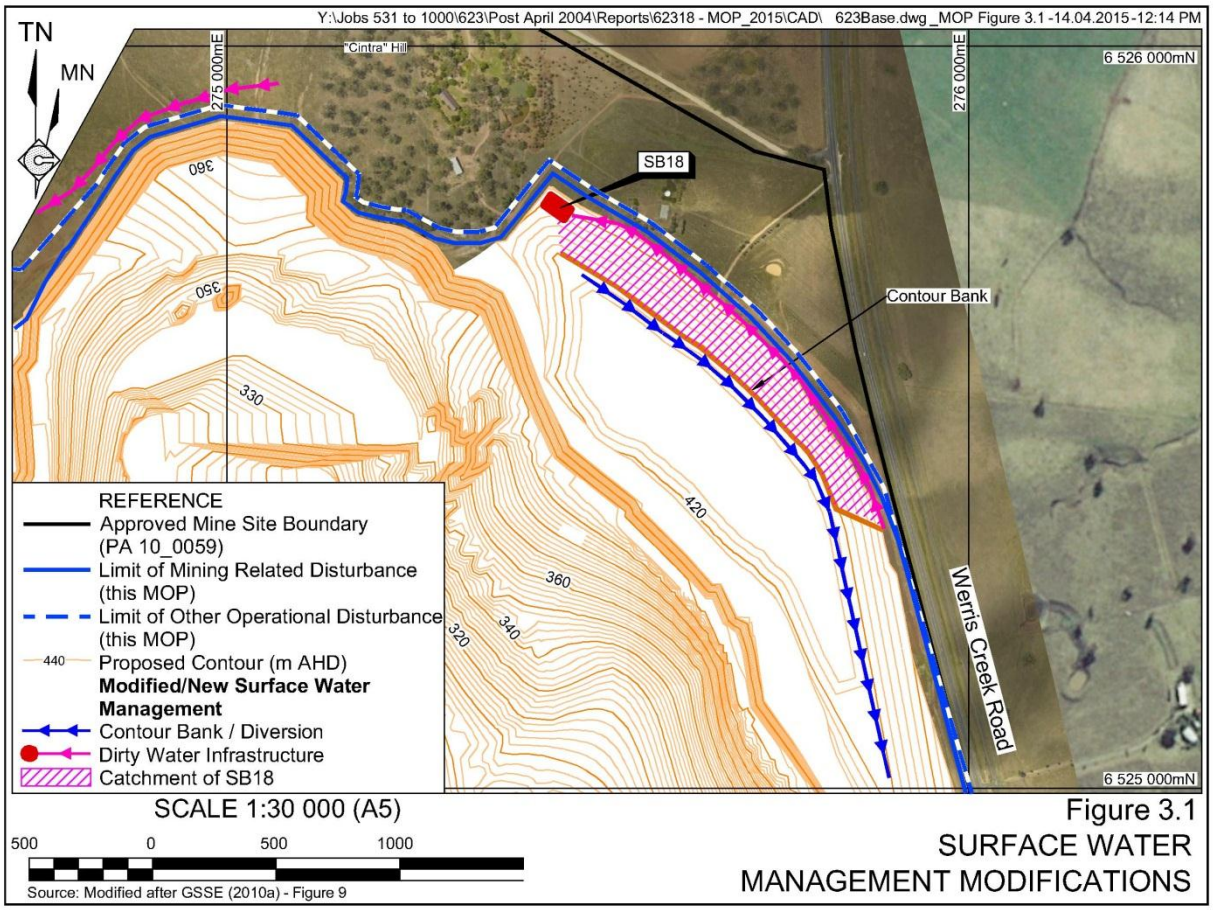
The Mine is operated in accordance with a *Site Water Management Plan* (SWMP), incorporating a section on Erosion and Sediment Control. An update to the SWMP is in preparation to account for the revised Mine Water Balance Model, minor adjustments to the final landform and drainage (refer to **Plan 4**), and inclusion of an additional discharge point at the northern end of the Mine (see **Figure 3.1**). The SWMP will be prepared and implemented in accordance with the requirements of Landcom (2004) and DECC (2008a) and once fully implemented, risks associated with sediment and erosion control will be adequately managed.

Soil Type(s) and Suitability

Three main soil units have been identified as occurring on areas of the Mine (GSSE, 2010).

- Brown Chromosol.
- Stony Brown Chromosol.
- Dark Brown Vertosol.

The Stony Brown Chromosol is identified by GSSE (2010) as unsuitable for stripping and reuse as a growth medium and will be identified prior to surface disturbance and managed as overburden.



The Dark Brown Vertosol (referred as Black Soil) has been identified as most suitable for agriculture and will be segregated for preferential respreading over areas designated for a return to agriculture.

On the basis of the segregation of soils, and the soil stripping and stockpile management measures are identified in Section 2.4.2, risks to rehabilitation associated with soil and its suitability are not considered to be significant.

Flora and Fauna

A *Biodiversity and Offset Management Plan*, detailing procedures for flora and fauna management has been prepared for the Mine. This Plan includes procedures for handling threatened species, seed collection, weed control, pest control and habitat management. The plan will ensure that risks associated with management of flora and fauna are reduced to the greatest extent practicable.

Weed Control and Management

Without appropriate management, areas of revegetation may become infested with weeds. Regular monitoring and targeted weed control programs are, and will continue to be implemented as documented in the approved *Biodiversity and Offset Management Plan* (BOMP). The monitoring procedures of the BOMP, which are described in greater detail in Section 8.1, will be regularly reviewed and updated in response to the results of rehabilitation.

Bushfire

The development of woodland vegetation and exclusion of grazing and agriculture from the majority of the final landform and surrounding Biodiversity Offset Area (BOA) will lead to increased biomass and fuel loads which may create a fire hazard and create an imbalance between fire tolerant and fire sensitive species. This presents a risk both to the sustainability of the rehabilitated landform and BOA, as well as surrounding land and assets. Management measures and procedures to reduce and manage the bushfire hazard associated with rehabilitation and the BOA are provided in the approved BOMP.

4. POST MINING LAND USE

4.1 REGULATORY REQUIREMENTS

Regulatory requirements for the post mining land use are detailed in **Table 4.1**.

4.2 POST MINING LAND USE GOAL

The nominated post mining land use goals for the Mine are as follows.

- To re-establish the following woodland vegetation communities:
  - Box Gum Woodland and Derived Native Grassland (EEC equivalent).
  - Brigalow-Belah Woodland (EEC equivalent).
  - Shrubby White Box Woodland.
- To reinstate areas of the Mine amenable to Class III capable agricultural land.
- To ensure rehabilitation and revegetation is self-sustaining and follows the principles of sustainable development.

The rehabilitation of the Mine forms part of a broader strategy to improve biodiversity outcomes of the local setting. This will be achieved through integration of the rehabilitated Mine landforms and vegetation types with the conservation of remnant native vegetation which is in good condition, along with improvement and conservation of degraded native vegetation, e.g. land previously managed for agriculture. The vegetation conservation and improvement activities are being undertaken in accordance with a Biodiversity Offset Strategy (BOS) which encompasses a Biodiversity Offset Area (BOA) of approximately 1,319ha on lands on and surrounding the Mine.

Figure 4.1 identifies the extent of the BOA, illustrating the linkage it provides between remnant native vegetation to the east and west of the Mine. The BOS is implemented in accordance with a BOMP, and available for review on the Werris Creek Coal Mine Environmental Management page of the Whitehaven Coal Limited website.

Building upon the land use goals specific to Mine rehabilitation noted above, a broader and post mining land use goal for Mine rehabilitation, integrated with the land use goal of the BOS, is as follows.

- To integrate the rehabilitated landform of the Mine with the BOA in order to maximise the wildlife corridor between remnant native vegetation of the hill to the east and west of the Mine.

4.3 REHABILITATION OBJECTIVES

In order to achieve the nominated post mining land use goals, and further illustrate the integration of Mine rehabilitation and the BOS, the objectives of rehabilitation and biodiversity offset management activities are presented in **Table 4.2**.

Table 4.1
Regulatory Requirements for Rehabilitation

Source Document	Subject	Rehabilitation Requirement	Refer to Section
Mining Lease (ML) 1563, 1671 & 1672	General	Any disturbance as a result of activities under this lease must be rehabilitated to the satisfaction of the Deputy Director General of Resources and Energy.	Sections 5 to 7, **Table 6.1**, **Plans 3A** to **4**
	Rehabilitation Security	Provide and maintain a security deposit.	Supplied separately
Project Approval (PA10_0059)	Rehabilitation	**Rehabilitation Objectives** The Proponent shall rehabilitate the site to the satisfaction of the Executive Director, Mineral Resources in DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EA and comply with the objectives in Table 13.	Sections 5 to 7, **Table 6.1**, **Plans 3A** to **4**

Table 13: Rehabilitation objectives

Feature	***Objective***
Mine Site (as a whole)	• Safe, stable & non-polluting; • Constructed landforms sympathetic to natural landforms (including landform micro-relief) as far as practical; • Final land uses compatible with surrounding land uses; and • Minimise visual impact of final landforms as far as reasonable and feasible.
Woodland areas and other vegetated land	• Establishment of at least 280 hectares of White Box-Yellow Box-Blakely's Red Gum Woodland EEC; and • Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems that is comprised of: – local native plant species; – at least 180 hectares of shrubby woodland.
Amenity Bunds and Overburden Emplacements	• Early revegetation and planting with local native woodland species; and • Free draining.
Final Void	• Minimise the size and depth of the final void as far as is reasonable and feasible, with its floor a minimum of 5 metres above the predicted long-term groundwater level.
Project infrastructure	• To be decommissioned and removed, unless the Executive Director, DRE agrees otherwise.
Community	• Minimise the adverse socio-economic effects associated with mine closure.

Table 4.1 (Cont'd)
Regulatory Requirements for Rehabilitation

Source Document	Subject	Rehabilitation Requirement	Refer to Section
Project Approval (PA10_0059) (Cont'd)	Rehabilitation (Cont'd)	**Progressive Rehabilitation** The Proponent shall carry out rehabilitation of the Mine Site progressively, that is, as soon as reasonably practicable after disturbance.	Sections 5 to 7, **Plans 3A** to **4**
		Rehabilitation Management Plan The Proponent shall prepare and implement a *Rehabilitation Management Plan* for the project to the satisfaction of the Executive Director, Mineral Resources in DRE. This plan must:	
		(a) be prepared in consultation with the Department, DPI Water, OEH, Council and the CCC;	Section 1.5.2
		(b) be submitted to the Executive Director, Mineral Resources in DRE by the end of April 2012;	N/A
		(c) be prepared in accordance with any relevant DRE guideline;	Section 1.1
		(d) describe how the rehabilitation of the site would be integrated with the implementation of the biodiversity offset strategy;	Section 4.3, **Table 4.2** and Section 7.2.9
		(e) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);	Section 6 and **Table 6.1**
		(f) describe the measures that would be implemented to ensure compliance with the conditions of this approval; and	Sections 6 & 8
		address all aspect of rehabilitation including,	Sections 5 to 7
		– mine closure,	Sections 1.1.1, 2.4.13, 5.1.3 & 5.3
		– final landform, and	Section 5.3 and **Plan 4**
		– final land use.	Section 4
		(g) include a program to monitor and report on the effectiveness of the measures, and progress against the detailed performance and completion criteria; and	Section 8 (and **Table 6.1**)
		(h) build to the maximum extent practicable on the other management plans required under this approval.	Section 1.3

Table 4.1 (Cont'd)
Regulatory Requirements for Rehabilitation

Source Document	Subject	Rehabilitation Requirement	Refer to Section
Project Approval (PA10_0059) (Cont'd)	Biodiversity	Integrate the Biodiversity Offset Strategy with the overall rehabilitation of the site.	Section 4.3, Table 4.2 and Section 7.2.9
		Ensure the biodiversity offset strategy and/or rehabilitation strategy is focused on the re-establishment and/or enhancement of: (a) the following endangered ecological communities: – White Box-Yellow Box-Blakely's Red Gum Woodland EEC; and – White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC; and (b) habitat for threatened fauna species, including the: – Regent Honey Eater, Swift Parrot, Brown Treecreeper, Hooded Robin, Little Lorikeet, and Barking Owl; and – Eastern Bent-wing Bat, Eastern False pipistrelle, Yellow-bellied Bent-wing Bat and Greater Broad-nosed Bat.	Sections 4.3, 6 and 8 (and **Tables 4.2** and **6.1**)
	Visual Amenity	Progressively rehabilitate overburden emplacement areas including partial rehabilitation of temporarily inactive areas and proposed topsoil storage Stockpiles.	Section 7 and **Plans 3A** to **4**
	Management Plans – General	The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
		(a) detailed baseline data;	Section 3 and **Plan 2**
		(b) a description of: – the relevant statutory requirements (including any relevant approval, licence or lease conditions); – any relevant limits or performance measures/criteria; – the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 4.1 (**Table 4.1**) Section 6 (**Table 6.1**)

Table 4.1 (Cont'd)
Regulatory Requirements for Rehabilitation

Source Document	Subject	Rehabilitation Requirement	Refer to Section
Project Approval (PA10_0059) (Cont'd)	Management Plans – General (Cont'd)	(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Sections 7 to 9
		(d) a program to monitor and report on the: – impacts and environmental performance of the project; – effectiveness of any management measures (see (c) above);	Section 8
		(e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 9 (**Table 9.1**)
		(f) a protocol for managing and reporting any: – incidents; – complaints; – non-compliances with statutory requirements; and – exceedances of the impact assessment criteria and/or performance criteria; and	N/A
		(g) a protocol for periodic review of the plan.	Section 12
Environmental Assessment (RWC, 2015)	Integrated Landscapes	• Provide a vegetated wildlife corridor across the Proponent's land holdings and the Quipolly Creek Catchment linking with sub-regional habitat corridors. • Reduce the visibility of mine-related activities from adjacent properties, Werris Creek and the local road network. • Construct a landform sympathetic to the surrounding topography. • Provide a low maintenance, geotechnically stable and safe landform with minimal erosion.	Sections 4.3 (**Table 4.2**), 5.2 (**Table 5.2**), 6 (**Table 6.1**) and 7 (**Tables 7.1 to 7.3**) **Plans 3A** to **4**
	Sustainable Growth and Development	• Achieve a soil profile capable of sustaining the specified final land use. • Establish native vegetation with the species diversity commensurate to each relevant vegetation community.	
	Final Land Use	• Re-instate areas of Rural Land Capability Class III commensurate with the agricultural land use on and around the Mine. • Re-instate woodland vegetation communities commensurate with the remnant woodland vegetation disturbed by mining and associated activities. • Undertake habitat augmentation to improve and promote corridors for fauna movement linking adjacent remnant woodland vegetation with the rehabilitation of the Mine.	

Table 4.1 (Cont'd)
Regulatory Requirements for Rehabilitation

Source Document	Subject	Rehabilitation Requirement	Refer to Section
Environmental Assessment (RWC, 2015) (Cont'd)	Decommissioning	Decommissioning of structures and facilities in accordance with the EA or as agreed as part of a Closure MOP.	Sections 2.4.13, 5.3 (**Table 5.3**) &**Table 6.1**
	Final Landform and Land Use	The final landform and land use will be in accordance with Sections 2.10.3 and 2.10.4, referencing Figure 2.6 of the EA (unless modified by this MOP).	Section 4, **Plan 4**
	Revegetation	The final landform is to be revegetated in accordance with Section 2.10.6.4 of the EA (unless modified by this MOP).	Section 7, **Plans 3A** to **4**

Table 4.2
Rehabilitation and BOS Objectives and Targets

Category	Objective		Target(s)
	Rehabilitation	**BOA**	
Integrated Landscapes	Decommission and remove all surface infrastructure (unless required for a lawful post mining land use).		• All surface infrastructure removed (unless required for a lawful post mining land use). i.e. roads.
	Create a final landform that is geotechnically stable and safe, non-polluting, sympathetic to the surrounding topography and landforms and has maintenance requirements no greater than the surrounding lands.	Maintain low maintenance, geotechnically stable and safe landform with minimal erosion	• Construct the final landform as nominated on **Plan 4**. • Provide for micro-relief such as drainage swales and rises on the upper surface of the overburden emplacement to support drainage to the five sub-catchments identified on **Plan 4**. • The final landform has maintenance requirements consistent with the agreed post mining land use(s). • Geotechnical assessment / analysis show the landform is stable. • Runoff and/or leachate from the final landform are non-polluting. • Establish and maintain groundcover which prevents gully or sheet erosion.
	Ensure the final void is safe, stable and secure.		• Construct slopes at or less than 10° for out-of-pit emplacement area and at or less than 18° for final void.
	Ensure the void is backfilled to an elevation greater than the local groundwater table to prevent accumulation of groundwater within the final void.		• Construct the final landform in accordance with **Plans 3A** to **3G** and **Plan 4**.
Sustainable Growth and Development	Establish and maintain a soil profile capable of sustaining the specified final land use.		• Physical and chemical soil parameters of the rehabilitated landform and areas of the BOA to be improved are equivalent to the soils of analogue sites.

Table 4.2 (Cont'd)
Rehabilitation and BOS Objectives and Targets

Category	Objective		Target(s)
	Rehabilitation	**BOA**	
Sustainable Growth and Development (Cont'd)	Re-establish the following woodland vegetation communities integrated with the Biodiversity Offset Area. – Box Gum Woodland and Derived Native Grassland (EEC equivalent). – Brigalow-Belah Woodland (EEC equivalent). – Shrubby White Box Woodland.	Restore vegetated wildlife corridors across WCC land holdings and Quipolly Creek Catchment linking with sub-regional habitat corridors.	• Rehabilitate the final landform Mine in accordance **Plan 4**. • Establish vegetation communities with floristic and biometric parameters equivalent to those of identified analogue sites.
Sustainable Growth and Development (Cont'd)	Provide for a return to sustainable agriculture over select area of the Mine.		• Achieve land capability Class III where the final land use is nominated as Agriculture Class III Land on **Plan 4**.
Final Land Use	Minimise adverse socio-economic outcomes following mine closure.		• Consult with the community and government agencies in relation to the post-mining land use. • Rehabilitate the Mine in accordance with **Plan 4**, unless otherwise agreed.
	Provide rehabilitated woodland communities which adjoin the established Biodiversity Offset Area to maximise the wildlife corridors created within the local setting.	Undertake habitat augmentation to improve and promote corridors for fauna movement linking adjacent remnant woodland vegetation with the rehabilitation of the Mine.	• Establish woodland vegetation over the landform equivalent to local analogues of that community. • Visual identification of wildlife corridors within the largely agricultural setting.
Other	Allow for the relinquishment of the Mining Lease and the return of the security lodged over the Mining Lease within a reasonable time after the end of the mine life.		• 50% within 5 years of final rehabilitation. • 100% within 10 years of final rehabilitation.

4.4 FINAL LANDFORM

Plan 4 presents the planned final landform based on the current mining schedule and most critically PA 10_0059. Critical features of this final landform are as follows.

- Partial backfilling of the final void area to an elevation higher than the surrounding groundwater. This will prevent the accumulation of saline groundwater within the final void. The internal slopes of the final void, at <18°, will be able to be revegetated (with some limitations) with native woodland and grassland species.
- Creation of a single above ground overburden emplacement with outer slopes of <10°. The relatively shallow outer slopes are amenable to rapid revegetation with grasses and woodland vegetation and are sympathetic to slopes within the Werris Creek valley.
- Removal of all infrastructure, unless required for an approved alternative final land use.
- Reinstatement of topography over the remaining areas of the Mine Site commensurate with the pre-mining landforms. This will enable revegetation to achieve the objectives as nominated for the relevant domain areas.

