WHITEHAVEN COAL

ABN: 69 107 169 102

Werris Creek Coal Pty Limited

Environmental Assessment

for the

Werris Creek Coal Mine Modification 2 (PA 10_0059)

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

April 2015

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(PA 10_0059)

Prepared for:

Werris Creek Coal Pty Limited
ABN: 69 107 169 102
PO Box 600
GUNNEDAH NSW 2380

Telephone: (02) 6768 7071
Facsimile: (02) 6768 7072
Email: awright@whitehaven.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

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R.W. CORKERY & CO. PTY. LIMITED

CONTENTS

Page

CONTENTS

Page

CONTENTS

Page

CONTENTS

Page

APPENDICES

CONTENTS

Page

FIGURES

CONTENTS

Page

TABLES

PLATES

BOX

Executive Summary

Werris Creek Coal Pty Limited operates the Werris Creek Coal Mine, located approximately 1.5km south of the town of Werris Creek and approximately 11km north-northwest of Quirindi in northern NSW (refer to **Figure 1.1**). Originally operated under development consent DA-172-7-2004 issued on 18 February 2005 for the recovery of approximately 10 million tonnes of coal, Project Approval (PA) 10_0059 was subsequently granted on 29 October 2011 for the complete recovery of the coal contained within the Werris Creek coal measures. PA 10_0059 has been modified once (30 August 2012), under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to enable the relocation of some surface infrastructure.

This *Environmental Assessment* has been prepared to support an application for a second modification to PA 10_0059 under Section 75W of the EP&A Act ("the Proposal"). The Proposal seeks to modify the following component activities and operations at the Mine.

- A small lateral extension of the Out-of-Pit Overburden Emplacement to the west over an area designated for soil stockpiles.
- A northerly extension of the 400m to 445m AHD benches of the Overburden Emplacement by approximately 250m.
- 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 beneficial agricultural activities on and surrounding the Mine Site.
- Increase the hours of road transportation for coal products.

Figure 2.1 presents the location of the proposed modifications to the overburden emplacement, required as a result of an increase in volume of overburden being generated, and Dry Separation Plant, proposed to reduce the ash and other contaminant content of the coal without requiring washing. The application of void water to agricultural lands has been proposed to alleviate potential future storage capacity constraints within the existing void water dams of the Mine. The use of surplus void water for agricultural purposes is considered a more beneficial use for this water than evaporation or discharge. The increased hours of road transportation have been proposed to be coincident with the approved operating hours of the Whitehaven Coal Handling and Preparation Plant (CHPP) at Gunnedah, which currently receives the bulk of coal despatched from the Mine by road.

In order to undertake a comprehensive *Environmental Assessment* of the Proposal, those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community were identified through:

- community and government consultation;
- a review of environmental planning documentation;
- a review of environmental performance at the Mine; and
- the experience of Mine personnel and the author of the *Environmental Assessment*.

It has been determined that the Proposal would have minimal or no impact on many aspects of the local environment, namely: blasting and vibration; biodiversity; cultural heritage; groundwater; soils and land capability; and hazards (such as bushfire). Environmental aspects where it was identified there could be some change in the level of impact received, and therefore where further assessment has been undertaken include: noise, air quality, visual amenity, surface water resources, void water management and transportation.

A summary of the outcomes of the assessment of each of these environmental aspects is as follows.

Noise

The assessment of noise emissions was conducted by modelling the noise emissions generated under a worst-case operating scenario (when mining operations approach the northern extent of the open cut and overburden is being placed on the upper lifts of the extended overburden emplacement), and reviewing the expected noise levels received at surrounding receivers against established noise criteria. A high level of confidence is placed in the noise model which has been regularly reviewed, updated and validated through comparison to actual noise monitoring results collected monthly at receivers surrounding the Mine.

The results of noise modelling indicate that with the exception of three residential receivers, the noise criteria of PA 10_0059 could be achieved (refer to **Table 4.2**). A worst-case night time noise level for Receivers R22, R96 ands R98 are now predicted to be higher than the current noise criteria, 1dB(A), 1dB(A) and 2dB(A) respectively. On the basis that the noise level predictions are reflective of a more accurate noise model, the implementation of all reasonable and feasible noise minimisation and mitigation, the very minor difference between current criteria and worst-case noise level predictions, and generally excellent performance of the Mine in complying with noise criteria, an increase in the noise criteria at these selected receivers is recommended.

In addition to the residential receivers, the noise levels received on Properties 16, 64 and 97 (Refer to **Figure 4.3**) was considered for the purposes of establishing noise criteria. Through interpretation of noise contours generated by the noise model, it is established that a noise level of 38dB(A) could be achieved over at least 75% of these properties with building entitlements.

The potential impact of an extension to the hours of road transportation was undertaken, with the $L_{eq(1hour)}$ noise levels generated by the heavy vehicle movements between 6:00pm and 10:00pm would be well below (8.6dB) the road noise criteria defined by the NSW Road Noise Policy. Furthermore, the predicted $L_{eq(1hour)}$ noise level received at the closest residence to transport route would be equivalent to ambient (L_{eq}) evening noise levels measured at a residence which adjoins the transport route in 2010.