The Company notes recent correspondence from the DRE which suggests that the landform as presented in **Plan 4**, specifically the plateau section of the overburden emplacement, does not represent a landform which is 'sympathetic to the local topography'. The Company acknowledges that the 'table top' feature of the overburden emplacement is not one which occurs in the surrounding locality, however, does consider that the design of this feature is sympathetic to the surrounding setting based on the following.

- The upper surface of the overburden emplacement will be separated into five separate sub-catchments, with micro-relief in the form of drainage swales and rises within each sub-catchment incorporated into the final design. Rather than being table flat, an average fall of 1% from a central location to the outer edges of the upper surface will be created.
- The upper surface of the overburden emplacement will only be visible from elevated vantage points surrounding the Mine Site, with the reduced slope outer batters the most dominant visual feature. These are certainly constructed in sympathy with local topography.
- The landform as presented in **Plan 4** is based on that approved by PA 10_0059 and therefore constrained in elevation and lateral extent. Both the vertical height and lateral extent of the overburden emplacement would require modification to achieve a landform, considering the upper plateau is already 25% to 30% constructed, which creates a more typical hilltop feature.

5. REHABILITATION PLANNING AND MANAGEMENT

5.1 DOMAIN SELECTION

5.1.1 Introduction

A domain is a land management unit with similar features of disturbance or end land use. Domains are considered either primary (operational) or secondary (post-mining) domains as follows.

1. Primary or operational domains - categorised on the basis of mining-related activities occurring within each domain.
2. Secondary or post-mining land use domains - categorised on the basis of similar post-mining land use objectives and rehabilitation outcomes.

Table 5.1 identifies the domains listed in the MOP Guidelines and used to define the domains described in the following subsections.

Table 5.1
Primary and Secondary MOP Domains

Code	Primary (Operational) Domains	Code	Secondary (Post Mining Land Use) Domains
1	Infrastructure Area	A	Infrastructure
3	Water Management Area	B	Water Management Area
4	Overburden Emplacement Areas	E	Rehabilitation Area – Woodland
5	Stockpiled Material	G	Rural Land Capability Class III[1]
6	Void (Open cut void)	J	Biodiversity Offset Area
9	Biodiversity Offset Area		
10	Rural Land		
Note 1:	Equivalent to Class 3 of the revised Land and Soil Capability (LSC) system currently in use in NSW		
Source:	Modified after The Guidelines – Table 4		

Plan 2 presents the status of the rehabilitation domains on the Mine at MOP commencement and **Plans 3A to 3G** present the status at the end of each year throughout this MOP term. The following subsections provide a description of each of the domains.

5.1.2 Primary Domains

Domain 1 – Infrastructure Areas

This domain includes:

- the Mine Infrastructure Area, including:
  - the ROM Pad;
  - Fixed crushing plant and screens;
  - Dry separation plant

  - Workshops;
  - Offices and ablution facilities;
  - Hydrocarbon storage facilities;
  - Car park; and
  - Various roads.
- the Rail Load-out Facility and Rail Loop;
- the Product Coal Storage Area;
- the Explosives Magazine;
- the Precursor Storage Facility;
- the "Eurunderee" homestead (which provides additional laydown area); and
- Mine roads (excluding haul roads).

Domain 3 – Water Management Areas

This domain includes all void, clean and dirty water dams, diversion drains and associated infrastructure.

Domain 4 – Overburden Emplacement Areas

This domain will include the overburden emplacement area, both in-pit and out-of-pit components, in its entirety. The extent of this domain will vary over the term of the MOP as the emplacement progressively in-fills the void (Domain 6) towards its maximum extent.

Other areas of the Mine included as Domain 4 include:

- the Acoustic and Visual Amenity Bund; and
- the Mine Infrastructure Area (MIA) Bund.

Domain 5 – Stockpiled Material

This domain includes stockpiles of soil or other materials set-aside for rehabilitation. ROM and product coal stockpiles are included as part of Domain 1. Stockpiles of overburden are included as Domain 4.

Domain 6 – Void (Open Cut Void)

This domain refers to the active area of mining beyond the toe of the in-pit component of the overburden emplacement. There is potential overlap between Domain 6 and Domain 4 given the overburden emplacement is constructed by backfilling the open cut void.

Domain 7 – Rehabilitation Area - Pasture

This domain refers to a small area of former soil stockpiles that have been stabilised with grasses prior to final rehabilitation.

Domain 9 – Biodiversity Offset Area

This domain includes those areas of the Mine included within the approved Biodiversity Offset Area defined in the *Biodiversity and Offset Management Plan* (WCC, 2013).

Domain 10 – Rural Land

This domain is limited to areas where agricultural operations will continue during the term of the MOP, most notably to the north of the open cut on the "Cintra" property. This domain will not be impacted by Mine-related activities and land management will be similar to the pre-mining land management operations.

5.1.3 Secondary Domains

Domain A – Infrastructure

This domain includes those items of infrastructure that will remain following mine closure for a lawful land use, namely a land use permitted without consent or following granting of development consent. In the absence of further approvals, this would indicatively include:

- Escott Road;
- Site Access Road; and
- the "Eurunderee" homestead[7].

Domain B – Water Management Areas

This domain includes those water management structures that will remain in place following mine closure, including:

- clean water diversion drains around the overburden emplacement (as these area expected to be well vegetated and form part of functioning and sustainable hydrological setting of the final overburden land form and areas immediately downslope);
- sediment basins down-slope of previous areas of disturbance (to act as watering points for livestock or habitat features for native fauna); and
- clean water dams located to the south of the Site Access Road.

Domain E – Rehabilitated Land – Woodland

This domain includes those areas of the Mine that will be rehabilitated to vegetation community consistent with either:

- Box Gum Woodland and Derived Native Grassland (EEC equivalent);
- Brigalow-Belah Woodland (EEC equivalent); or
- Shrubby White Box Woodland.

[7] Subject to future review of structural stability.

Domain G – Rural Land Capability Classification 1 – 7

Utilising the Land and Soil Capability (LSC) system for NSW, this domain includes those areas of the Mine that will be rehabilitated in a manner suitable for agricultural purposes to achieve an agricultural capability equivalent to Class 3. This domain is predominantly associated with the Product Coal Storage Area, Rail Load-out Facility and Rail Loop.

Domain J – Biodiversity Offset Areas

This domain includes those areas of the Mine within the approved Biodiversity Offset Area.

5.2 REHABILITATION DOMAIN OBJECTIVES

Table 4.2 presents the post mining rehabilitation objectives and targets while **Table 5.2** presents the rehabilitation domain objectives. These objectives have been used to develop the performance indicators and completion/relinquishment criteria presented in Section 6. **Plans 3A** to **3G** present the location of each primary / secondary domain combination of the Mine.

Table 5.2
Rehabilitation Domain Objectives

Page 1 of 2

Primary Domain	Secondary Domain	Rehabilitation Objective
1. Infrastructure Area	A. Infrastructure	• All infrastructure and services not suitable for a lawful final land use to be removed • Electricity, roads and hardstand areas to be retained for a lawful final land use suitable for the final land use. • Domain safe and free from hazardous materials.
	E. Woodland	• Stable and permanent landform established. • Final landform non-polluting. • Vegetation consistent with the White Box Grassy Woodland.
	G. Rural Land Capability Class I to VIII	• The area does not represent an erosion hazard. • Land capability similar to existing land capability (Class III).
3. Water Management Area	B. Water Management Area	• Domain stable and non-polluting. • No active erosion.
	E. Woodland	• Stable and permanent landform established. • Final landform non-polluting. • Vegetation consistent with the White Box Grassy Woodland.
	G. Rural Land Capability Class I to VIII	• The area does not represent an erosion hazard. • Land capability similar to existing land capability (Class III).
4. Overburden Emplacement Area	E. Woodland	• Stable and permanent landform established. • Runoff and/or leachate from the landform are non-polluting. • Vegetation consistent with the White Box Grassy Woodland or Brigalow Woodland.

Table 5.2 (Cont'd)
Rehabilitation Domain Objectives

Primary Domain	Secondary Domain	Rehabilitation Objective
5. Stockpiled Material	E. Woodland	• Stable and permanent landform established. • Soils, hydrology, and woodland (Grassy and Shrubby White Box Woodland*) ecosystem with maintenance needs no greater than those of a local analogue site. • Vegetation consistent with the White Box Grassy Woodland or Brigalow Woodland.
6. Void (Open cut void)	E. Woodland	• Final landform safe, stable and secure. • Runoff and/or leachate from the landform are non-polluting. • Vegetation consistent with the White Box Grassy Woodland.
7. Rehabilitation Area - Pasture	E. Woodland	• Stable and permanent landform established. • Soils, hydrology, and woodland (Grassy and Shrubby White Box Woodland*) ecosystem with maintenance needs no greater than those of a local analogue site. • Vegetation consistent with the White Box Grassy Woodland or Brigalow Woodland.
9. Biodiversity Offset Area	J. Biodiversity Offset Area	• Maximise preservation of remnant vegetation within the Biodiversity Offset Area (White Box Grassy Woodland or Brigalow Woodland).
10. Rural Land	G. Rural Land Capability Class I to VII	• Land capability similar to existing land capability. • Soils, hydrology, and noxious weed maintenance needs no greater than those of surrounding, non-mine disturbed land.
* Grassy White Box Woodland EEC equivalent		

5.3 REHABILITATION PHASES

Successful rehabilitation is best considered in terms of logical steps or phases. That is, the successful achievement of objectives for one phase is the precursor for progression to the next phase, and so on until all rehabilitation objectives and criteria are complete. The use of rehabilitation phases in this manner allows the progress of rehabilitation to be clearly managed and monitored.

The rehabilitation hierarchy used in this MOP follows the guidance provided in Explanatory Note 2(h) of ESG3, which references six separate phases as follows.

Phase i: Decommissioning

Decommissioning includes the cessation of infrastructure usage, its demolition and removal from the Mine or preparation for a supplementary post-mining land use. The order in which the decommissioning of the infrastructure occurs will be determined and agreed upon prior to mine closure.

As noted in Section 2.4.13, decommissioning activities will be defined in greater detail in a Closure MOP to be completed closer to the completion of the term of this MOP. The Closure MOP will specify final land use for the Mine, the timing and methods for decommissioning of infrastructure and fixed equipment, and final land preparation and rehabilitation to be undertaken prior to relinquishment.

Phase ii: Landform Establishment

The landform establishment phase involves the earthworks required to construct and/or profile all or part of each domain as nominated in this MOP (**Plans 3A** to **4**). The constructed landform should be suitable for the proposed final land use and sympathetic to the adjacent topography. This stage will also include the construction of any drainage structures needed for the area.

Phase iii: Growth Medium Development

The growth medium development phase involves the placement of weathered overburden, subsoil and topsoil on the final landform and preparation of the surface for revegetation. Soil preparation will include ripping or scarifying the surface with fertiliser or soil ameliorant only applied if required.

Phase iv: Ecosystem and Land Use Establishment

The ecosystem and land use establishment phase involves the establishment and maintenance of vegetation on the completed landform. On completion of ecosystem and land use establishment for a final land use of woodland vegetation, an initial cover of native ground cover (grasses) will be established. The final stage of revegetation will comprise of planting woodland overstorey species commensurate with the target vegetation community. The criteria for completion of ecosystem and land use establishment in areas identified for agricultural use will depend on the type of agriculture to be undertaken and may include establishment of suitable pasture or planting of an initial crop.

Phase v: Ecosystem and Land Use Sustainability

The ecosystem and land use sustainability phase occurs once monitoring illustrates the achievement of relevant performance indicators with respect to ecosystem development. Areas of the landform may remain within this phase for extended periods whilst progress is made towards achieving relinquishment criteria.

Phase vi: Land Relinquishment

On achievement of the nominated closure criteria for ML's 1563, 1671 & 1672, the land will be relinquished and the rehabilitation security held by the DRE released in full for that component of the final landform.

Table 5.3 provides the proposed status of rehabilitation, by phase for each domain, at the end of this MOP period. Further detail on the proposed rehabilitation to be completed each year of this MOP is provided in Section 7.2. Section 7.3 and **Table 7.2** provides further detail on the relative areas (by rehabilitation phase) of each domain completed over the term of this MOP.

Table 5.3
Summary of Rehabilitation Phases Proposed for Completion at the end of the MOP Term

Rehabilitation Phase[1]	Infrastructure – Infrastructure (1A)	Infrastructure – Woodland (1E)	Infrastructure – Rural Land (1G)	Water Management Area – Water Management Area (3B)	Water Management Area – Woodland (3E)	Overburden Emplacements – Woodland (4E)	Stockpiled Material – Woodland (5E)	Void (Open cut void) - Woodland (6E)	Biodiversity Offset Areas (9J)	Rural Land – Rural land (10G)
I. Active Mining Area	NA	NA	NA	NA	NA	✓	✓	✓	NA	NA
II. Decommissioning	✓	×	×	NA	×	P	✓	P	NA	NA
III. Landform Establishment	✓	×	×	✓	×	P	✓	P	NA	NA
IV. Growth Medium Development	NA	×	×	NA	×	P	✓	P	NA	NA
V. Ecosystem and Land use Establishment	NA	×	×	P	×	P	✓	P	✓	✓
VI. Ecosystem and land use Sustainability	NA	×	×	P	×	P	✓	P	✓	✓
VII. Relinquished Lands	NA	×	×	P	×	P	✓	P	NA	NA

✓ = rehabilitation phase completed at end of MOP term
× = rehabilitation phase not completed at end of MOP term
P = rehabilitation phase partially completed at end of MOP term
NA = not applicable

Note: 1: Refer to Plans 3A to 3G

Source: Werris Creek Coal Pty Limited

6. PERFORMANCE INDICATORS, MEASURES AND RELINQUISHMENT CRITERIA

Performance indicators and relinquishment criteria provide a means by which the progress of rehabilitation can be measured to quantitatively demonstrate the successful achievement of a biophysical process, i.e. the standards that are to be met by successful rehabilitation.

Performance indicators and performance criteria are inter-related as a performance indicator is an attribute of the biophysical environment (e.g. pH, slope, topsoil and subsoil depth) that can be used to approximate the progression of that biophysical process against a defined end point, i.e. the completion/relinquishment criterion.

Table 6.1 provides the rehabilitation performance indicators, measures and relinquishment criteria developed for the Mine to achieve the nominated post mining land use goals and rehabilitation objectives (refer to Sections 4.2 and 4.3). The performance indicators cross-reference the Rehabilitation Domain Objectives identified in Section 5.2. **Plans 3A** to **3G** present the annual progression of mining and rehabilitation activities throughout the term of this MOP.

Table 6.1
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase I – Decommissioning									
Domain 1 – Infrastructure Area									
All infrastructure and services not suitable for a lawful final land use will be removed	Services disconnected	Services not required for final land use disconnected	Relevant services disconnected	-	-	EA Section 2.14.6.2	Not Commenced	Post MOP	NA
	Infrastructure removed	Infrastructure not required for final land use removed	Relevant infrastructure removed	-	-	EA Section 2.14.6.2	Not Commenced	Post MOP	NA
All roads and hardstand areas to be retained for a lawful final land use reduced in width to that suitable for final land use	Roads removed	Roads not required for final land use are removed	Roads removed unless permitted for agricultural or other approved activity	Photographs	Following decommissioning	EA Section 2.14.6.2	Not Commenced	Post MOP	NA
	Hardstand areas reduced or removed	Hardstand areas reduced in size to that suitable for final legal land use of removed fully	Permitted hardstand areas identified and remainder removed	Photographs	Following decommissioning	EA Section 2.14.6.2	Not Commenced	Post MOP	NA
Domain safe and free from hazardous materials	Contaminated land identified and remediated	Contaminated land assessment indicates contamination acceptable for final land use	No contamination remaining at surface	Contamination report prepare by qualified person	Following decommissioning	To ensure no ongoing environmental liability	Not Commenced	Post MOP	1
	No hazardous materials remain	All hazardous materials removed	No hazardous materials remain on site	Contamination report prepare by qualified person	Following decommissioning	To eliminate safety risks for future land user	Not Commenced	Post MOP	NA
Domain 3 – Water Management Area									
Domain stable and non-polluting	Redundant water management structures removed	Water management structures removed or isolated from drainage		Plan showing redundant structures Photographs	Following decommissioning	To ensure maximum harvestable rights capacity of the Mine is not exceeded	Not Commenced	Post MOP	NA
Domain 4 – Overburden Emplacements									
Stable and permanent landform established	Landform geotechnically stable	Geotechnical stability of the landform	Geotechnical report indicating no evidence of instability of emplacements	Independent engineers report	Ongoing and following decommissioning	-	Not Commenced	Partially Complete	3
Domain 5 – Stockpiled Material									
Stable and permanent landform established	Stockpiled soil used for rehabilitation of other domains	Stockpiled soil removed	Stockpiled soil removed	Photographs	Following decommissioning	-	Not Commenced	Partially Complete	NA
Phase II – Landform Establishment									
Domain 1 – Infrastructure Area									
Stable and permanent landform established	Landform constructed in accordance with **Plan 4** (or subsequent plan approved for mine closure)	Comparison between post-mining landform and **Plan 4**	Final survey confirms landform constructed in accordance with **Plan 4**	Comparison to MOP Plan 4 Plan(s) prepared by surveyor	Following completion	EA Section 2.14.2	Not Commenced	Post MOP	NA
	Suitable surface water controls installed and operating effectively	Surface water quality	Maximum erosion rilling of 75mm wide and 100mm deep Monitoring of water discharged from the Mine complies with EPL criteria	Inspection / Photographs Water quality sampling and analyses as per the approved *Water Management Plan*	Following rainfall Quarterly following landform establishment until achievement of criteria demonstrated	EA Section 2.14.2	Not Commenced	Post MOP	6

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase II – Landform Establishment (Cont'd)									
Domain 1 – Infrastructure Area (cont'd)									
Final landform non-polluting	No polluted or contaminated runoff from the landform	No runoff Or Water quality parameters of EPL	No discharge to drainage lines of the Mine Or Water quality criteria of EPL achieved	Observation post rainfall Or Water quality sampling and analyses as per the approved *Water Management Plan*	Following runoff generating rainfall Quarterly following landform establishment until achievement of criteria demonstrated	EA Section 2.14.2	Not Commenced	Post MOP	6
Domain 3 – Water Management Area									
No active erosion	Redundant water management structures backfilled	No subsidence over site of former water management feature	No pooling of water over site following rainfall	Observation / Photographs	Following rainfall	So as not to exceed maximum harvestable rights capacity for the site.	Not commenced	Post MOP	6
	Remaining water management structures non-polluting	Water quality of discharge complies with relevant water quality criteria	Monitoring indicates that surface water complies with ANZECC (2000) trigger value for livestock (cattle) or analogue monitoring site	Water quality testing as per the approved *Site Water Management Plan*	Quarterly following landform establishment until achievement of criteria demonstrated	Condition L3 of EPL 12290 Site Water Management Plan	Not commenced	Post MOP	
Domain 4 – Overburden Emplacements									
Stable and permanent landform established	Landform suitable for growth media establishment	Final slope	Final slope <10º	As constructed survey plans	Following completion	EA Section 2.14.6.3	Commenced	Post MOP	NA
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL 12290 limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Site Water Management Plan* Photographs	Quarterly following landform establishment until achievement of criteria demonstrated	EA Section 2.14.6.3	Not Commenced	Post MOP	6
	Continued vehicular access	Access for light vehicles maintained	Access for light vehicles maintained	As constructed survey plans Photographs	Following completion	-	Not Commenced	Post MOP	NA
Runoff and/or leachate from the landform is non-polluting	Water quality of runoff is non-polluting	pH and salinity of runoff	pH of 6.5 to 8.5 Electrical conductivity < 1,100µS/cm	Sampling and analyses of runoff	Quarterly following landform establishment until achievement of criteria demonstrated	Background water quality of void water	Not Commenced	Post MOP	6
Domain 5 – Stockpiled Material									
Stable and permanent landform established	Landform suitable for growth media establishment	Final slope	All slopes <10º	As constructed survey plans	Following completion	EA Section 2.14.6.3	Commenced	Post MOP	NA
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Site Water Management Plan* Photographs	Quarterly following operations until achievement of criteria demonstrated.	EA Section 2.14.6.3	Not Commenced	Post MOP	6
	Continued vehicular access	Access for light vehicles maintained	Access for light vehicles maintained	As constructed survey plans Photographs	Following completion	-	Not Commenced	Post MOP	NA

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase II – Landform Establishment (Cont'd)									
Domain 6 – Void (Open cut void)									
Final landform safe, stable and secure	Landform suitable for growth media establishment	Final slope	Slopes of southern perimeter (concurrent with Domain 4) and floor <10° Remaining slopes <18°	As constructed survey plans	Following completion	EA Section 2.14.6.3	Not Commenced	Post MOP	NA
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Site Water Management Plan* Photographs	Quarterly following landform establishment until achievement of criteria demonstrated	EA Section 2.14.6.3	Not Commenced	Post MOP	6
	Access to void restricted by public	Mine fenced and a lockable gate installed	Fencing established to prevent inadvertent access by the public	Photographs	Following decommissioning	To ensure obligations under relevant legislation related to mine safety are met	Not Commenced	Post MOP	NA
	Void geotechnically stable	Geotechnical stability of the final void	Geotechnical report indicating no unacceptable risk of instability	Independent engineers report	Ongoing and following decommissioning	EA Section 2.14.6.3	Not Commenced	Post MOP	NA
Phase III – Growth Medium Development									
Domain 1 – Infrastructure Area									
The rehabilitated area does not represent an erosion hazard	Soil thickness on shaped landform	Soil test pits	Mine Infrastructure Area: Topsoil material average 200mm thick unless rehabilitation trials indicate that an alternative thickness is acceptable Rail Load-out Facility and Product Coal Storage Area: average 500mm subsoil and average 200mm topsoil unless rehabilitation trials indicate that an alternative thickness is acceptable to achieve Class III land	Test pit	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Commenced	Post MOP	4
	Soil characteristics in the range of pre-mining soil characteristics	Physical and chemical soil characteristics	Results average within 20% of analogue site for: pH[A], Organic carbon, potassium, sulphate, EC, trace metals exchangeable sodium & dispersion index Note A: Within 1 unit of range	Soil monitoring report outlining the results of physical and laboratory soil tests	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Commenced	Post MOP	5
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Site Water Management Plan* Photographs	Quarterly following operations until achievement of criteria demonstrated.	EPL 12290	Commenced	Post MOP	6
Land capability equivalent to existing land capability	Land capability class		Class III agricultural land classification achieved	Final soils assessment by qualified soil scientist	As defined by soil scientist commissioned	PA 10_0059	Not Commenced	Post MOP	5, 10

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase III – Growth Medium Development (Cont'd)									
Domain 4 – Overburden Emplacements									
Soils, hydrology, and woodland (Grassy and Shrubby White Box Woodland) ecosystem with maintenance needs no greater than those of a local analogue site	Soil thickness on shaped landform	Soil test pits	Topsoil / subsoil thickness average 400mm unless rehabilitation trials indicate that an alternative thickness is acceptable	Test pit	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Commenced	Variable	4
	Soil characteristics in the range of pre-mining soil characteristics	Physical and chemical soil characteristics	Results average within 20% of analogue site for: pH[A], Organic carbon, potassium, sulphate, EC, trace metals exchangeable sodium & dispersion index Note A: Within 1 unit of range	Soil monitoring report outlining the results of physical and laboratory soil tests	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Commenced	Variable	5
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Site Water Management Plan* Photographs	Quarterly following landform establishment until achievement of criteria demonstrated	EPL 12290	Not Commenced	Post MOP	6
Domain 5 – Stockpiled Material									
Soils, hydrology, and woodland (Grassy and Shrubby White Box Woodland) ecosystem with maintenance needs no greater than those of a local analogue site	Soil thickness on shaped landform	Soil test pits	Topsoil / subsoil thickness average 200mm thick unless rehabilitation trials indicate that an alternative thickness is acceptable	Test pit	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Not Commenced	Variable	4
	Soil characteristics in the range of pre-mining soil characteristics	Physical and chemical soil characteristics	Results average within 20% of analogue site for: pH[A], Organic carbon, potassium, sulphate, EC, trace metals exchangeable sodium & dispersion index Note A: Within 1 unit of range	Soil monitoring report outlining the results of physical and laboratory soil tests	Post rehabilitation	LDSDP – 10. Mine Rehabilitation (C'wealth of Aus, 2006)	Not Commenced	Variable	5
	Suitable surface water controls installed and operating effectively	Surface water quality	Monitoring of water discharged from the Mine complies with EPL limits No identifiable erosion or sedimentation	Water quality testing as per the approved *Water Management Plan* Photographs	Quarterly following landform establishment until achievement of criteria demonstrated	EPL 12290	Not Commenced	Post MOP	6
Domain 6 – Void (Open cut void)									
Soils, hydrology, and woodland (Grassy and Shrubby White Box Woodland) ecosystem with maintenance needs no greater than those of a local analogue site	Soil thickness on shaped landform	Soil test pits	Topsoil / subsoil thickness average 100mm thick unless rehabilitation trials indicate that an alternative thickness is acceptable	Test pit	Post rehabilitation	-	Not Commenced	Variable	4
	Soil characteristics in the range of pre-mining soil characteristics	Physical and chemical soil characteristics	Results average within 20% of analogue site for: pH[A], Organic carbon, potassium, sulphate, EC, trace metals exchangeable sodium & dispersion index Note A: Within 1 unit of range	Soil monitoring report outlining the results of physical and laboratory soil tests	Post rehabilitation	-	Not Commenced	Variable	5

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase IV - Ecosystem and Land Use Establishment									
Domain B – Water Management Structures									
Domain stable and non-polluting	Water management structures stabilised and capable of retaining and conveying water without causing pollution	Design of structures	Design in accordance with Landcom (2004) and DECC (2008a) No identifiable erosion or sedimentation	Visual inspection Photographs	Following rainfall event which generated runoff	Water Management Plan EPL 12290	In progress	Ongoing	NA
	Water discharged from site within relevant criteria	Monitoring of water discharged from the Mine complies with EPL limits	Monitoring of water discharged from the Mine complies with EPL limits	Water quality testing as per the approved *Water Management Plan*	Quarterly following landform establishment until achievement of criteria demonstrated	EPL 12290	In progress	On going	6
Domain E – Woodland									
Vegetation consistent with Grassy White Box Woodland EEC equivalent community	Appropriate native plant species richness	No. of native species	Native plant species numbers (per 400m²) average within 20% of Analogue Site (refer to **Note A**) or BioMetric benchmark (DECC, 2008b / OEH, 2014) (refer to **Note B**).	Vegetation monitoring by ecologist to determine native plant species richness (refer to Section 8.1.4)	Annually by suitably qualified consultant, with intermediate monitoring by Mine personnel	BOMP Table 2.12 of EA	Not Commenced	Variable	7
	Appropriate density/structure of native overstorey	Overstorey coverage percentage	Average within 20% of Analogue Site (refer to **Note A**) or BioMetric benchmark (DECC, 2008b / OEH, 2014) (refer to **Note C**).	Vegetation monitoring by ecologist to determine density/structure of native overstorey (refer to Section 8.1.4)	Annually by suitably qualified consultant, with intermediate monitoring by Mine personnel	BOMP Table 2.12 of EA	Not Commenced	Variable	8
	Appropriate native groundcover is present	Native groundcover percentage	Average within 20% of Analogue Site (refer to **Note A**) or BioMetric benchmark (DECC, 2008b / OEH, 2014) (refer to **Note D**).	Vegetation monitoring by ecologist to determine Percentage bare ground (refer to Section 8.1.4)	Annually by suitably qualified consultant, with intermediate monitoring by Mine personnel	BOMP Table 2.12 of EA	Not Commenced	Variable	8
Domain G – Rural Land									
Land capability equivalent to existing land capability	Ground cover	Percentage groundcover	Average greater than 80%	Assessment report prepared by suitably qualified person	Annually by suitably qualified consultant, with intermediate monitoring by Mine personnel	Landcom (2004)	Not commenced	Variable	8
	Weed species and abundance	Exotic species richness and coverage	Number of weed species and abundance average no greater than 20% more than that of analogue sites	Biodiversity (species diversity) monitoring	Annual	BOMP – Section 8.7	Commenced	Ongoing	NA
	Vertebrate pests	Abundance	Abundance of vertebrate pests no greater than surrounding lands	Sand pad monitoring	Annual	BOMP – Section 8.7	Commenced	Ongoing	NA
	Agricultural productivity	Agricultural Land Class	Class III agricultural land	Soil Sampling, testing and analyses of other contributing factors by a qualified soil scientist or agronomist	Prior to lease relinquishment	Nominated by DRE	Not commenced	Variable	10

Note A. Analogue Sites (AS) for each vegetation community are identified within the approved BOMP for the Mine (see also Section 8.1.4). Each AS exhibits biometric and floristic parameters typical of remnant native vegetation of the local setting. This standard has been identified as Condition Class 4 (ELA, 2010) and contains native understorey >50% native species groundcover and mid-storey / overstorey of relevant species for the nominated vegetation community. Each AS meets, to the extent practicable, the requirements of a Local Reference Site (LRS) in accordance with *Appendix 3* of the BioBanking Assessment Methodology 2014 (OEH, 2014).

Note B. In the absence of sufficient data from an AS, **native plant species numbers** (per 400m²) achieves the biometric benchmarks established for Biometric Vegetation Types (BVT) (DECC, 2008b) (as nominated in the initial BOMP) or Plant Community Types (PCT) in accordance with the NSW Vegetation Information System Classification Database (VIS) (OEH, 2014).

Note C. In the absence of sufficient data from an AS, **overstorey coverage percentage** achieves the biometric benchmarks established for BVTs (DECC, 2008b) (as nominated in the initial BOMP) or PCTs in accordance with the NSW VIS (OEH, 2014).

Note D. In the absence of sufficient data from an AS, **native groundcover percentage** achieves the biometric benchmarks established for BVTs (DECC, 2008b) (as nominated in the initial BOMP) or PCTs in accordance with the NSW VIS (OEH, 2014).

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase IV - Ecosystem and Land Use Establishment (Cont'd)									
Domain J - Biodiversity Offset Areas`									
Maximise preservation of remnant grassland and woodland communities	Offset areas protected	Legally binding protection established	Conservation listed on land titles	Audit	Following implementation	BOMP	In progress	Variable	NA
	Weed species and abundance	Exotic species richness and coverage	Number of weed species and abundance average no greater than 20% more than that of analogue sites	Biodiversity (species diversity) monitoring	Annual			Ongoing	NA
	Diversity of species consistent with the analogue community	Vegetation survey	Average species diversity consistent with the analogue community	Assessment report prepared by suitably qualified person	Annually by suitably qualified consultant			Ongoing	NA
Phase V – Ecosystem and Land Use Sustainability									
Domain A - Infrastructure									
Remaining infrastructure suitable for a lawful final land use	Infrastructure remaining at the end of the mine life is suitable for a lawful final land use	Lawful land use at the end of Mine life	Infrastructure safe and suitable for a lawful final land use	Photographs	Prior to relinquishment	-	Not Commenced	Post MOP	NA
Domain E – Woodland									
Vegetation consistent with Grassy White Box Woodland EEC equivalent community	*Species number, overstorey and groundcover remain as described for Rehabilitation Phase 4*								
	Landform Function Analysis	Landscape Organisation Index (characterises and maps the spatial patterns of resource loss or accumulation at a site)	Within 20% of Analogue Site.	In accordance with methods of Tongway and Hindley (2004) (refer to Section 8.1.5)	Annually by suitably qualified consultant (in LFA)	BOMP – Section 9.3	Commenced at Analogue Sites 11 & 17 and Treatment Sites 6 & 14	Relinquishment	7, 8 & 9
		Soil Surface Assessment Indices – Stability	Within 20% of Analogue Site.						
		Soil Surface Assessment Indices – Infiltration							
		Soil Surface Assessment Indices – Nutrient Cycling							
	Weed species abundance and management	Exotic species richness and coverage	Number of weed species and abundance average no greater than 20% more than that of analogue sites	Biodiversity (species diversity) monitoring	Annual	BOMP	Commenced	Ongoing	NA
	Vertebrate pests	Abundance	Abundance of vertebrate pests no greater than surrounding lands	Sand pad monitoring	Annual	BOMP – Section 8.7	Commenced	Ongoing	NA
Domain G – Rural Land									
Land capability equivalent to existing land capability	Agricultural productivity	Agricultural Land Class	Class III agricultural land	Soil Sampling, testing and analyses of other contributing factors by a qualified soil scientist or agronomist	Prior to lease relinquishment	Nominated by DRE	Not commenced	Variable	10

This page has intentionally been left blank

Table 6.1 (Cont'd)
Measurement of Rehabilitation Performance

Objective (see also Table 5.2)	Performance Indicator	Performance Measure	Relinquishment Criteria	Monitoring Methodology	Monitoring Frequency[1]	Justification/ Source	Progress at start of MOP	Expected Completion	TARP Ref No.
Phase V – Ecosystem and Land Use Sustainability (Cont'd)									
Domain J - Biodiversity Offset Areas`									
Maximise preservation of remnant woodland	Offset areas protected	Legally binding protection established	Conservation listed on land titles	Audit	Following implementation	BOMP	In progress	Ongoing	NA
	Weed species and abundance	Exotic species richness and coverage	Number of weed species and abundance average no greater than 20% more than that of analogue sites	Biodiversity (species diversity) monitoring	Annual	BOMP – Section 8.7	In progress	Ongoing	NA
	Diversity of species consistent with the analogue community identified in the Biodiversity Offset Area	Vegetation survey	Average species diversity at least 80% of that contained within analogue community identified in the Biodiversity Offset Area	Assessment report prepared by suitably qualified person	Annually by suitably qualified consultant	BOMP	In progress	Ongoing	NA
Phase VI – Relinquished Lands									
Domain 1 – Infrastructure Area									
All domains	Demonstrated compliance with the above					-	Not Commenced	Post MOP	NA

ABS = Australian Bureau of Statistics

LDSDP = Leading Practice Sustainable Development Program for the Mining Industry

This page has intentionally been left blank

7. REHABILITATION IMPLEMENTATION

7.1 STATUS AT MOP COMMENCEMENT

Table 7.1 presents the status of rehabilitation at the commencement of this MOP.

Table 7.1
Status of Rehabilitation at the Commencement of the MOP

Primary Domain	Secondary Domain	Status of Rehabilitation at the Commencement of the MOP[1] (ha)
1 – Infrastructure Area	A – Infrastructure	-
	E – Woodland	-
	G – Rural Land	-
3 – Water Management Area	B – Water Management Area	-
	E – Woodland	-
4 – Overburden Emplacements	E – Woodland	106
5 – Stockpiled Material	E – Woodland	-
6 – Open Cut Void	E – Woodland	-
7 – Rehabilitated Land - Pasture	E – Woodland	3.9
9 – Biodiversity Offset Areas	J – Biodiversity Offset Areas	217
10 – Rural Land	G – Rural Land	185
Note 1: Rehabilitation restricted to rehabilitation phases in line with reporting completed to date, i.e. in AEMR's: (iv) Ecosystem and Land Use Establishment; and (v) Ecosystem and Land Use Sustainability		
Source: Plan 2		

7.2 PROPOSED REHABILITATION ACTIVITIES DURING THE MOP TERM

7.2.1 Introduction

This section provides an overview of the rehabilitation activities proposed to be implemented during this MOP term on a domain by domain basis. Reference is made to the rehabilitation phases described in Section 5.3.

The descriptions provided in this Section are consistent with the rehabilitation activities presented on **Plans 3A** to **3G.** It is noted, that information in relation to the timing of each rehabilitation stage presented in this Section and within **Plans 3A** to **3G** is based on the proposed material production schedule presented in Section 2.4.14. Should the actual material production schedule vary from the proposed schedule, the timing of rehabilitation activities will also vary.

7.2.2 Domain 1 – Infrastructure Area

Domain 1 – Infrastructure Area would remain as an active mining area throughout the term of this MOP and no rehabilitation is proposed.

7.2.3 Domain 3 – Water Management Area

Domain 3 – Water Management Area would remain as an active mining area throughout the term of this MOP. Notwithstanding this, WCC acknowledges its obligations to ensure that water permitted to discharge from disturbed sections of the Mine complies with the requirements within PA10_0059 and EPL 12290.

7.2.4 Domain 4 – Overburden Emplacement Area

The in-pit and out-of-pit overburden emplacements will be progressively rehabilitated as available during the term of this MOP. The status of progressive rehabilitation during this MOP term is illustrated on **Plans 3A** to **3G.**

The following provides a detailed description of the rehabilitation methodology that will be implemented for the Overburden Emplacement throughout the term of this MOP.

Landform Establishment

- Completed sections of the overburden emplacements would be clearly identified on the ground to prevent further inadvertent placement of overburden.
- The outer faces of the emplacements would be reshaped to achieve the following.
  - A maximum final slope of 10°.
- The upper surface of the final emplacements will be separated into five separate sub-catchments, with micro-relief including drainage swales and rises within each sub-catchment incorporated into the final design. Rather than being table flat, an average fall of 1% from a central location to the outer edges of the upper surface will be created.

Growth Medium Development

- Surface water controls, including diversion structures, contour banks, sediment basins and drop structures will be installed on the final landform in accordance with the requirements of Landcom (2004) and DECC (2008a).
- Soil material will be directly placed on rehabilitation if soil stripping and rehabilitation are occurring concurrently.
- Stockpiled soil will be reclaimed from the soil stockpiles using an excavator or front-end loader and transported to the rehabilitation site by haul truck. The material will be spread using a small bulldozer, with care taken to ensure that the placed soil is not overly compacted.
- The upper surface of the topsoil will be ripped along the contour to facilitate infiltration of water and retention of spread seed.

Ecosystem and Land Use Establishment

- Where available, habitat elements such as stags, logs, large rocks or broken vegetation would be placed on the final landform.

- The overburden emplacements will be rehabilitated with an initial cover of native ground cover (grasses) and then seeding and/or planting of woodland overstorey species commensurate with the target vegetation community.
- WCC will progressively review the revegetation strategies during updates to the BOMP and present species used in annual rehabilitation programs in the AEMR.
- The rehabilitation area will have a barrier (i.e. windrow) installed and/or signposted, to mitigate inadvertent disturbance by Mine-related activities.
- Establishment of the vegetation communities will be monitored through regular inspections as described in Section 8.1, with ameliorative or other actions implemented in accordance with the Trigger Action Response Plan (TARP) procedures identified in Section 9.2.

Ecosystem and Land Use Sustainability

- The rehabilitated areas will not be used for agricultural purposes.