Air Quality

A comparison of air quality monitoring and other data was completed which validated the predictions of the dispersion model previously used to predict air emissions from the Mine and establish air quality criteria. The air emissions inventory of this validated model was then updated to reflect changes to the number and type of dust emissions sources (mobile and fixed plant), proposed activity areas, and a review of emission factors and calculation methodologies, in order to provide an estimate of TSP, PM_{10} and $PM_{2.5}$ emission rates. The modified emission rates were compared to the emission rates previously established and for which compliance with the air quality criteria were predicted.

The results of the comparison between the updated and previous emission rates indicate continued compliance air quality criteria can be achieved should the Proposal be approved.

Visual Amenity

With reference to several critical visual vantage points towards the Mine, it has been established that:

- views of the Mine from the south are unlikely to change;
- views of the Mine from the elevated vantage points to the east of the Mine would continue to change but not differ from that already approved;
- the upper lifts of the overburden emplacement, which are visible from vantage points in the south and east of Werris Creek, would encroach approximately 250m closer; and
- the effects of night time lighting are unlikely to change significantly given it is not proposed to increase the number of lighting plants or alter current light minimisation practices.

On the basis that the Applicant has demonstrated a commitment to minimising visual impacts (through progressive rehabilitation and establishment of a near real time camera to monitor lighting impacts), and the very minor changes to the visible elements of the Mine Site, the additional impact on local visual amenity of this minor modification is unlikely to be significant.

Surface Water Resources

A minor change to the drainage, collection and management of dirty water runoff is proposed. Runoff from the northern sections of the Acoustic and Visual Amenity Bund which was previously designed to drain around "Cintra Hill", would now be directed to a new sediment basin (SB18) before potential discharge to the northeast of the Mine (refer to **Figure 4.7**).

On the basis that this sediment basin is constructed in accordance with the design specification provided in the Environmental Assessment, the dirty water runoff could be managed to comply with criteria nominated in the Environment Protection Licence (12290) and the objectives of *Managing Urban Stormwater: Soils and Construction Vol. 1 4th Eds*.

Void Water

An updated Water Balance Model (WBM) for the Mine was prepared through consideration of actual water pumping and monitoring data. Considering rainfall, evaporation and groundwater inflows under three meteorological scenarios (dry, median and wet years) and three operating scenarios (Years 2015, 2017 and 2020), the WBM predicts that a surplus of up to 200ML would require disposal to prevent accumulation within the open cut in wet years.

The ability of land to accept void water without adversely impacting on soil properties or receiving waters was modelled using the EPA endorsed *Effluent Reuse Irrigation Model* (ERIM). Inputs to the modelling program included water quality data collected at the Mine and soil quality data collected from agricultural land adjacent to the Mine Site.

The modelling confirmed the following.

- The void water could be applied at an indicative rate of 6.25ML/ha/year, subject to specific analysis of the chosen location prior to application, without impact on the receiving soils and catchment.
- Application of void water at this rate would have no noticeable impact on soil nutrient or other contaminant (e.g. heavy metal) concentrations.

On the basis of the above, and subject to the completion of a specific *Pre-Agricultural Void Water Use Assessment* for the proposed lands prior to commencement, the application of void water to surrounding agricultural land is considered a practical and beneficial use of surplus void water resources.

Transportation

The volume of truck movements from the Mine would be naturally restricted by the limit on road transport imposed by PA 10_0059. Therefore, road traffic from the Mine would continue to be undertaken as periodic campaigns to supply specific domestic customers, the largest of which is the Whitehaven CHPP.

Even on the heaviest traffic days, truck movements would generally be restricted to less than 86, i.e. less than six movements per hour when spread over the 15 hours proposed for road transport. This would have no noticeable impact on road capacity or intersection performance and considering the small number of trucks which would be operated, the movement of trucks could be easily schedule to avoid convoying.

The proposed increase in hours of road transportation would therefore allow for the concurrence of hours of operation between transport and the Whitehaven CHPP without any significant impact on road condition, intersection performance or noise.

Evaluation and Conclusion

It is concluded that the Proposal would not result in any significant increase or additional impacts on the local environment. The very minor increases in noise levels predicted are in fact more likely a result of more accurate noise modelling than changes resultant from the Proposal. Continued compliance with air quality and surface water discharge criteria is predicted and any changes to visual amenity are considered very minor given the closest vantage points where these modifications may be viewed remains 3.7km to the north. The application of surplus void water to beneficial agricultural use is considered an acceptable and practical use of this water. The proposed increase in the road transport hours is also considered a practical modification which would not have any noticeable impact on the local road network or road users. On balance, it is assessed that the Proposal could be undertaken in a manner which meets relevant environmental criteria and meet reasonable community expectations.

1. INTRODUCTION

1.1 SCOPE

This *Environmental Assessment* has been prepared by R.W. Corkery & Co. Pty. Limited (RWC) to support an application to modify Project Approval 10_0059 (PA10_0059) by Werris Creek Coal Pty Limited ("the Applicant"). The proposed modifications (the "Proposal") would improve the operational flexibility of the Werris Creek Coal Mine (the "Mine" or "Mine Site") to continue mining efficiently and productively.