7.2.5 Domain 5 – Stockpiled Material

Towards the end of the term of this MOP (see **Plans 3F** and **3G**), the soil contained with the stockpiles at the southern end of the Mine would be re-excavated and used in the growth medium development phase of the overburden emplacement.

The following provides a description of the rehabilitation methodology that will be implemented for the soil stockpiles throughout the term of this MOP.

Landform Establishment

- On removal of stockpiled soil, the landform will be graded and lightly ripped in preparation of soil application.

Growth Medium Development

- If all topsoil has been removed, a layer of topsoil will be placed over the ripped landform.
- The surface of the soil will be ripped along the contour to facilitate infiltration of water and retention of spread seed.

Ecosystem and Land Use Establishment

- Where available, habitat elements such as stags, logs, large rocks or broken vegetation will be placed on the final landform.
- An initial cover of native ground cover (grasses) will be established by direct seeding.
- Native species will then be planted to achieve the species richness target nominated in **Table 6.1**.
- The rehabilitation area will have a barrier (i.e. windrow) installed and/or signposted, to mitigate inadvertent disturbance by Mine-related activities.

- Establishment of the vegetation communities will be monitored during the Annual Biodiversity Monitoring program.

Ecosystem and Land Use Sustainability

- The rehabilitated areas will not be used for agricultural purposes.

7.2.6 Domain 6 – Open Cut Void

The open cut void will be progressively rehabilitated during the term of this MOP following the in-pit emplacement extending in a northwards direction, essentially following the active mining area. The status of progressive rehabilitation during this MOP term is illustrated on **Plan 3**.

The following provides a description of the rehabilitation methodology that will be implemented for the soil stockpiles throughout the term of this MOP.

Landform Establishment

- Final high walls at the completion of mining will be blasted to create the 18° final slope.

Growth Medium Development

- Surface water controls, including diversion structures, contour banks, sediment basins and drop structures will be installed on the final landform in accordance with the Site Water Management Plan.
- Stockpiled soil will be reclaimed from the soil stockpiles using an excavator and transported to the crest of the void and bulk pushed down the void surface. The material will then be spread using a small bulldozer, with care taken to ensure that the placed soil is not overly compacted.
- Topsoil separate will be placed on the shaped landform.
- The upper surface of the topsoil will be ripped along the contour to facilitate infiltration of water and retention of spread seed.

Ecosystem and Land Use Establishment

- Where available, habitat elements such as stags, logs, large rocks or broken vegetation will be placed on the final landform.
- An initial cover of native ground cover (grasses) will be established by direct seeding.
- Native species will then be planted to achieve the species richness target nominated in **Table 6.1**.
- The rehabilitation area will have a barrier (i.e. windrow) installed and/or signposted, to mitigate inadvertent disturbance by Mine-related activities.

- Establishment of the vegetation communities will be monitored through regular inspections as described in Section 8.1, with ameliorative or other actions implemented in accordance with the procedures identified in Section 9.2.

Ecosystem and Land Use Sustainability

- The rehabilitated areas will not be used for agricultural purposes.

7.2.7 Domain 9 – Biodiversity Offset Areas

Management of Domain 9 – Biodiversity Offset Areas is described in full in the *Biodiversity and Offset Management Plan* (BOMP) dated August 2013 which can be downloaded and viewed on the Werris Creek Coal Environmental Management page of the Whitehaven Coal Limited website.

7.3 SUMMARY OF REHABILITATION DURING THE MOP TERM

Table 7.2 presents a summary of the anticipated annual and cumulative rehabilitation (as rehabilitation phase (vi) ecosystem and land use sustainability) over the term of this MOP. **Table 7.2** also provides, based on the indicative mining and rehabilitation sequence of **Plans 3A** to **3G**, the progressive increase in mining footprint and the annual targets for completion of rehabilitation phases (iii) to (v) (which will enable an average of 20ha to achieve rehabilitation phase (vi) each year for the term of the MOP).

7.4 RELINQUISHMENT PHASE ACHIEVED DURING MOP PERIOD

WCC does not anticipate that the relinquishment phase will be achieved for any land within the Mine during the term of this MOP.

Table 7.2
Disturbance and Rehabilitation Progression during the term of the MOP

Year	Total Disturbance Area (ha)[1]	Rehabilitation Area (ha)[2]		Comments[3]
		Annual	Cumulative	
Start of MOP	485.4	-	106	Includes approximately 40ha of landform establishment and 106ha at various stages of rehabilitation between phase iv (growth medium development) and phase vi (ecosystem and land use sustainability) on the overburden emplacement, Acoustic and Visual Amenity Bund and MIA Bund (Domain 4).
1	499	17	123	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development:30ha (v) Ecosystem and Land Use Establishment: 15ha (vi) Ecosystem and Land Use Sustainability: 5ha Includes the following areas on the Acoustic and Visual Amenity Bund (Domain 4): (vi) Ecosystem and Land Use Sustainability: 12ha Includes the following areas on the MIA Bund (Domain 4): (v) Ecosystem and Land Use Establishment: 5ha
2	513	15	138	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 29ha (v) Ecosystem and Land Use Establishment: 30ha (vi) Ecosystem and Land Use Sustainability: 15ha Includes the following areas on the Acoustic and Visual Amenity Bund (Domain 4): (v) Ecosystem and Land Use Establishment: 7ha

Note 1: Total disturbance area includes all areas, including active mining as well as the various phases of rehabilitation

Note 2: Annual and Cumulative Rehabilitation Areas only include rehabilitation phase vi: Ecosystem and Land Use Sustainability

Note 3: Approximate areas of all rehabilitation phases (iv to vi) are identified as targets which will provide for an average annual increase of 20ha in rehabilitation achieving phase vi

Table 7.2 (Cont'd)
Disturbance and Rehabilitation Progression during the term of the MOP

Year	Total Disturbance Area (ha)[1]	Rehabilitation Area (ha)[2]		Comments[3]
		Annual	Cumulative	
3	534	37	175	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 16ha (v) Ecosystem and Land Use Establishment: 12ha (vi) Ecosystem and Land Use Sustainability: 25ha Includes the following areas on the Acoustic and Visual Amenity Bund (Domain 4): (vi) Ecosystem and Land Use Sustainability: 7ha Includes the following areas on the MIA Bund (Domain 4): (vi) Ecosystem and Land Use Sustainability: 5ha
4	548	20	195	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 17ha (v) Ecosystem and Land Use Establishment: 16ha (vi) Ecosystem and Land Use Sustainability: 20ha
5	560	16	211	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 41ha (v) Ecosystem and Land Use Establishment: 17ha (vi) Ecosystem and Land Use Sustainability: 16ha Includes the following areas on the soil stockpiles (Domain 5): (iv) Growth Medium Development: 21ha

Note 1: Total disturbance area includes all areas, including active mining as well as the various phases of rehabilitation

Note 2: Annual and Cumulative Rehabilitation Areas only include rehabilitation phase vi: Ecosystem and Land Use Sustainability

Note 3: Approximate areas of all rehabilitation phases (iv to vi) are identified as targets which will provide for an average annual increase of 20ha in rehabilitation achieving phase vi

Table 7.2 (Cont'd)
Disturbance and Rehabilitation Progression during the term of the MOP

Year	Total Disturbance Area (ha)[1]	Rehabilitation Area (ha)[2]		Comments[3]
		Annual	Cumulative	
6	575	22	233	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 24ha (v) Ecosystem and Land Use Establishment: 35ha (vi) Ecosystem and Land Use Sustainability: 22ha Includes the following areas on the soil stockpiles (Domain 5): (v) Ecosystem and Land Use Establishment: 21ha
At end of MOP	587	52	285	Includes the following areas on the overburden emplacement (Domain 4): (iv) Growth Medium Development: 26ha (v) Ecosystem and Land Use Establishment: 30ha (vi) Ecosystem and Land Use Sustainability: 31ha Includes the following areas on the soil stockpiles (Domain 5): (vi) Ecosystem and Land Use Sustainability: 21ha

Note 1: Total disturbance area includes all areas, including active mining as well as the various phases of rehabilitation
Note 2: Annual and Cumulative Rehabilitation Areas only include rehabilitation phase vi: Ecosystem and Land Use Sustainability
Note 3: Approximate areas of all rehabilitation phases (iv to vi) are identified as targets which will provide for an average annual increase of 20ha in rehabilitation achieving phase vi

Source: Sequential Mine Plans 3A to 3G

8. REHABILITATION MONITORING AND RESEARCH

8.1 REHABILITATION MONITORING

8.1.1 Introduction

Rehabilitation monitoring focuses upon measuring progress towards achievement of relevant performance indicators and completion criteria. **Table 6.1** presents a summary of the rehabilitation monitoring methodology and frequency for each indicator and criteria identified. The following provides an overview of the monitoring undertaken with respect to these performance indicators and completion criteria.

The rehabilitation of the final landform is integrated with the Biodiversity Offset Strategy for the Mine, with the aim to establish a wildlife corridor of high quality grassland and grassy woodland vegetation communities between remnants maintained on the hills to the east and west of the Mine. The monitoring described in the following subsections is summarised from the more detailed description contained within the approved BOMP (WCC, 2013). The BOMP is regularly reviewed and updated and can be downloaded from the Werris Creek Coal Environmental Management page of the Whitehaven Coal Limited website.

8.1.2 Visual Inspections

An inspection of the landform under rehabilitation is undertaken on a quarterly basis by the Mine Environmental Officer and involves a rapid assessment tool that provides an assessment of various landscape contributors and triggers appropriate remedial actions. Features of rehabilitated landforms and the BOA considered include:

- vegetation components (overstorey, understorey and ground cover where applicable);
- presence of exotic weed and feral animals species;
- surface stability and erosion issues;
- presence of available microhabitat; and
- disturbance factors including fire and unauthorised access e.g. rubbish dumping.

Remedial activities are programmed as required to address issues such as eroding surface, poor vegetation establishment or weed infestation.

8.1.3 Annual Soil Analysis

On an annual basis, composite soil samples are collected from soils of the rehabilitated landforms (rehabilitation phase (v): Ecosystem and Land Use Establishment), BOA and soil stockpile areas. These samples are sent to and analysed by a Soil Laboratory for key chemical parameters (including pH and electrical conductivity).

The results of the analyses of soils from the rehabilitated landforms and areas within the BOA where vegetation condition improvement is planned ('treatment sites') are compared to the analyses of soils taken from those areas of the BOA of higher condition (low degradation) ('analogue sites'). The objective of soil management is to achieve soil parameters of the treatment soils equivalent to those of analogue soils, with soil treatment and remediation undertaken on the basis of soil analyses to achieve this. It is noted that given the former agriculture land use of large areas of the Mine and BOA, there is potential that soils could contain high nutrient (phosphorus and nitrogen) concentrations that may constrain the establishment of woodland communities. Methods to reduce soil nutrients, such as scalping, will be developed on the basis of soils analysis results.

8.1.4 Vegetation Monitoring

An independent ecological consultancy is engaged to undertake monitoring of vegetation on rehabilitated lands and the Mine Biodiversity Offset Area (BOA) in spring each year.

The floristic and other biometric parameters of monitoring sites contained within the rehabilitated landforms of the Mine, areas of the BOA being improved, and 'analogue' sites within the BOA, are collected and compared. In accordance with the BOMP for the Mine, the number of vegetation monitoring sites ("plots") will achieve the following minimum standard.

- Rehabilitated Landforms: One site per 30ha of rehabilitated land (rehabilitation phase (v): Ecosystem and Land Use Establishment).
- Biodiversity Offset Area: With the exception of the *Rusty Fig – Wild Quince – Native Olive dry rainforest of rocky areas* vegetation community (which represents a very minor proportion of the BOA), at least one site has been established in each vegetation community.

Figure 8.1 identifies the location of vegetation monitoring sites (as of November 2015)[8].

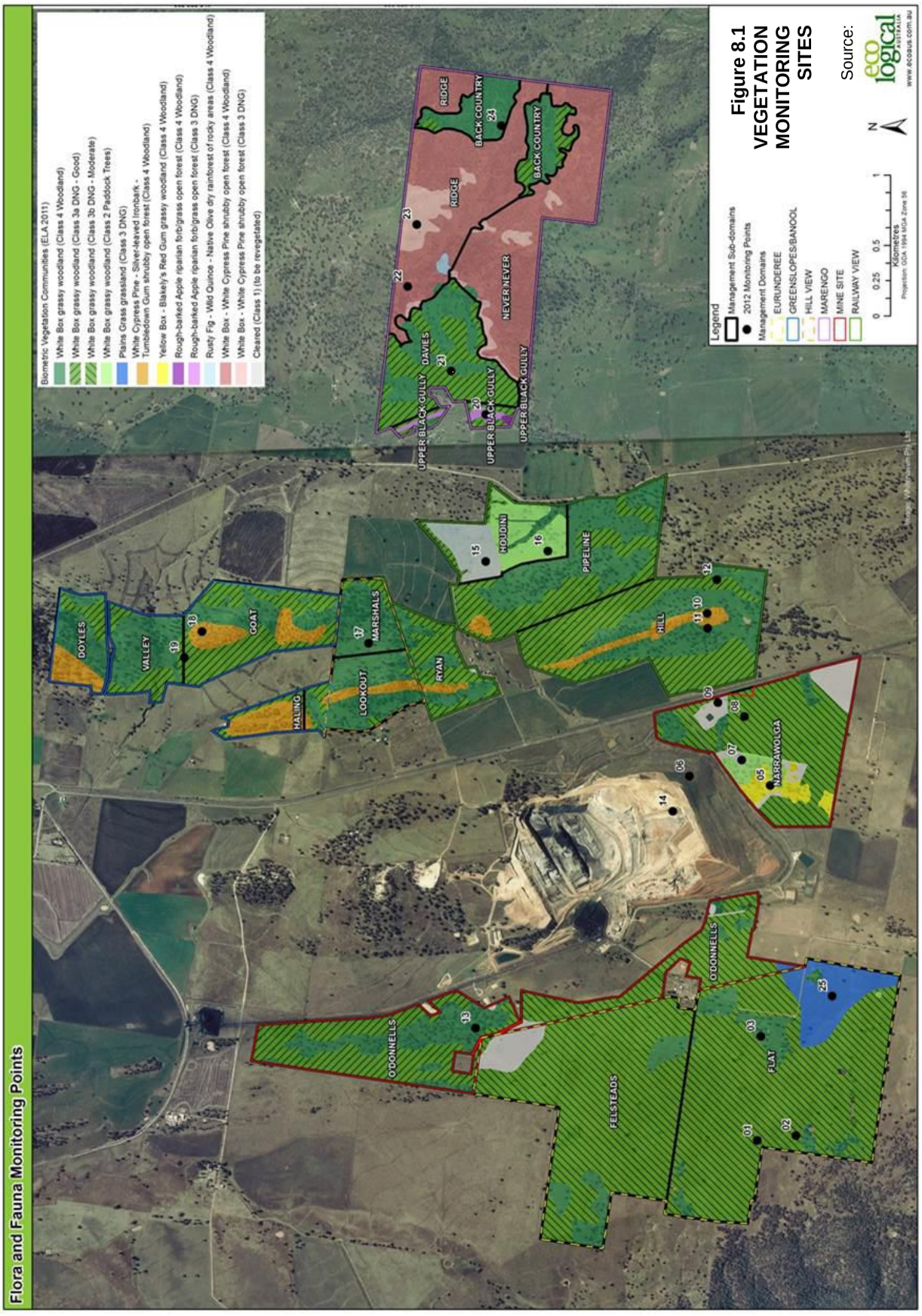
- Analogue Sites. Nine sites (3, 5, 10, 11, 13, 17, 18, 22 and 24) located within vegetation communities (of Condition Class 4[9]) against which the floristic and other biometric parameters of rehabilitated lands are compared (refer to **Table 6.1**).
- BOA Treatment Sites.13 sites (1, 2, 7, 8, 9, 12, 15, 16, 19, 20, 21, 23 and 25).
- Rehabilitation Treatment Sites. Two sites (which will be increased in line with the 1 site / 30ha ratio noted above) on active rehabilitation areas.

The locations of future Rehabilitation Treatments Sites will be identified within progressive updates of the BOMP.

---

[8] Refer to the BOMP for updates to the number and location of Analogue and Treatment Monitoring Sites.

[9] Containing both a native understorey (> 50% native species ground cover) and mid-storey / overstorey of relevant species for the nominated vegetation community, the Analogue Sites exhibit biometric and floristic parameters typical of remnant native vegetation of the local setting.


Flora and Fauna Monitoring Points
Biometric Vegetation Communities (ELA 2011)
White Box grassy woodland (Class 4 Woodland)
White Box grassy woodland (Class 3a DNG - Good)
White Box grassy woodland (Class 3b DNG - Moderate)
White Box grassy woodland (Class 2 Paddock Trees)
Plains Grass grassland (Class 3 DNG)
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest (Class 4 Woodland)
Yellow Box - Blakely's Red Gum grassy woodland (Class 4 Woodland)
Rough-barked Apple riparian forb/grass open forest (Class 4 Woodland)
Rough-barked Apple riparian forb/grass open forest (Class 3 DNG)
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas (Class 4 Woodland)
White Box - White Cypress Pine shrubby open forest (Class 4 Woodland)
White Box - White Cypress Pine shrubby open forest (Class 3 DNG)
Cleared (Class 1) (to be revegetated)
Legend
Management Sub-domains
2012 Monitoring Points
Management Domains
EURUNDEREE
GREENSLOPES/BANOOL
HILL VIEW
MARENGO
MINE SITE
RAILWAY VIEW
Kilometres
Figure 8.1
VEGETATION MONITORING SITES
Source:
eco logical AUSTRALIA
www.ecoaus.com.au
DOYLES
VALLEY
GOAT
HALING
LOOKOUT
MARSHALS
RYAN
HOUDINI
PIPELINE
HILL
MARRAMOLGA
O'DONNELLS
FELSTEADS
FLAT
UPPER BLACK GULLY
DAVIES
NEVER NEVER
RIDGE
BACK COUNTRY

As described in **Table 6.1** (for rehabilitation phase (iv)), the objective of the monitoring is to demonstrate achievement of floristic and other biometric parameters in the treatment plots of the rehabilitated lands and BOA which are equivalent to the analogue sites and are self-sustaining in the long-term. The BOMP provides further detail on the monitoring methods with the results reported annually in the AEMR.

8.1.5 Landscape Function Analysis

The Landscape Function Analysis (LFA) method was developed by the CSIRO specifically for monitoring soil surface condition within rangeland environments and more recently has been adapted to mine rehabilitation projects. Monitoring in accordance with LFA methods is undertaken within the rehabilitated lands (refer to **Table 6.1** – rehabilitation phase (v): Ecosystem and Land Use Establishment) of the Mine as a means of demonstrating the restoration of degraded landscapes.

The LFA monitoring incorporates monitoring sites of the rehabilitated landforms (one site per 30ha of rehabilitated land, e.g. 6 and 14) against selected analogue sites (11 and 17). The objective of rehabilitation and BOA improvement is to demonstrate equivalence to the analogue sites and sustainability in the long-term (refer to **Table 6.1**).

In terms of LFA, a soil landscape that is on a trajectory toward self sustainability (in context of vegetative cover and soil stability) would have:

- A high Landscape Organisation Index (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, which would affect wind and water movement and the introduction and transportation of resources into and out of the system.
- High Soil Surface Assessment (SSA) indices, indicating that the site had favourable Nutrient, Infiltration and Stability characteristics. The SSA indicators include:
  - Rain splash protection;
  - Perennial vegetation cover;
  - Litter cover, origin and decomposition;
  - Cryptogram cover;
  - Crust brokenness;
  - Soil erosion type and severity;
  - Deposited materials;
  - Soil surface roughness;
  - Surface nature (resistance to disturbance);
  - Slake test; and
  - Soil surface nature.