Following discussions with the NSW Department of Planning & Environment (DPE), it has been confirmed that an application to modify PA 10_0059 (the Proposal) may be made under Section 75W of the *Environmental Planning & Assessment Act 1979* (EP&A Act), in accordance with the transitional arrangements of the EP&A Act associated with the repeal of Part 3A. The application has been lodged online via the DPE Major Projects Assessment website.

The Mine is located within Mining Leases (ML) 1563, 1671 & 1672, and (at its closest point) is approximately 1.5km south of Werris Creek and 11km north-northwest of Quirindi in northern NSW (see **Figure 1.1**). The Proposal seeks to modify the following component activities and operations at the Mine.

- Increase the storage capacity of the overburden emplacement through a small increase to the footprint of the out-of-pit section and small northerly extension of the upper lifts of the in-pit section.
- Inclusion of a dry processing plant to remove excess coal impurities.
- Provide alternative beneficial agricultural uses for collected mine void water on agricultural land both owned by the Proponent and neighbouring private landowners.
- Modify drainage from the Acoustic and Visual Amenity Bund, with runoff from the northern section to be directed to a new sediment basin at the northern-most point of the bund.
- Increase the hours of road transportation for coal products.

The information contained in this document relates specifically to those aspects of the Mine to be modified. Aspects of the Mine that would not be modified would continue to be undertaken in accordance with the terms of approval nominated by *Condition 2* (of Schedule 2) of PA 10_0059, i.e. in accordance with;

- the *Environmental Assessment* prepared by R.W. Corkery & Co. Pty Limited for the Werris Creek Coal Mine Life of Mine (LOM) Project (RWC, 2010);
- the Statement of Commitments included as *Appendix 6* of PA 10_0059;
- Mine Infrastructure Augmentation Modification (10_0059 MOD 1) approved by the DP&E on 30 August 2012; and
- the conditions of PA 10_0059 and associated plans.

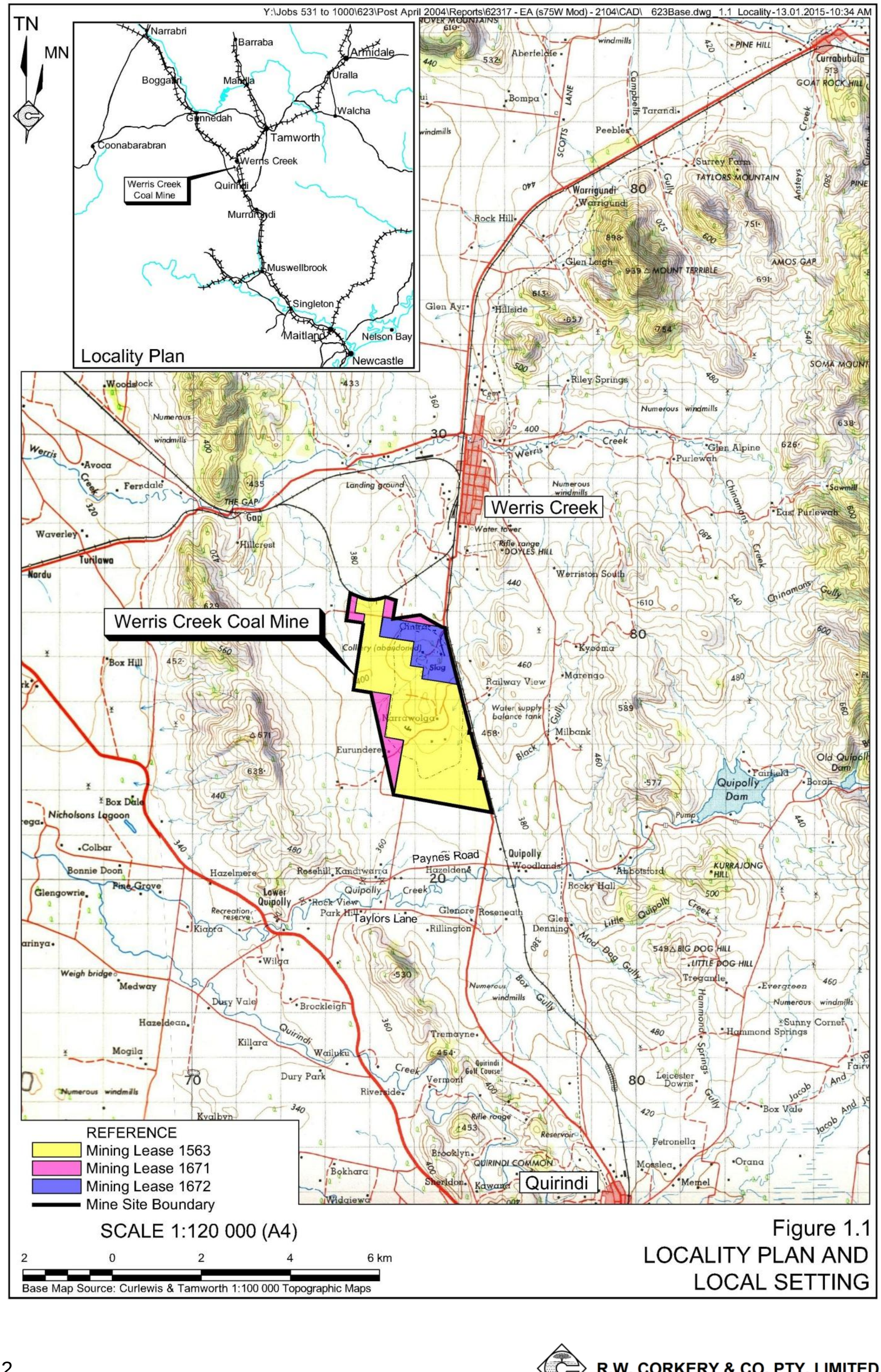


Figure 1.1
LOCALITY PLAN AND LOCAL SETTING

The information presented in this document covers all aspects of the planning, development, operation, rehabilitation and environmental management and monitoring of the Proposal, whilst utilising information sourced from the "*Werris Creek Coal Mine - Life of Mine Project Environmental Assessment*" (RWC, 2010), at a level consistent with industry standards and the scale of proposed operations. These aspects are presented in a manner that would provide DPE, other State and local government agencies, and community stakeholders with sufficiently detailed information to assess the Proposal and the impact upon the surrounding environment following the implementation of appropriate mitigation and management measures. **Appendix 1** provides correspondence with DPE and the informal requirements to be assessed within the document, as formal *Secretary's Environmental Assessment Requirements* (SEARs) were not required to be issued for the Proposal.

1.2 FORMAT OF THE REPORT

This *Environmental Assessment* includes five sections of text, a reference section and a set of appendices.

Section 1: Introduces the Proposal, the Applicant and relevant background information.

Section 2: Describes the Proposal in sufficient detail to enable the application for modification to be determined.

Section 3: Provides a description of the stakeholder consultation and a review of relevant planning instruments.

Section 4: Describes the key environmental issues associated with the Proposal.

Section 5: Summarises the minor administrative adjustments to the conditions of PA10_0059 proposed to clarify each in the context of the modified operations.

Section 6: Provides an updated Statement of Commitments to account for additional commitments included as a result of the Proposal as well as those commitments which have been superseded by operational controls or management measures documented in approved management plans.

Section 7: Evaluates the Proposal in terms of biophysical, economic and social consideration, and the goals and guidelines of Ecologically Sustainable Development and provides a conclusion to the document.

References: Lists the various source documents referred to for information and data used during the preparation of the *Environmental Assessment*.

Appendices: Present the following additional information.

1. Correspondence from DP&E re: application of Section 75W and assessment requirements.
2. Werris Creek Water Balance Assessment completed by Environ Pty Ltd.
3. Noise Impact Assessment completed by Spectrum Acoustics Pty Limited.
4. Air Quality Impact Assessment prepared by SLR Consulting Pty Ltd.
5. Void Water Irrigation Assessment completed by SEEC.

1.3 THE APPLICANT

The Applicant for the Proposal, Werris Creek Coal Pty Limited (ABN 69 107 169 102), is the current owner and operator of the Werris Creek Coal Mine. The Proponent is a wholly-owned subsidiary of Whitehaven Coal Limited (WCL) which is currently operating and developing coal projects in the Gunnedah Coalfields Region of New South Wales.

WCL acquired a 100% interest in the Werris Creek Coal Mine in December 2007. WCL has been progressively undertaking a review of operations with a view to improving the operational efficiency and environmental performance of the Mine.

1.4 MINE SITE

The application area for this *Environmental Assessment* is covered by the existing Werris Creek Coal Mine, within the existing MLs 1563, 1671 & 1672, incorporating an area of approximately 910ha. **Figure 1.2** identifies the Mine Site and the main features of the approved Werris Creek Coal Mine operations.

The existing operations are located on land owned by the Applicant. **Figure 1.3** identifies the land owned by the Applicant on and surrounding the Mine Site, along with the locations of Applicant-owned and privately-owned residences.

1.5 BACKGROUND TO THE PROPOSAL

1.5.1 Introduction

The following sub-headings provide background information to the Proposal regarding the existing approved mineral authorities, revised resources and reserve calculations and the approved activities occurring at the Mine that are proposed to be modified.