The BOMP provides further detail on the monitoring methods with the results reported annually in the AEMR.

8.1.6 Fauna Monitoring

Annual spring fauna monitoring and winter bird surveys are undertaken by qualified ecologists. The monitoring methodology and target species are described in the BOMP with comparison between treatment sites, i.e. rehabilitated landforms and lower condition areas of the BOA compared to analogue sites for the following parameters.

- the occurrence and abundance of threatened and key indicator species, i.e. species that may inform success of ecological restoration and invasive species; and
- species diversity.

It is noted that these parameters are not used as performance indicators of rehabilitation success (in **Table 6.1**), they do allow the Company to gauge the relative success of rehabilitation and restoration works and trends towards self-sustaining vegetation communities.

The BOMP provides further detail on the monitoring methods with the results reported annually in the AEMR.

8.1.7 Land Capability Assessment

Prior to relinquishment, areas identified as Secondary Domain G (Class III) would be inspected by a qualified soil scientist to confirm achievement of the nominated land capability class.

8.2 RESEARCH AND REHABILITATION TRIALS

No rehabilitation trials or research on active rehabilitation are currently planned for the Mine given the results of biometric and LFA monitoring, as reported in each AEMR, is illustrative of successful rehabilitation.

However, two trials which may influence future management of rehabilitation are ongoing within the BOA.

- Controlled burns to review effectiveness in reducing weeds and overall biomass as a method of encouraging establishment of native species.
- Feed sites for feral pigs have been established within the BOA. If used by the pigs, the potential to bait these to reduce pig density (which could adversely affect achievement of closure criteria) may be then trialled.

The results of these trials and any future research and rehabilitation trials will be reported upon and analysed within each AEMR.

9. INTERVENTION AND ADAPTIVE MANAGEMENT

9.1 THREATS TO REHABILITATION

Section 3 of this document presents an assessment of environmental risks associated with the Mine, describes the management of these risks, and identifies and provides specific focus on risks to rehabilitation success. After consideration of the performance indicators and relinquishment criteria for each phase of rehabilitation (see **Table 6.1**), developed with consideration to these specific rehabilitation risks, a consolidated summary of threats to rehabilitation, including the potential adverse outcomes, have been compiled (see **Table 9.1**).

Table 9.1
Analysis of Rehabilitation Threats

Rehabilitation Threat	Potential Adverse Outcome	Consequence	Likelihood	Risk
Failure to remove infrastructure	Unable to complete rehabilitation or establish the identified final land use	2	E	L
Failure to remove roads and hardstand areas	Unable to complete rehabilitation or establish the identified final land use	2	E	L
Failure to remove hazardous materials	Unable to complete rehabilitation or establish the identified final land use	2	E	L
Failure to address contamination	Contaminated land present	3	E	M
	Overburden Emplacement, bunds, ROM Pad or Coal Product Storage Area are a source of contaminated leachate	3	E	M
Final landform not safe, stable and secure	Geotechnical instability of final void	4	E	M
	Geotechnical instability of Overburden Emplacement or bunds	2	E	L
	Public access to void possible	2	E	L
Spontaneous combustion within the final landform	Initiation of fire prevents establishment of target vegetation community(ies)	3	E	M
	Heating of soil reduces effectiveness as a growth medium which is then not capable of sustaining identified final land use/vegetation community/land capability criteria	3	E	M
Respread soil does not conform to relinquishment criteria	Soil not capable of sustaining identified final land use/vegetation community/land capability criteria	3	E	M
Sediment and erosion control structures inadequate or fail	Final landform is an unacceptable source of sediment	3	E	M
Low or inappropriate species established during revegetation operations	Species richness and diversity criteria not achieved	3	E	M
	Percentage overstorey and groundcover completion criteria not achieved	3	E	M
Weed or pest management fails	Weeds and pests become established and require significant resources to manage	2	D	L

Table 9.1 (Cont'd)
Analysis of Rehabilitation Threats

Rehabilitation Threat	Potential Adverse Outcome	Consequence	Likelihood	Risk
Vegetation of the final landform is not self-sustaining	Mine relinquishment not possible	2	C	M
Final agricultural productivity is inadequate	Agricultural productivity significantly less than analogue sites.	3	D	M
Bushfire	Structure / composition of final vegetation community(ies) altered by occurrence of fire	3	E	M
Drought	Failure of vegetation communities to establish as a consequence of limited water availability	3	D	M

For each threat and potential adverse outcomes, **Table 9.1** also allocates a risk rating based on the potential consequences and likelihood of occurrence. Similar to the assessment of risk considered in Section 3, the analysis has been prepared broadly in accordance with the requirements of *AS/NZS ISO31000:2009 Risk Management - Principles and Guidelines* (**Tables 3.1** to **3.3** present the consequence, likelihood and risk rating used during this analysis), and considers the Company's commitments embodied in the various environmental management plans (refer to Section 1.3) and/or the Statement of Commitments presented as *Appendix 6* of PA 10_0059.

Where risks were determined to be unacceptable, namely those risks classified as "moderate" or above, a TARP has been developed and is presented in Section 9.2.

9.2 TRIGGER ACTION RESPONSE PLAN

Table 9.2 presents the Trigger Action Response Plan for each of the rehabilitation threats and potential adverse outcomes identified in **Table 9.1** as having a risk rating of moderate or above. **Table 9.2** also provides individual reference numbers for each Trigger Action Response.

Table 9.2
Trigger Action Response Plan

Rehabilitation Threat	Potential Adverse Outcome	Trigger	Action/ Response	TARP Ref No
Failure to address contamination	Contaminated land present	• Contamination assessment identifies contaminated land present within Mine	• Implement recommendations of contamination assessment • Repeat contamination assessment until contamination has been removed	1
	Overburden Emplacement, bunds, ROM Pad or Coal Product Storage Area are a source of contaminated leachate	• Monitoring indicates that leachate (if present) does not comply with trigger values determined in accordance with ANZECC (2000)	• Reassessment of waste rock to determine source of contamination • Preparation of a *Contamination Assessment* by a suitably qualified expert identifying suitable measures to manage leachate generation and prevent further contamination	2
Final landform not safe, stable and secure	Geotechnical instability of final void	• Monitoring or final closure geotechnical assessment identifies instability/ unacceptable movement (actual or potential) in final face of open cut void	• Suitably qualified geotechnical engineer engaged to assess the instability and provide a range of recommendations to remediate the instability • Implement above recommendations in consultation with Division of Resources and Energy	3
	Geotechnical instability of Overburden Emplacement, Acoustic and Amenity Bund or MIA Bund	• Routine monitoring for identifies instability/ unacceptable movement (actual or potential) in embankment(s)		
Spontaneous combustion within the final landform	Heating of soil reduces effectiveness as a growth medium which is then not capable of sustaining identified final land use/vegetation community/land capability criteria	• Failure to achieve SSM performance criteria *refer to **Table 6.1** – rehabilitation phase vi).	• Affected area isolated and heating potential removed by excavation, saturation and spreading. • Ecosystem establishment reviewed against LFA and vegetation establishment performance indicators. If the results of vegetation or LFA monitoring indicates these are not trending towards closure criteria then: – Additional soil material spread on the final landform	4

Table 9.2 (Cont'd)
Trigger Action Response Plan

Rehabilitation Threat	Potential Adverse Outcome	Trigger	Action/ Response	TARP Ref No
Spontaneous combustion within the final landform (Cont'd)	Initiation of fire prevents establishment of target vegetation community(ies)	• Evidence of smoke, smouldering or fire	• The affected area isolated, extinguished by excavation, saturation and spreading. • Ecosystem establishment reviewed against LFA and vegetation establishment performance indicators. If the results of vegetation or LFA monitoring indicates these are not trending towards closure criteria then: – Suitably qualified ecologist or revegetation expert engaged to assess reasons for additional management requirements and recommend actions to align management required with that of the analogue sites – Implement above recommendations in consultation with Division of Resources and Energy	5
Respread soil does not conform to relinquishment criteria	Inadequate soil thickness applied to shaped landform	• Test pitting following placement of soil material identifies placed soil thickness not consistent with relinquishment criteria	• Ecosystem establishment reviewed against LFA and vegetation establishment performance indicators. If the results of vegetation or LFA monitoring indicates these are not trending towards closure criteria then: – Additional soil material spread on the final landform	4
	Soil not capable of sustaining identified final land use/vegetation community/land capability	• Topsoil parameters not within the identified criteria	• Ecosystem establishment reviewed against LFA and vegetation establishment performance indicators. If the results of vegetation or LFA monitoring indicates these are not trending towards closure criteria then: – Suitably qualified agronomist or soil scientist engaged to prepare a report including a range of recommendation to ensure that the identified closure criteria are achieved; and – Implement above recommendations in consultation with Division of Resources and Energy	5

Table 9.2 (Cont'd)
Trigger Action Response Plan

Rehabilitation Threat	Potential Adverse Outcome	Trigger	Action/ Response	TARP Ref No
Final landform not non-polluting	Final landform is an unacceptable source of sediment	• Surface water monitoring or visual inspection indicates that final landform is eroding or is a source of unacceptable levels sedimentation	• Remediate eroding area through additional earthworks, soil works, revegetation or other stabilisation works • If the above is unsuccessful, engage a suitably qualified professional in sediment and erosion control to prepare an assessment report and recommendations • Implement above recommendations in consultation with Division of Resources and Energy	6
Low or inappropriate species established during revegetation operations	Species richness and diversity criteria not achieved	• Monitoring indicates that species richness and diversity on the final landform does not meet criteria	• Plant additional species to achieve required species richness commensurate to vegetation community	7
	Percentage overstorey and groundcover completion criteria not achieved	• Monitoring indicates that vegetation does not comply with the proportional ground cover, mid-storey and overstorey criteria.	• Suitably qualified ecologist or revegetation expert engaged to assess reasons for divergence of species mix and recommend actions to ensure that the final vegetation community corresponds as closely as possible to the approved community • Implement above recommendations in consultation with Division of Resources and Energy	8
Vegetation of the final landform is not self-sustaining	Vegetation community does not become established on final landform. Mine relinquishment not possible	• Monitoring of the rehabilitated landform indicates that progress towards identified indices is slower than anticipated or non existent	• Suitably qualified ecologist or revegetation expert engaged to assess reasons for additional management requirements and recommend actions to align management required with that of the analogue sites • Implement above recommendations in consultation with Division of Resources and Energy	9
Final agricultural productivity is inadequate	Agricultural productivity significantly less than analogue sites	• Measured agricultural productivity of the final landform is significantly less than that of an analogue sites	• Suitably qualified agronomist engaged to assess reasons for lower productivity and recommend actions to sustainably improve productivity • Implement above recommendations in consultation with Division of Resources and Energy	10

Table 9.2 (Cont'd)
Trigger Action Response Plan

Rehabilitation Threat	Potential Adverse Outcome	Trigger	Action/ Response	TARP Ref No
Bushfire	Structure / composition of final vegetation community(ies) altered by occurrence of fire	• Monitoring of the rehabilitated landform (post-fire) indicates that progress towards identified indices is slower than anticipated or non existent	• Suitably qualified ecologist or revegetation expert engaged to assess reasons for additional management requirements and recommend actions to align management required with that of the analogue sites • Suitably qualified agronomist engaged to assess reasons for lower productivity and recommend actions to sustainably improve productivity • Implement above recommendations in consultation with Division of Resources and Energy	9 / 10
Drought	Failure of vegetation communities to establish as a consequence of limited water availability	• Monitoring of the rehabilitated landform indicates that progress towards identified indices is slower than anticipated or non existent	• Suitably qualified ecologist or revegetation expert engaged to assess reasons for additional management requirements and recommend actions to align management required with that of the analogue sites • Suitably qualified agronomist engaged to assess reasons for lower productivity and recommend actions to sustainably improve productivity • Implement above recommendations in consultation with Division of Resources and Energy	9 / 10

10. REPORTING

An AEMR is produced for the Mine each year in accordance with the requirements of the three MLs, providing an update on the status of rehabilitation within the Mine and progress against the rehabilitation performance indicators and relinquishment criteria identified in **Table 6.1**. The report will also describe the results of rehabilitation trials and research. Each AEMR is posted on the Company's Website.

11. PLANS

The following plans are provided on the following pages[10].

- Plan 1A – Pre-mining Environment – Project Locality.
- Plan 1B – Pre-mining Environment – Natural Environment.
- Plan 1C – Pre-mining Environment – Built Environment.
- Plan 2 – Mine Domains at Commencement of MOP.
- Plans 3A to 3G – Annual Mining and Rehabilitation (Year 1 to Year 7).
- Plan 4 – Final Rehabilitation and Post-mining Land Use.
- Plan 5 – Cross Sections.

These plans have been prepared in accordance with the Guidelines. It is specifically noted that the approved disturbance boundary of PA 10_0059, identified on **Figure 2.1**, is referenced as 'Limit of Other Disturbance (this MOP)' on **Plans 1** to **4**.

12. REVIEW AND IMPLEMENTATION OF THE MOP

12.1 REVIEW OF THE MOP

The MOP will be reviewed on a periodic basis, generally concurrent with the preparation of the AEMR. If a review indicates the need to amend the MOP, then an amended MOP will be prepared and submitted to the DRE for review and approval.

12.2 IMPLEMENTATION

Table 12.1 outlines the roles and responsibilities of personnel who have responsibility for monitoring, review and implementation for this MOP.

[10] Signed plans have been supplied separately (June 2015).

TN
MN

Werris Creek Coal Mine

Werris Creek

GUNNEDAH

LIVERPOOL PLAINS

REFERENCE
- Approved Mine Site Boundary (PA 10_0059)
- LGA Boundary
- GUNNEDAH LGA Reference
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)

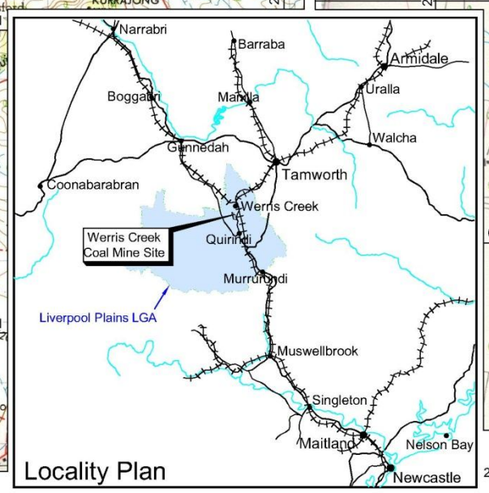
SCALE 1:100 000 (A3)

1 0 1 2 3 4 5 km

WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	

Base Map Source: Curlewis & Tamworth 1:100 000 Topographic Maps

Locality Plan



REFERENCE
- Mining Lease 1563
- Mining Lease 1671
- Mining Lease 1672
- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)

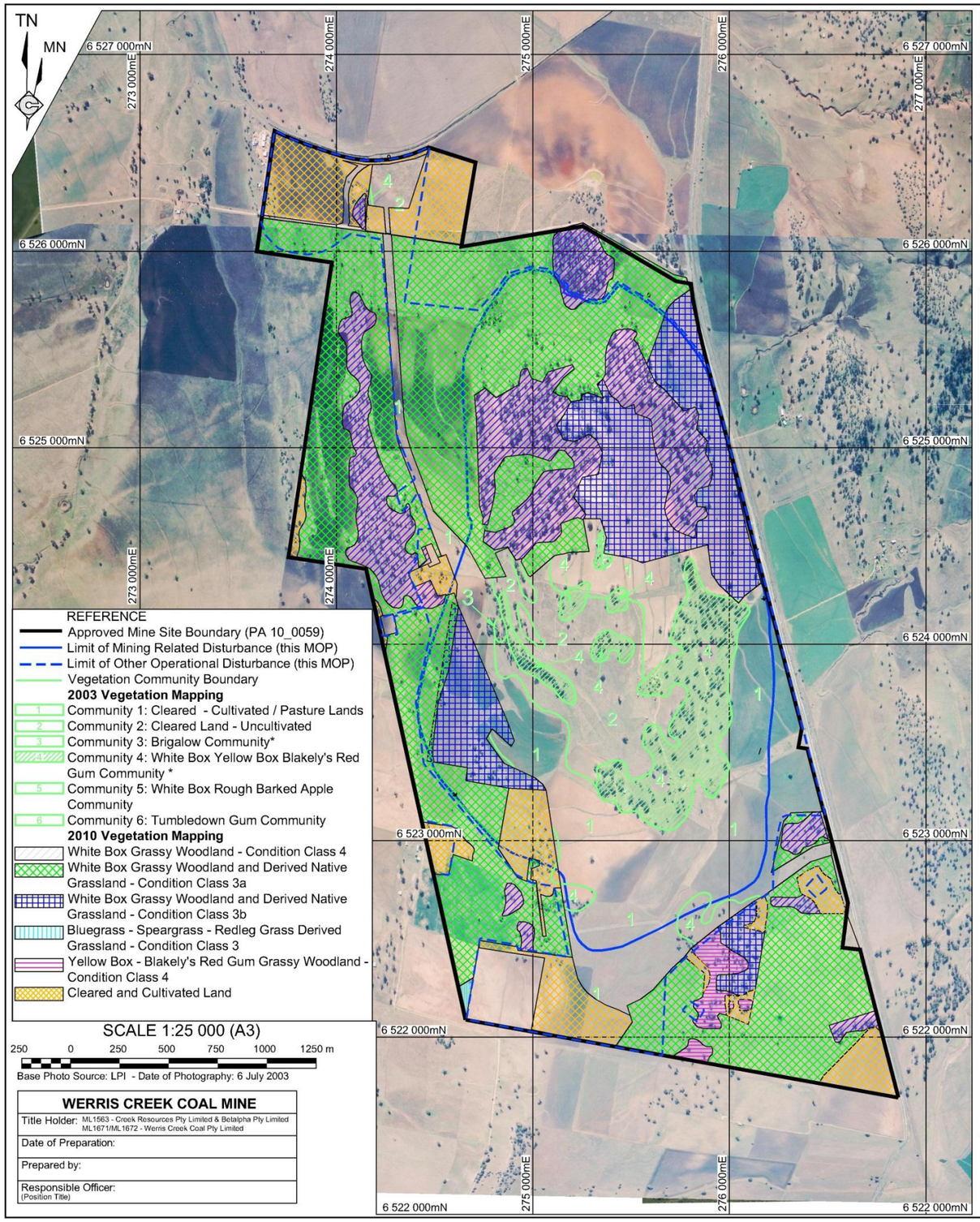
SCALE 1:25 000 (A3)

250 0 250 500 750 1000 1250 m

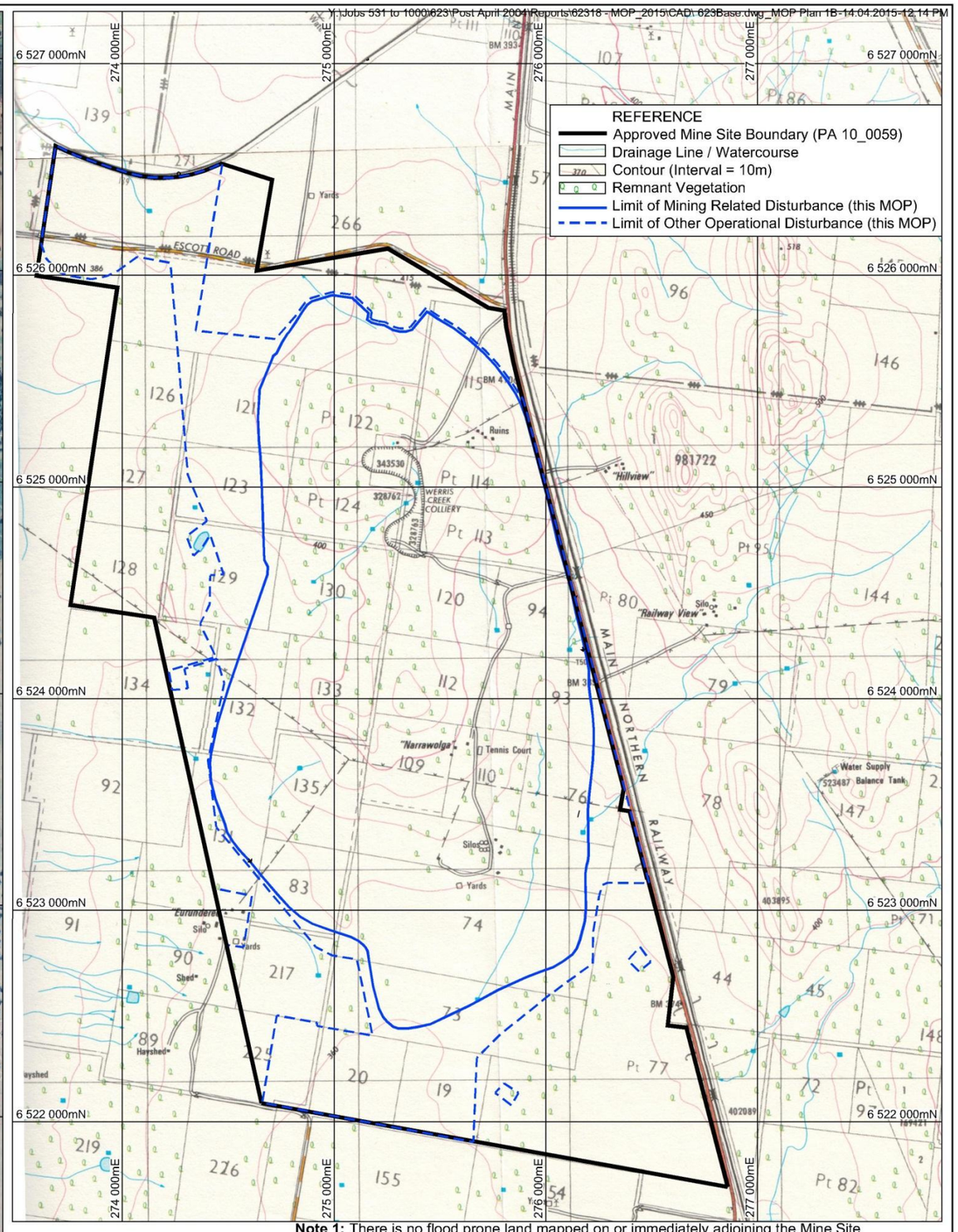
Base Map Source: Werris Creek & Quipolly 1:25 000 Topographic Maps

Plan 1A
PRE-MINING ENVIRONMENT - PROJECT LOCALITY

This page has intentionally been left blank



WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	



Note 1: There is no flood prone land mapped on or immediately adjoining the Mine Site
2: 1m Contours of the Mine Site are provided on Plan 1C

Plan 1B
PRE-MINING ENVIRONMENT - NATURAL ENVIRONMENT

This page has intentionally been left blank

Y:\Jobs 531 to 1000\623\Post April 2004\Reports\62318 - MOP_2015\CAD\623Base.dwg_MOP Plan 1C-14.04.2015-4:51 PM

TN
MN

274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN

DETAIL
SCALE 0 100m

Werris Creek Colliery Deputy Managers Residence
Werris Creek Colliery Above Ground Ruins
Werris Creek Colliery Coal Loading Ramp
"Narrawolga" Axe-Grinding Grooves (original and currently approved final location)
Temporary Storage location of "Narrawolga" Axe Grinding Grooves
Main Northern Rail Line
Werris Creek - Quirindi Road

REFERENCE
- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP
- Pre-mining Contour (m AHD)(Interval = 1m)
- Pre-mining Watercourse / Drainage Line
- Pre-mining Dam / Water Storage
- Pre-mining Fence
- Sealed Road
- Unsealed Road / Track
- Power Line
- Historical Underground Workings
- Building
- Previously Identified Aboriginal Heritage Site (ASR, 2004) (site has been relocated)
- Relocated "Narrawolga" Axe Grinding Grooves
- Identified Historical Heritage Site

SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m

Source: Geo-spectrum (Australia) Pty Ltd (2004)

WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	

Werris Creek (See Detail Left)
Werris Creek Rail Siding
Zeolite Australia
"Escott"
"Tonsley Park"
"Greenslopes"
"Cintra"
"Preston Park"
"Old Colliery"
"Hillview"
"Kyooma"
"Marengo"
"Railway View"
"Millbank"
"Eurunderee"
"Plain View"
"Meadholm"
"Glenara"
"Almawillee"
"Rosehill"
"Mountain View"
"Gedhurst"
"Hazeldene"
"Woodlands"
Escott Road
Black Wattle Creek Road
Wallaby Creek
Quirindi Road
Wadwells Lane
Paynes Road
Taylors Lane
To Quirindi

REFERENCE
- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP
- Residence (Project-related)
- Residence (Non Project-related)
- Residential Receiver Reference
- Mine-owned Land
- Crown Road
- Public Road
- Railway Line

Pre-Mining Land Use
- Agriculture
- Residential
- Railway Infrastructure
- Industrial
- Extractive Industry

SCALE 1:50 000 (A3)
0.5 0 0.5 1.0 1.5 2.0 2.5 km

Cadastral Information Source: LPI (Bathurst) - Digitised from DCDB
Land Ownership Source: LPI Title Search (2010)

Plan 1C
PRE-MINING ENVIRONMENT - BUILT ENVIRONMENT

This page has intentionally been left blank

TN
MN

274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN

Werris Creek Rail Siding
Main Northern Rail Line

REFERENCE
- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)
- Cadastral Boundary
- Land Owned by Werris Creek Coal
- Contour (m AHD)(Interval = 5m)
- Watercourse / Drainage Line
- Dam / Water Storage
- Sealed Road
- Unsealed Road / Track
- Fence
- Transmission Line

SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m

Base Map Source: Werris Creek Coal Pty Limited (2015)

WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	

REFERENCE
- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)

Primary Domains
- **1** - Infrastructure Area
- **3** - Water Management Area
- **4** - Overburden Emplacement
- **5** - Stockpiled Material
- **6** - Void
- **7** - Rehabilitated Land - Pasture
- **9** - Conservation and Biodiversity Offset Area
- **10** - Agricultural Land (remainder)

Secondary Domains
- **A** - Infrastructure
- **B** - Water Management Area
- **C** - Rehabilitation Area - Grassland
- **E** - Rehabilitation Area - Woodland
- **G** - Rehabilitation Area - Rural Land Capability Class III
- **J** - Conservation and Biodiversity Offset Area

Y:\Jobs 531 to 1000\623\Post April 2004\Reports\62318 - MOP_2015\CAD\623Base.dwg_MOP Plan 2 14.04.2015-1:10 PM

Miscellaneous Stockpile Area
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
MIA Bund
Product Coal Haul Road
Mine Infrastructure Area
Void Water Dam 5
ROM Coal Management and Processing
Werris Creek Road
Precursor Storage Facility
Explosives Magazine
Soil Stockpile
Mine Entrance
Site Access Road

1/G 1/G 3/G 1/A 4/E 3/E 4/E 3/E 1/E 9/J 6/E 3/E 1/E 5/E 4/E 5/E 7/E 1/A 3/B 9/J 5/E 3/E 1/E 3/B 3/E 3/B 3/B 9/J

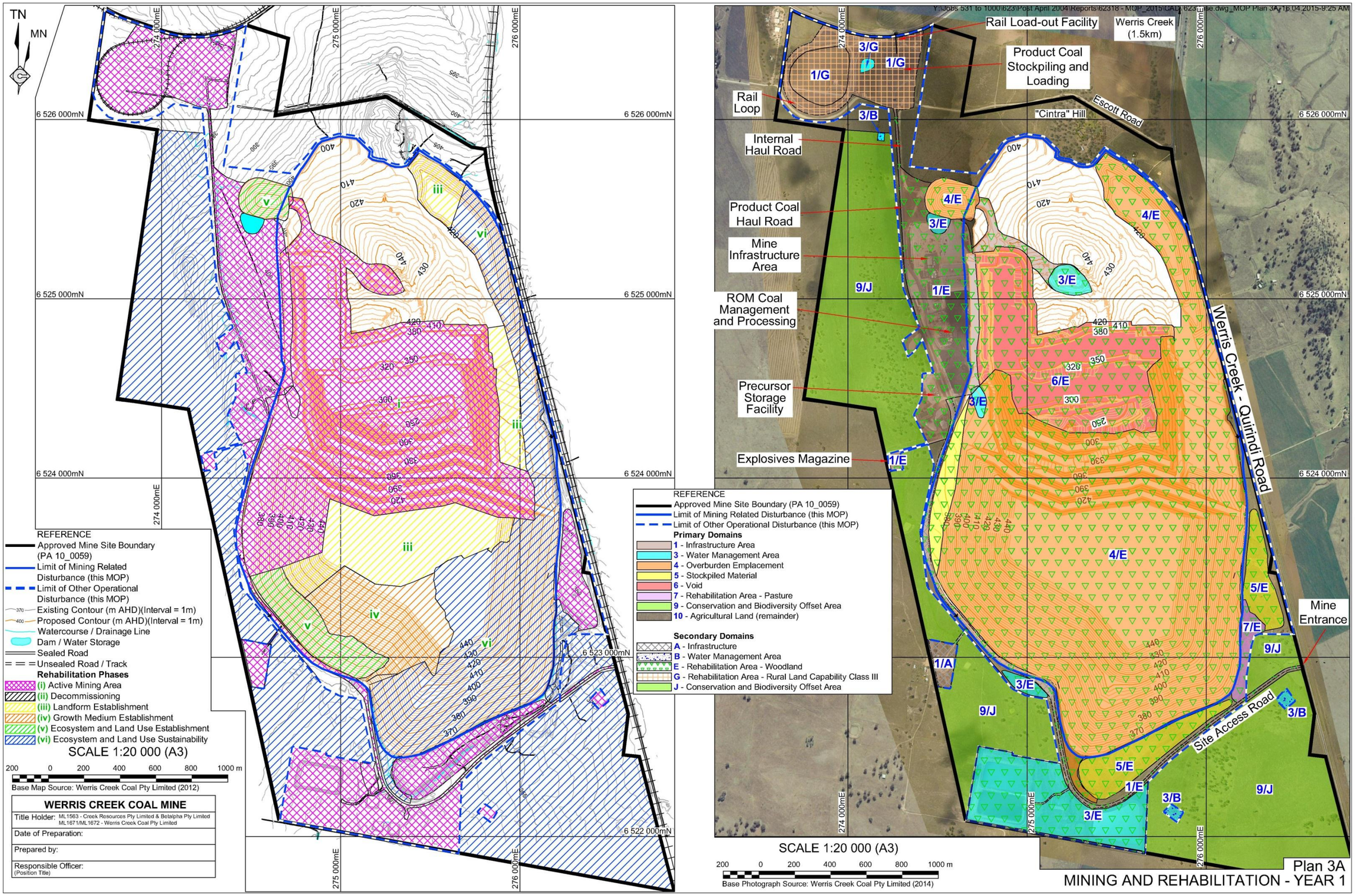
A A' B B' C C' D D' E E'

SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m

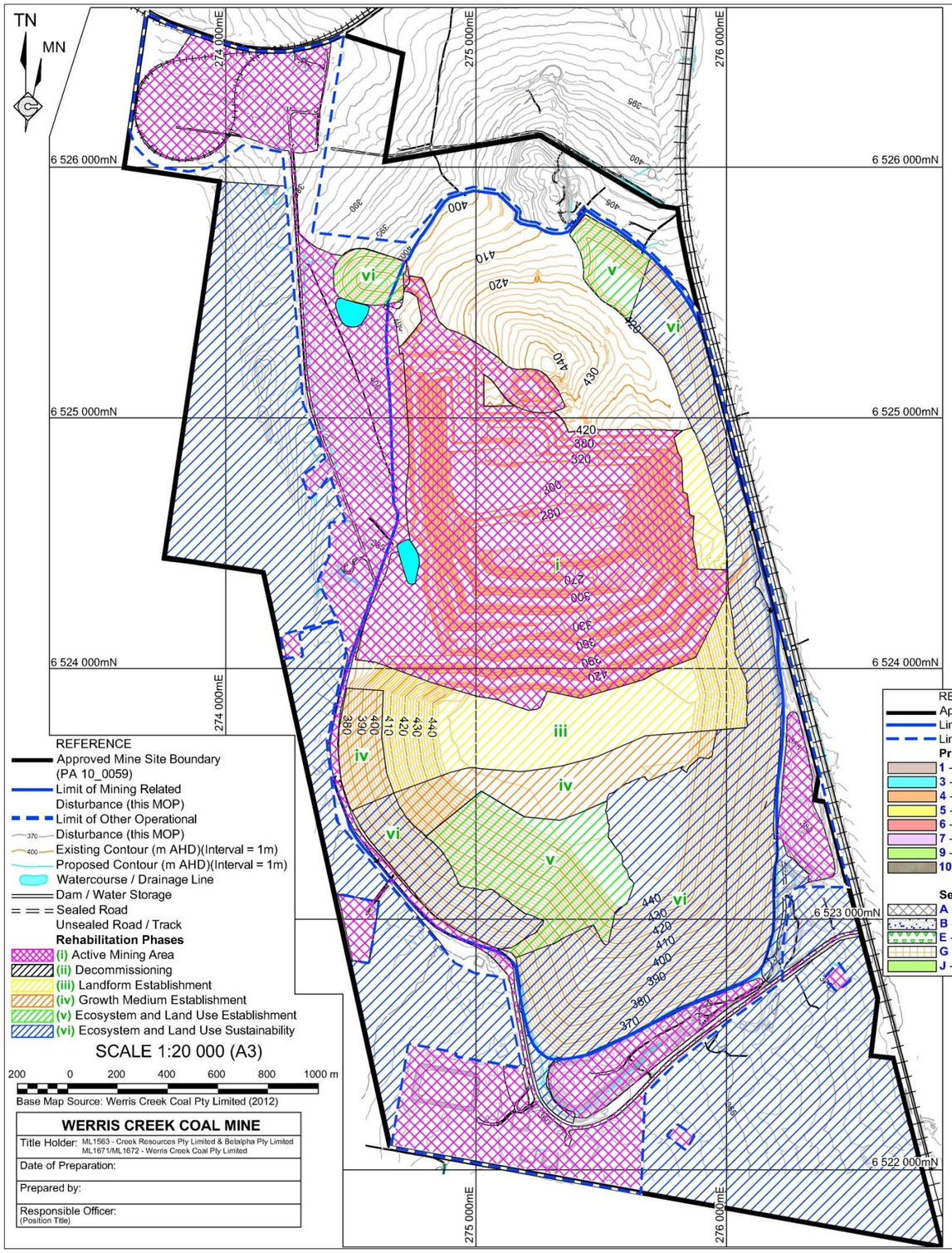
Base Photograph Source: Werris Creek Coal Pty Limited (2014)

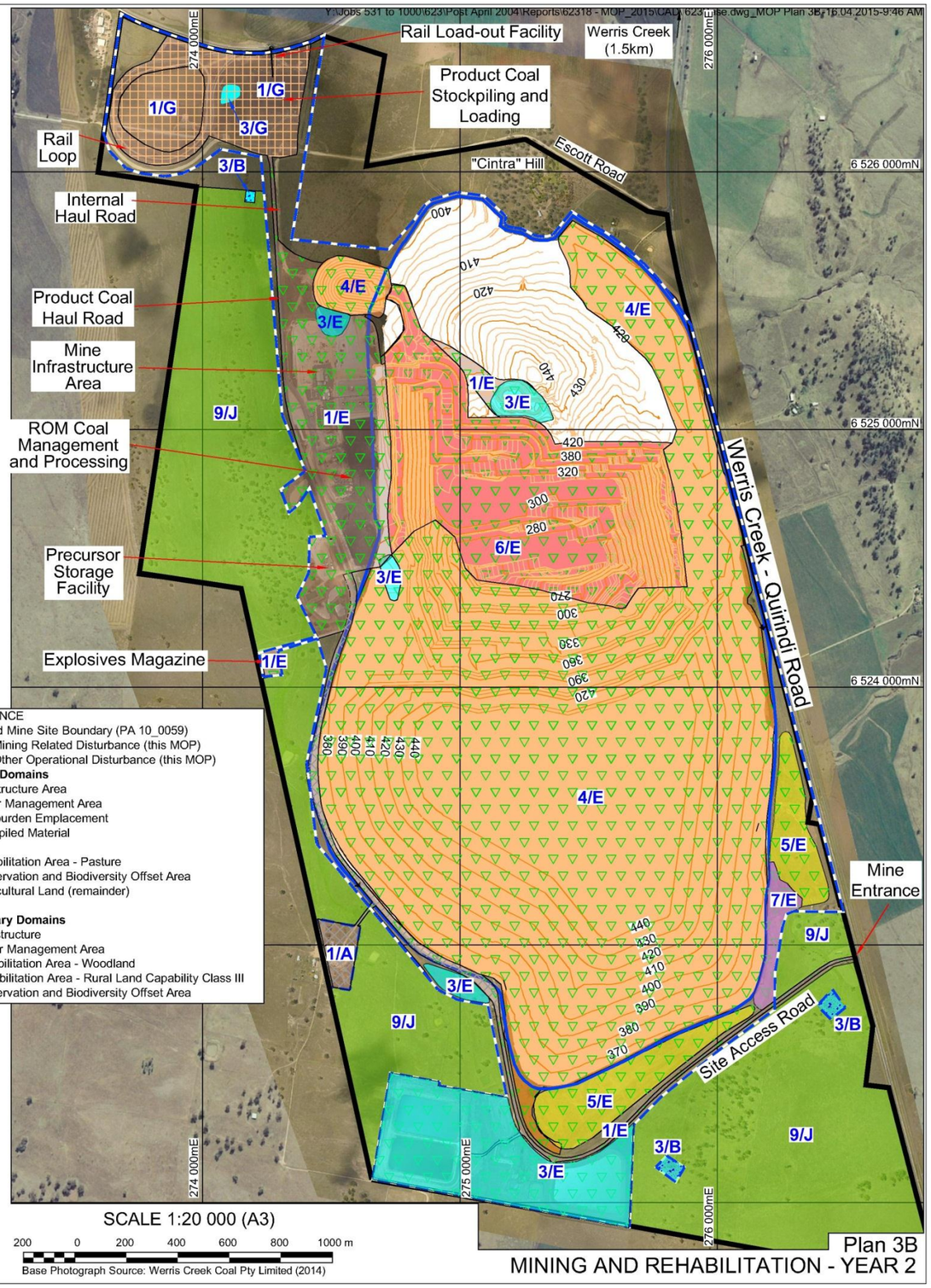
Plan 2
MINE DOMAINS AT COMMENCEMENT OF MOP

This page has intentionally been left blank


TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
i
ii
iii
iv
v
vi
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer: (Position Title)
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Mine Entrance
Site Access Road
3/G
1/G
3/B
4/E
3/E
1/E
9/J
6/E
5/E
7/E
1/A
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
Plan 3A
MINING AND REHABILITATION - YEAR 1