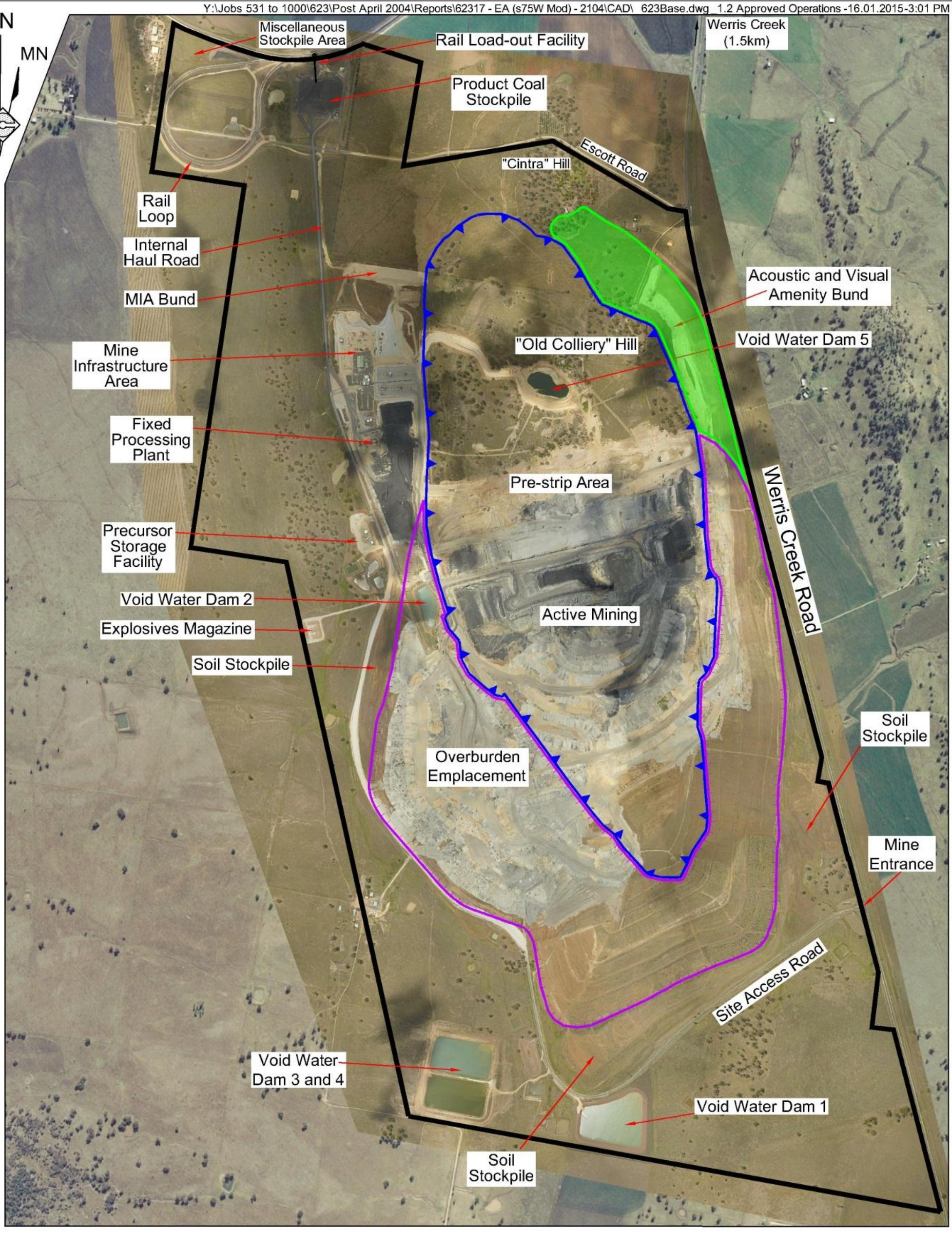
1.5.2 Existing Approvals, Licences and Tenements

Table 1.1 identifies the approvals, licences and tenements currently in place for the Werris Creek Coal Mine, the issuing / responsible authority, date of issue, duration (where limited) and relevant comments.

1.5.3 Identified Resources and Reserves

The most recent resource statement (Coxhead, 2014) identified the coal resource as 27.9 million tonnes (Mt) (**Table 1.2**).

The most recent reserve statement (Runge Pincock Minarco, 2014) identified a proved and probable reserve of 21.0Mt within ML 1563, ML 1671 and ML 1672 (see **Table 1.3**). This reserve excludes the coal removed by the former Werris Creek Colliery.