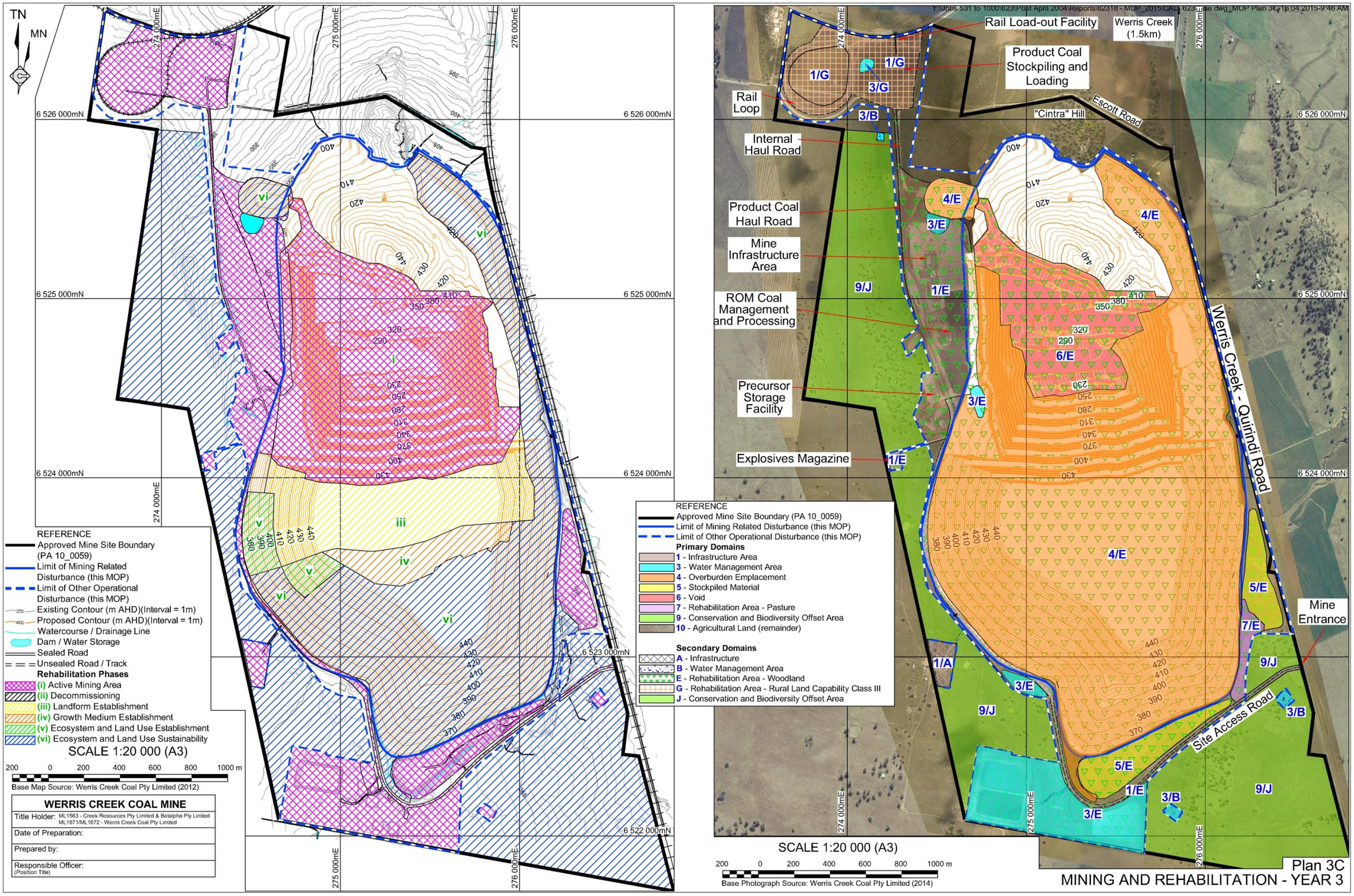
This page has intentionally been left blank



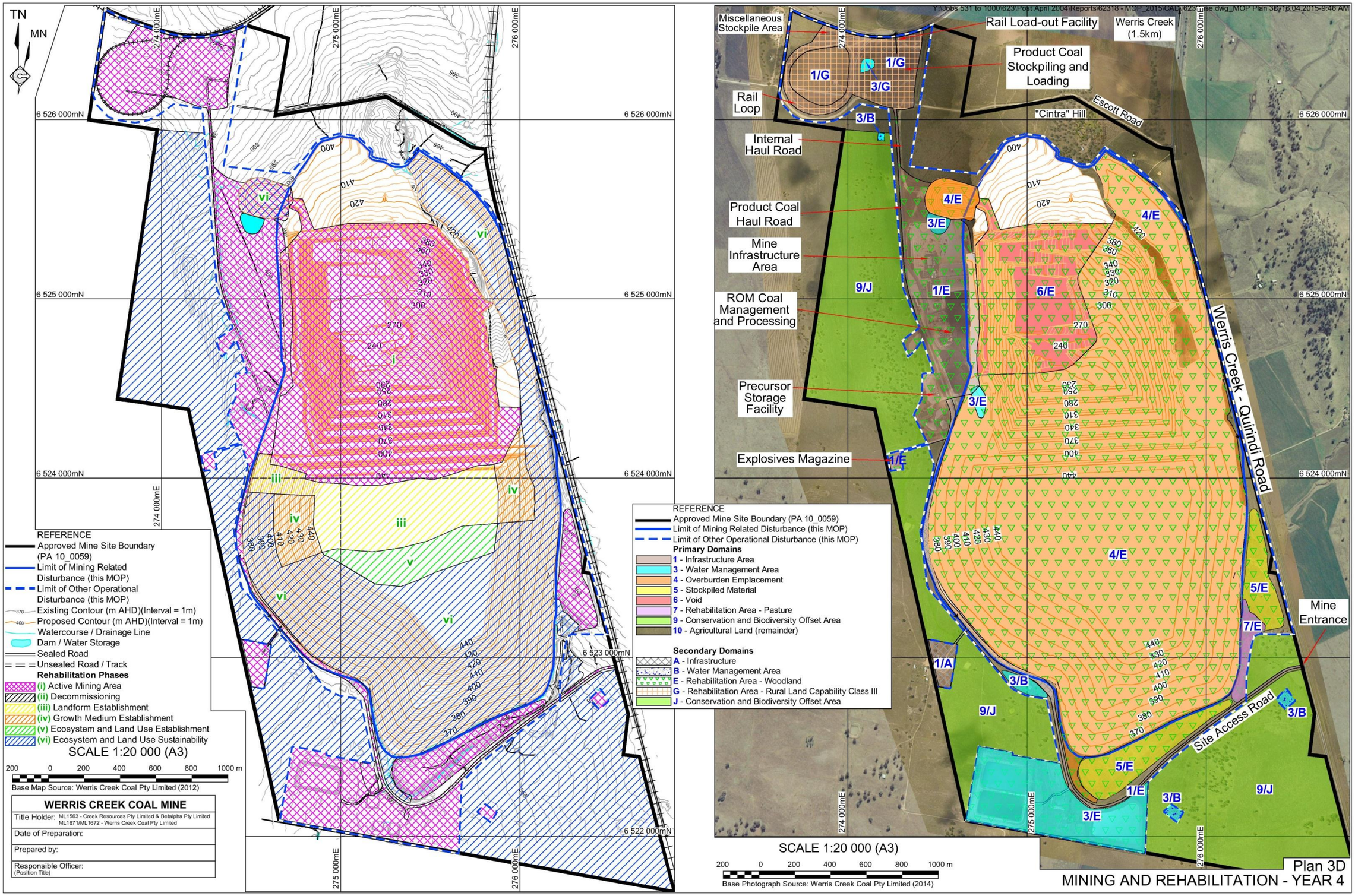


Plan 3B
MINING AND REHABILITATION - YEAR 2

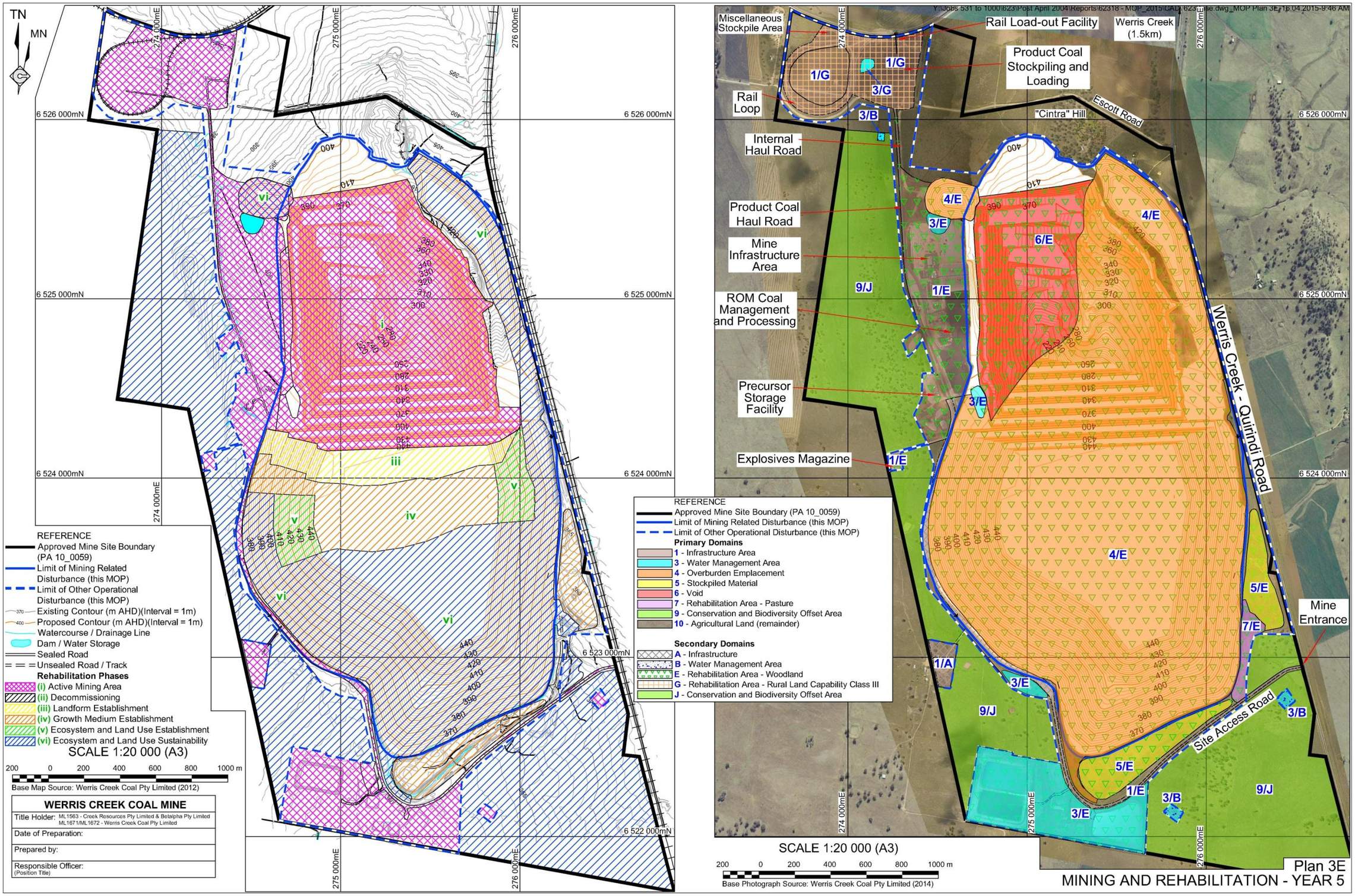
This page has intentionally been left blank


TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer: (Position Title)
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Mine Entrance
Site Access Road
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
Plan 3C
MINING AND REHABILITATION - YEAR 3

This page has intentionally been left blank


TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
Miscellaneous Stockpile Area
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Site Access Road
Mine Entrance
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer: (Position Title)
Plan 3D
MINING AND REHABILITATION - YEAR 4

This page has intentionally been left blank


TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited
ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer:
(Position Title)
Miscellaneous Stockpile Area
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Mine Entrance
Site Access Road
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
Plan 3E
MINING AND REHABILITATION - YEAR 5

This page has intentionally been left blank

TN
MN

274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN

REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track

Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability

SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)

WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	

REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)

Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)

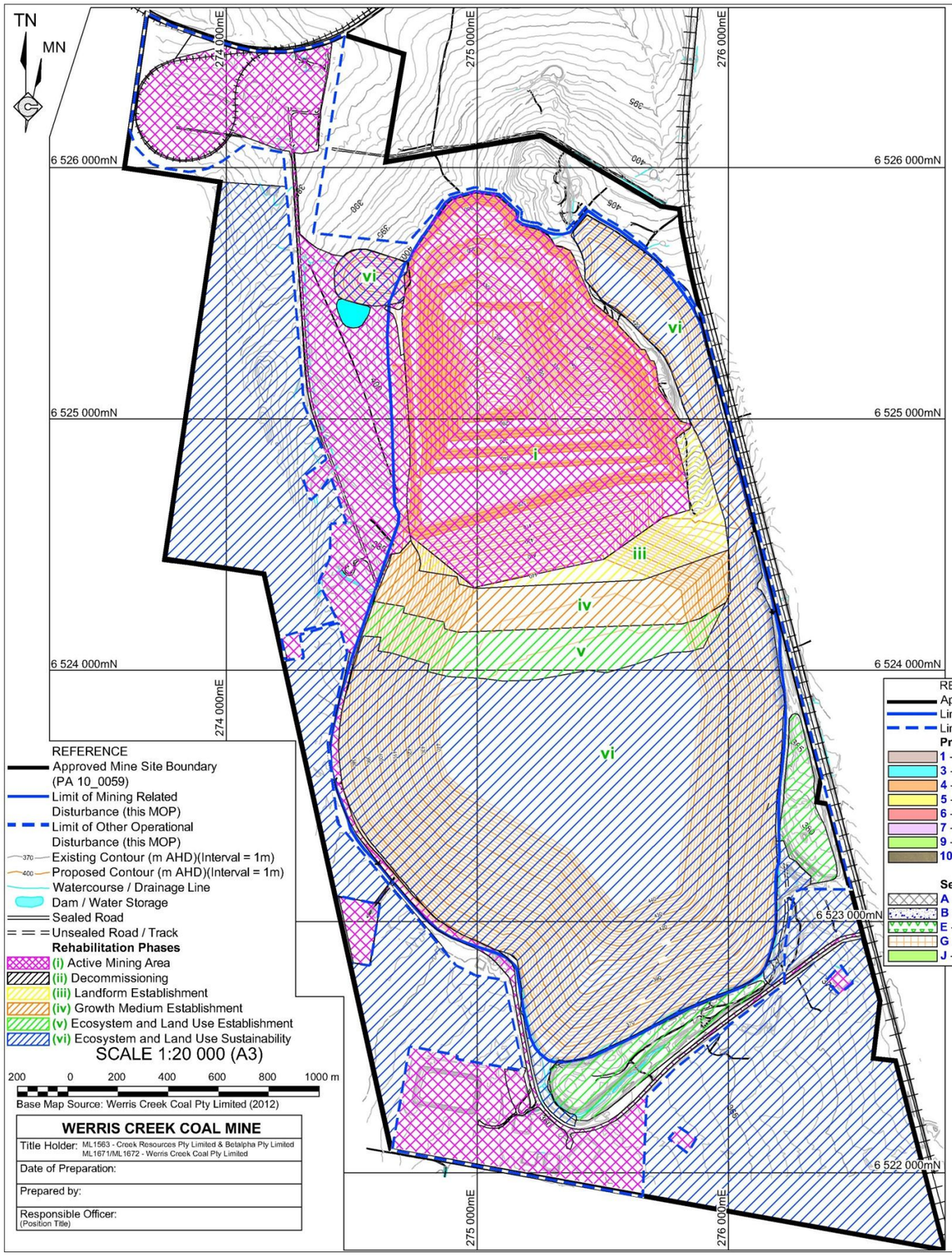
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area

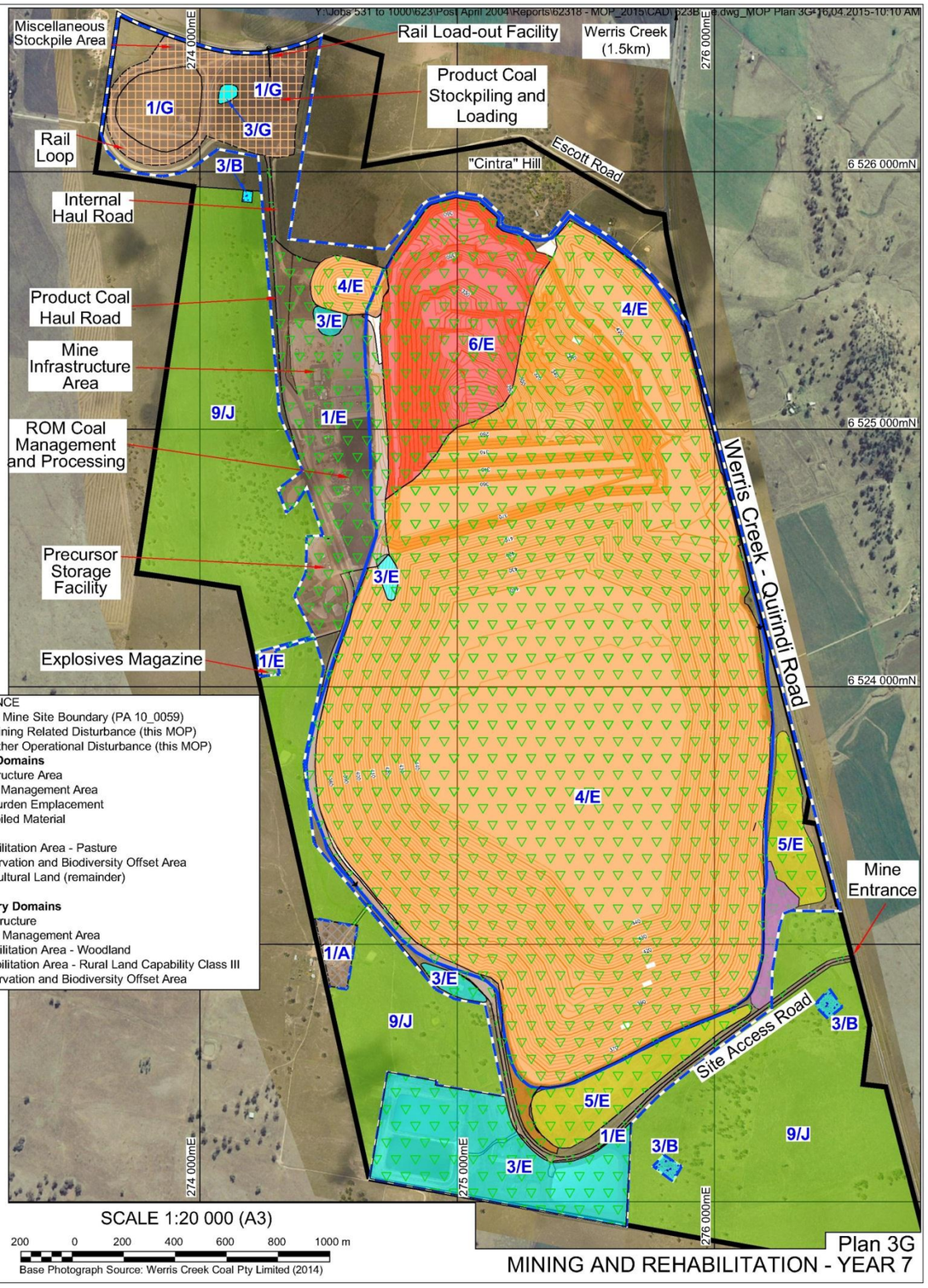
Miscellaneous Stockpile Area
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
"Cintra" Hill
Escott Road
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Mine Entrance
Site Access Road

SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)

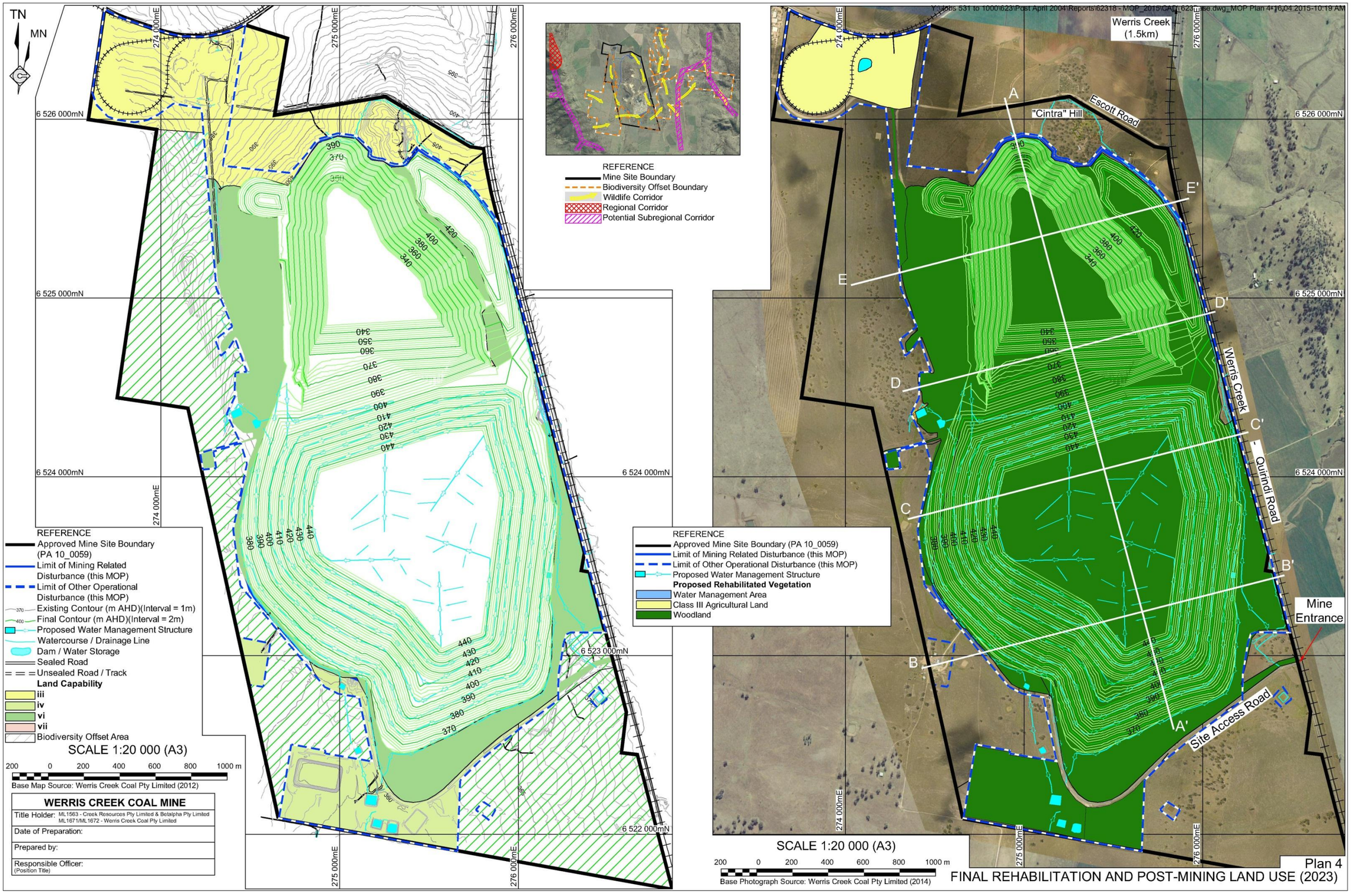
Plan 3F
MINING AND REHABILITATION - YEAR 6

This page has intentionally been left blank


TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
i
ii
iii
iv
v
vi
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Existing Contour (m AHD)(Interval = 1m)
Proposed Contour (m AHD)(Interval = 1m)
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Rehabilitation Phases
(i) Active Mining Area
(ii) Decommissioning
(iii) Landform Establishment
(iv) Growth Medium Establishment
(v) Ecosystem and Land Use Establishment
(vi) Ecosystem and Land Use Sustainability
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited
ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer:
(Position Title)

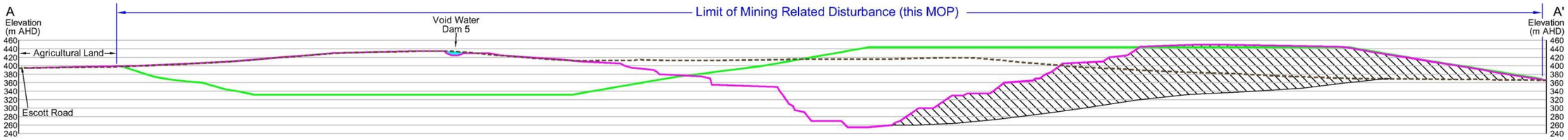

Miscellaneous Stockpile Area
Rail Load-out Facility
Werris Creek (1.5km)
Product Coal Stockpiling and Loading
Rail Loop
Escott Road
"Cintra" Hill
Internal Haul Road
Product Coal Haul Road
Mine Infrastructure Area
ROM Coal Management and Processing
Precursor Storage Facility
Explosives Magazine
Werris Creek - Quirindi Road
Site Access Road
Mine Entrance
1/G
3/G
3/B
4/E
3/E
6/E
9/J
1/E
1/A
5/E
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Primary Domains
1 - Infrastructure Area
3 - Water Management Area
4 - Overburden Emplacement
5 - Stockpiled Material
6 - Void
7 - Rehabilitation Area - Pasture
9 - Conservation and Biodiversity Offset Area
10 - Agricultural Land (remainder)
Secondary Domains
A - Infrastructure
B - Water Management Area
E - Rehabilitation Area - Woodland
G - Rehabilitation Area - Rural Land Capability Class III
J - Conservation and Biodiversity Offset Area
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
Plan 3G
MINING AND REHABILITATION - YEAR 7

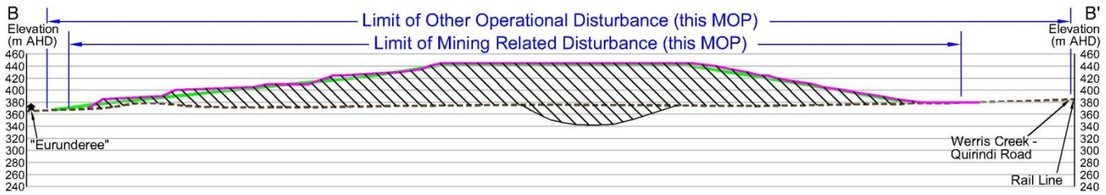
This page has intentionally been left blank

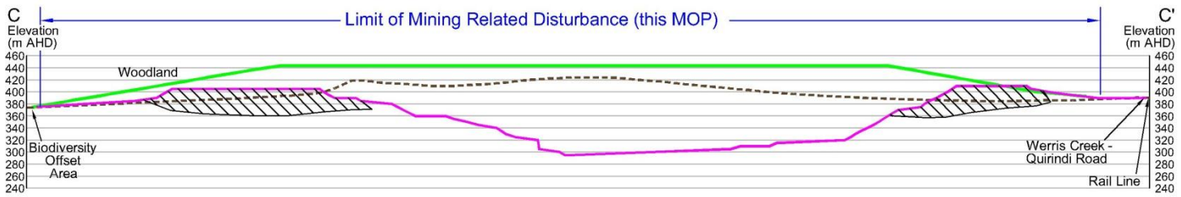

TN
MN
274 000mE
275 000mE
276 000mE
6 526 000mN
6 525 000mN
6 524 000mN
6 523 000mN
6 522 000mN
REFERENCE
Mine Site Boundary
Biodiversity Offset Boundary
Wildlife Corridor
Regional Corridor
Potential Subregional Corridor
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Proposed Water Management Structure
Watercourse / Drainage Line
Dam / Water Storage
Sealed Road
Unsealed Road / Track
Land Capability
iii
iv
vi
vii
Biodiversity Offset Area
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Map Source: Werris Creek Coal Pty Limited (2012)
WERRIS CREEK COAL MINE
Title Holder: ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited
ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:
Prepared by:
Responsible Officer:
(Position Title)
Y:\Jobs 531 to 1000\623\Post April 2004 Reports\62318 - MOP_2015\CAD\623_se.dwg_MOP Plan 4 16.04.2015 10:19 AM
Werris Creek
(1.5km)
"Cintra" Hill
Escott Road
Werris Creek
Quirindi Road
Mine
Entrance
Site Access Road
A
A'
B
B'
C
C'
D
D'
E
E'
REFERENCE
Approved Mine Site Boundary (PA 10_0059)
Limit of Mining Related Disturbance (this MOP)
Limit of Other Operational Disturbance (this MOP)
Proposed Water Management Structure
Proposed Rehabilitated Vegetation
Water Management Area
Class III Agricultural Land
Woodland
SCALE 1:20 000 (A3)
200 0 200 400 600 800 1000 m
Base Photograph Source: Werris Creek Coal Pty Limited (2014)
Plan 4
FINAL REHABILITATION AND POST-MINING LAND USE (2023)

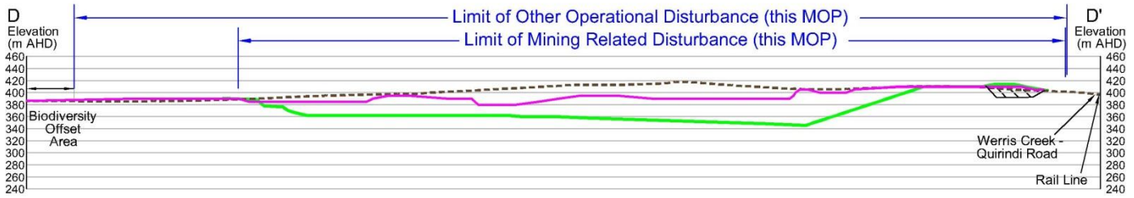
This page has intentionally been left blank

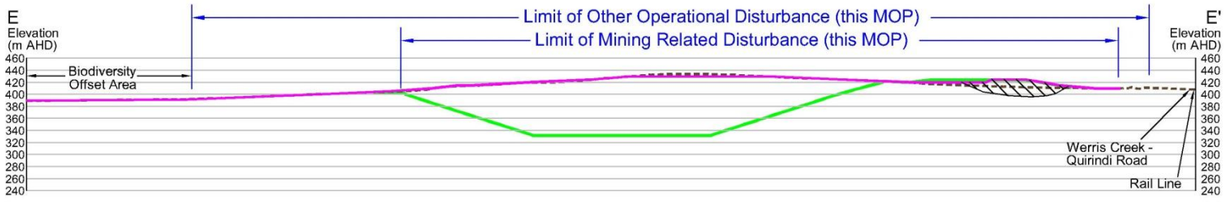
Y:\Jobs 531 to 1000\623\Post April 2004\Reports\62318 - MOP_2015\CAD\623Base.dwg_MOP Plan 5-14.04.2015-4:44 PM

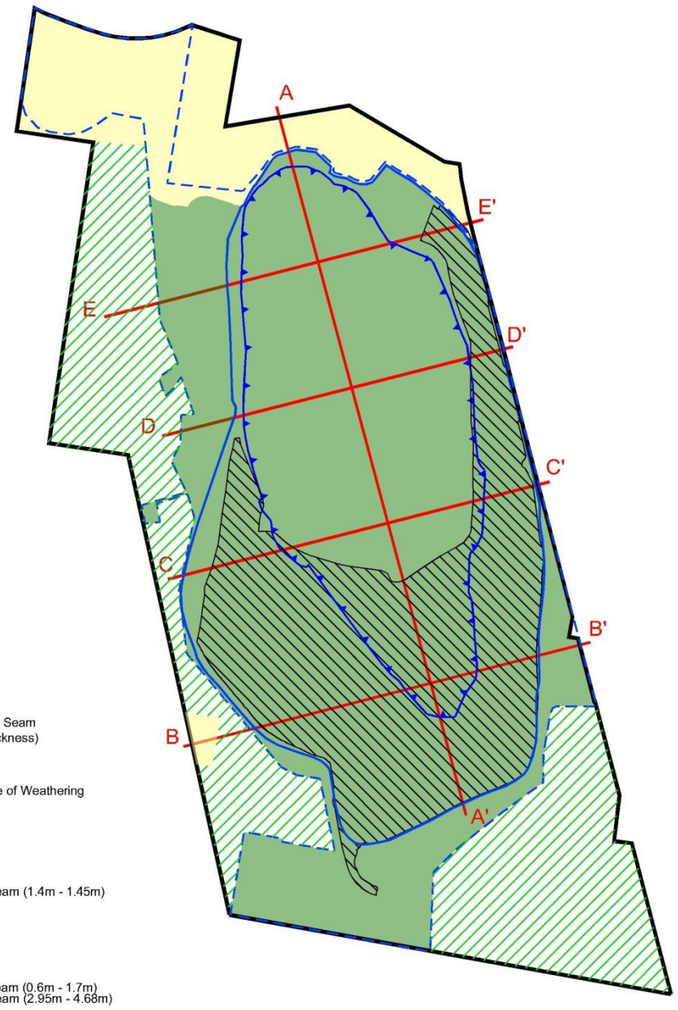








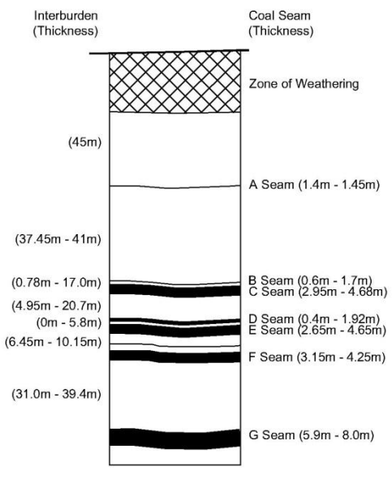




SCALE 1:30 000

500 0 500 1000 1500 m

TYPICAL SECTION



REFERENCE

- Approved Mine Site Boundary (PA 10_0059)
- Limit of Mining Related Disturbance (this MOP)
- Limit of Other Operational Disturbance (this MOP)
- Approved Open Cut
- Pre-mining Landform
- Current Completed Overburden Emplacement (approximate 2015)
- Current Landform
- Final Landform
- Woodland
- Agricultural Land
- Biodiversity Offset Area

SCALE 1:10 000(A3)

100 0 100 200 300 400 500 m

WERRIS CREEK COAL MINE	
Title Holder:	ML1563 - Creek Resources Pty Limited & Betalpha Pty Limited ML1671/ML1672 - Werris Creek Coal Pty Limited
Date of Preparation:	
Prepared by:	
Responsible Officer: (Position Title)	

Plan 5
CROSS SECTIONS

This page has intentionally been left blank

Table 12.1
Roles and Responsibilities for MOP Implementation

Role	Responsibilities
General Manager	Ensure adequate resources are available to enable implementation of the MOP. Provide necessary resources required to implement the rehabilitation process outlined within the MOP. Ensure employees are competent through training and awareness programs.
WCC Operations Manager	Accountable for the overall environmental performance of the operations, including the outcomes of this MOP. Ensure that mine planning is compliant with the requirements of the MOP and applicable approvals. Ensure that monitoring and review of performance via field inspections and Monthly Environmental Reports outlined within the MOP and referenced Management Plans are undertaken.
Environmental Officer	Ensure the implementation of this MOP, including reporting of non-compliances, and subsequent implementation of the relevant action plan. Ensure employees are competent through training and awareness programs.
Open Cut Examiner (OCE)	Follow direction provided by the General Manager and/or WCC Operations Manager. Ensure mine planning and operations practices are consistent with the plans and objectives detailed in this MOP.
All employees	Follow direction provided by the OCE and/or Environmental Officer with respect to regulatory compliance. Ensure operations are consistent with the plans and objectives detailed in this MOP.

13. REFERENCES

ANZECC (2000). *Australian and New Zealand Guidelines for Marine and Fresh Water Quality*.

Branagan (1969). *Northwestern Coalfield. Geological Society of New South Wales, Journal 16, 444-445.*

Department of Environment and Climate Change (DECC) (2008a). *Managing Urban Stormwater: Soils and Construction, Vol. 2E,* DECC, NSW, Sydney.

Department of Environment and Climate Change (DECC) (2008b). *BioBanking Assessment Methodology,* DECC, NSW, Sydney.

Department of Industry Tourism and Resources (DITR) (2007). *Managing Acid and Metalliferous Drainage* http://www.ret.gov.au/resources/documents/lpsdp/lpsdp-acidhandbook.pdf.

Eco Logical Australia (ELA) (2010). *Biodiversity Assessment for the Werris Creek Coal Mine Life of Mine Project. Part 5 of the Specialist Consultant Studies Compendium.*

ENVIRON (2015). *LOM Project Modification, Evaluation of Site Water Balance*. Letter Report to R.W. Corkery & Co. Pty Limited, 29 January 2015.

GSS Environmental (GSSE) (2010). *Soils Assessment for the Werris Creek Coal Mine Life of Mine Project. Part 7 of the Specialist Consultant Studies Compendium.*

Landcom (2004). *Managing Urban Stormwater: Soils and Construction.* 4th Edition. Landcom, Sydney.

Office of Environment and Heritage (OEH) (2014). *BioBanking Assessment Methodology, September 2014,* OEH, NSW, Sydney.

RCA Australia (2004). *Groundwater Assessment of the Werris Creek Coal Mine.* Prepared on behalf of Werris Creek Coal Pty Limited – Part 2 of the Specialist Consultant Studies Compendium.

R.W. Corkery & Co. Pty Limited (RWC) (2005). Mining Operations Plan for the *Werris Creek Coal Mine*, April 2005.

R.W. Corkery & Co. Pty Limited (RWC) (2010). *Environmental Assessment for Werris Creek Coal Mine – Life of Mine Project*, December 2010.

R.W. Corkery & Co. Pty Limited (RWC) (2015). *Environmental Assessment for Werris Creek Coal Mine – Modification 2*, March 2015.

Tongway D & N Hindley (2004). *Landscape Function Analysis: Methods for monitoring and assessing landscapes, with special reference to mine sites and rangelands*. CSIRO Sustainable Ecosystems, Canberra.

URS (2004). *Acid Mine Drainage and Salinity Potential Assessment for the Proposed Werris Creek Coal Mine*. Prepared on behalf of Werris Creek Coal Pty Limited - Part 9 of the Specialist Consultant Studies Compendium.

Werris Creek Coal Pty Limited (WCC) (2008). *Mining Operations Plan for the Werris Creek Coal Mine*.

Werris Creek Coal Pty Limited (WCC) (2011). *Mining Operations Plan for the Werris Creek Coal Mine*.

Werris Creek Coal Pty Limited (WCC) (2013). *Biodiversity and Offset Management Plan,* August 2013.