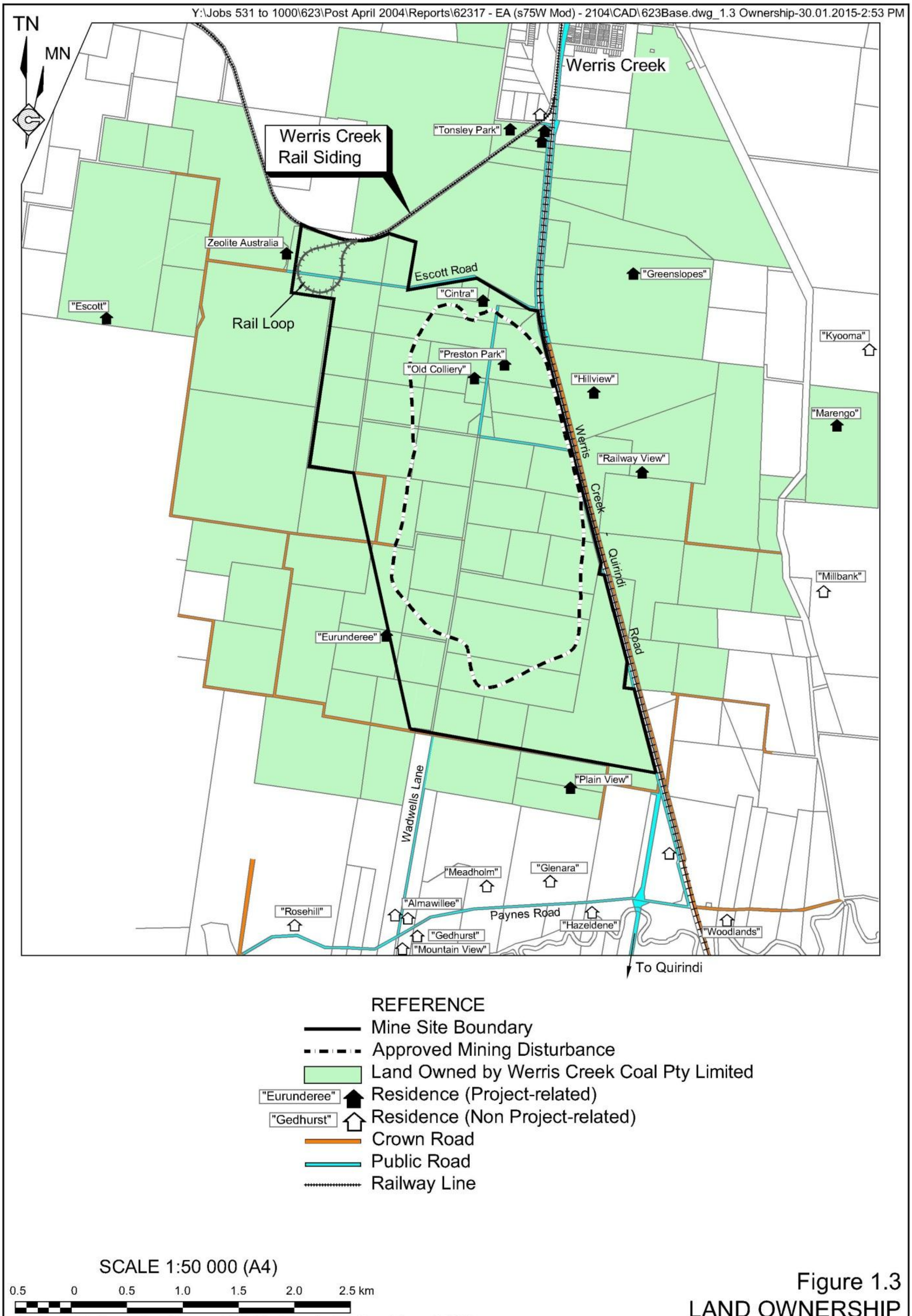
REFERENCE
Mine Site Boundary (MLs 1563, 1671 & 1672)
Approved Open Cut
Approved Out-of-Pit Overburden Emplacement
Approved Acoustic and Visual Amenity Bund

SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

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

Figure 1.2
EXISTING AND APPROVED MINING OPERATIONS



Cadastral Information Source: LPI (Bathurst) - Digitised from DCDB
Land Ownership Source: LPI Title Search (2009)

Figure 1.3
LAND OWNERSHIP AND RESIDENCES

Table 1.1
Tenements, Licences and Approvals

Issuing Authority	Type	Date of Issue	Expiry	Comments
Department of Planning & Infrastructure [1]	PA 10_0059	25 October 2011	December 2032	Issued under the now repealed Part 3A of the EP&A Act.
	PA 10_0059 MOD 1	30 August 2012		Approving modification to the location of void water dams and explosives magazine.
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 Infrastructure, Planning and Natural Resources [3]	Water Access Licence (WAL) 29506	21 February 2013	In perpetuity	Industrial and Mining Bore allocation of 50 ML per year.
	WAL 32224	19 June 2013	In perpetuity	Aquifer interference (excavation) 211 ML per year.

Note 1: Now, Department of Planning & Environment (DP&E)
Note 2: Now, Department of Trade & Investment, Regional Infrastructure & Services - Division of Resources & Energy (DRE)
Note 3: Now, Department of Primary Industries – NSW Office of Water (NOW)

Table 1.2
Coal Resource Summary (ML1563, ML1671 & ML1672)

Category	Resource
Measured	20.9Mt
Indicated	5.3Mt
Inferred	1.7Mt
Total	29.9Mt

Source: Coxhead (2014)

Table 1.3
Coal Reserve Summary (ML1563, ML1671 & ML1672)

Category	Reserve
Proved	16.7Mt
Probable	4.3Mt
Total	21.0Mt

Source: Runge Pincock Minarco (2014)

1.6 APPROVED AND ONGOING ACTIVITIES

1.6.1 Introduction

The approved mining and associated activities of the Mine are identified on **Figure 1.2**. The existing site layout of the Werris Creek Coal Mine comprises of the following components.

1.6.2 Open Cut Mining Area

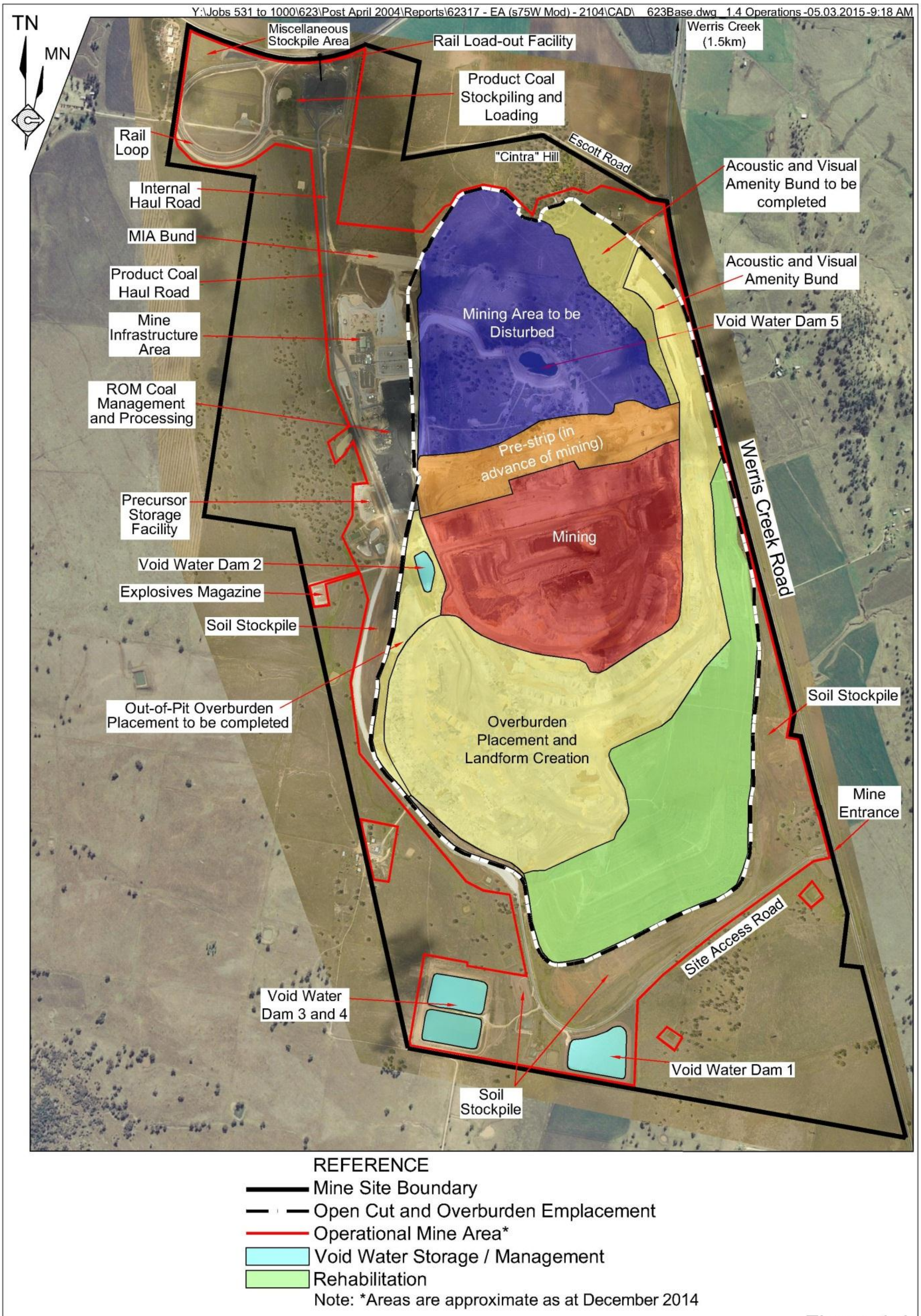
Designed to recover the coal from the synclinal (bowl-shaped) coal measures, the open cut mining area is roughly elliptical in shape. Since commencement of mining in 2005, the open cut has been developed as a series of east-west oriented benches, with access to the lower sections of the open cut obtained 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). Benches at varying heights are maintained to ensure that development and coal recovery are being undertaken at consistent rates over the life of the mine, thereby ensuring a consistent supply of ROM coal to the processing plant.

Mining is approaching the deepest section of the open cut (see **Figure 1.4**) and is encountering the underground workings of the former Werris Creek Colliery. As a result of reduced coal recovery from some seams[1], the strip ratio is greater than the originally forecast (5.4:1). As a result, the volume of overburden requiring disposal is being generated at an accelerated rate to that originally forecast. As is discussed in Section 1.6.3, this increased and accelerated generation of overburden is resulting in the open cut void being backfilled at an increased rate reducing the available space for waste emplacement.

1.6.3 Overburden Emplacement Area

Originally constructed around the eastern, southern and southwestern perimeter of the open cut area, overburden and interburden is now largely placed within the mined-out sections of the open cut. The out-of-pit disturbance footprint of the overburden emplacement has been effectively reached with successive lifts of between 10m and 20m raising the height of the emplacement to 445m AHD as it is progressively constructed in a northerly direction. In accordance with designs presented in the 2010 EA for the LOM Project (RWC, 2010), the upper 400m to 445m AHD lift of the overburden emplacement is restricted in extent to the north. As illustrated by **Figure 1.4**, large sections of the eastern and southern embankments of the overburden emplacement have been profiled, spread with soil and revegetated (105ha as of December 2014).

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



SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

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

Figure 1.4
STATUS OF MINING OPERATIONS AND REHABILITATION

As noted in Section 1.6.2, a higher than anticipated strip ratio has resulted in an increase in the volume of overburden requiring disposal. The capacity with the overburden emplacement is further constrained by the development of haul ramps into and out of the open cut on the low wall side, i.e. against the emplacement as this limits the areas where overburden can be tipped for safety reasons. Recent projections indicate that by 2016 the active capacity (available at the time that overburden is generated and requires disposal) of the overburden emplacement would be reduced to 22.5 million bank cubic meters (Mbcm) and provide for only a 15% surplus over the scheduled overburden and interburden to be generated (19.5Mbcm) in that year.

Such a small active capacity of the overburden emplacement would impact productivity by imposing significant inefficiencies associated with having to haul overburden from the bottom of the open cut to the top of the overburden emplacement (or vice versa) depending on where the actual space is available for overburden emplacement.

A recent review of the active capacity of the overburden emplacement determined this to be only 8 weeks of mining. This does not provide sufficient margin for events that may result in further increases in overburden generation, restriction in areas available for placement of overburden or reduced coal recovery. It is feasible to envisage a situation where continued mining is compromised by a lack of available areas within the approved overburden emplacement for placing overburden.

1.6.4 Acoustic and Visual Amenity Bund

The structure was proposed and approved to provide for an acoustic and visual screen of mining operations as the open cut is developed through “Old Colliery” Hill. Constructed as a northerly extension of the Out-of-Pit Overburden Emplacement around the eastern and northeastern perimeter of the open cut, this structure is approximately 60% complete (see **Figure 1.4**). The Acoustic and Visual Amenity Bund is progressively profiled, respread with topsoil and revegetated as constructed to limit the visual impact of the bund itself from surrounding vantage points.

1.6.5 Coal Processing and Stockpiling 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. **Figure 1.4** identifies the main features of the Coal Processing Area.

No washing of the coal is undertaken, however, crushing and screening is required to achieve customer size requirement prior to despatch. Coal is segregated at the ROM Coal Stockpile based on the expected ash content of the coal. The higher ash coal products are processed through the fixed plant crusher at an average 420t/hr using a Front End Loader to feed the hopper of the primary crusher (to <150mm) and subsequently processed through the secondary crusher to <50mm size, this being the specification for export quality coal. Low ash coal products are processed by the mobile crushers at an average 240t/hr straight to <50mm product and then screened. While this is the general configuration of the coal processing plant, based on shipments and other market demands as specified; different coal products can be produced using either crushing plants.

As mining has encountered the underground workings of the former Werris Creek Colliery, the quality of the coal recovered from the affected coal (Seams D and E) has reduced. Some coal has been transported to the Whitehaven Coal Handling and Processing Plant at Gunnedah by road in accordance with the limits set by PA 10_0059 for processing to reduce ash content.

1.6.6 Site Entrance, Mine Infrastructure Area and MIA Bund

The entrance to the Mine off Werris Creek Road has been retained in preference to the construction of a new entrance off Escott Road, as proposed in RWC (2010), primarily due to the change in status of Escott Road. Where previously, this road was to be upgraded as a public road servicing local properties, WCC has leased, while in the process of purchasing, the road easement from Liverpool Plains Shire Council. As a private road, servicing the Mine and properties owned by WCC, no upgrade of this road is required. Therefore, the previously identified benefits of more direct road access from the Mine Site via Escott Road, as presented in RWC (2010), are now outweighed by the additional cost and traffic disruption of upgrading Escott Road. Furthermore, the existing entrance on Werris Creek Road is appropriate for the volume of traffic using and passing this entrance.

Mine offices, workshops and other facilities are collectively referred to as the Mine Infrastructure Area. To the north of the Mine Infrastructure Area, and as nominated in RWC (2010), a bund wall has been constructed (MIA Bund) to attenuate noise generated within the Mine Infrastructure Area and Coal Processing Area and reduce the visibility of operations from the north (see **Figure 1.4**).

1.6.7 Water Management

Water is categorised as either: void, dirty, clean or waste/contaminated water, with each category segregated and managed separately.

- **Void Water**. Water which accumulates within the open cut and comprises of incidental (direct) rainfall, rainfall runoff from the overburden emplacement and open cut catchment, and groundwater intercepted in the base of the open cut void. This water is collected at the lowest point in the void and pumped as required to one of five void water dams (see **Figures 1.2** and **1.4**).

  Total operational capacity of the void water dams is 714ML[2], distributed between the five dams as follows.

  – Void Water Dam 1: 250ML.

  – Void Water Dam 2: 25ML.

  – Void Water Dam 3: 214ML.

  – Void Water Dam 4: 145ML.

  – Void Water Dam 5: 80ML.

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[2]This takes into account freeboard requirements. Maximum capacity to the spillway level of dams is higher than the operational capacity.

Notably Void Water Dams 2 and 5 (105ML) occur within the open cut and overburden emplacement impact footprint with an additional dam (which would have an equivalent storage capacity) approved for construction between the Mine Infrastructure Area and MIA Bund.

The purpose of the dams is to provide temporary storage of water prior to use for dust suppression and/or evaporation as discharge of this water is not permitted. Evaporation from the void water dams is expedited through the operation of two misting evaporators which spray the water as a fine mist over the surface of the void water dams. Records from the 2013/2014 AEMR period indicate that one evaporator, operated 24 hours per day for six months over spring - summer and during daylight hours the remainder of the year[3], resulted in the evaporation of 180ML. A second evaporator has been introduced with results to February 2015 confirming this is operating at an equivalent evaporative rate.

The void water dams have been operating close to capacity and the total volume of void water requiring storage within the Mine Site has the potential to exceed the capacity of the surface void water dams. Any excess void water would therefore require temporary storage within the open cut, which in turn could affect mining of the basal coal seam if water storage prevents access to this coal seam.

- **Dirty Water**. Runoff from areas disturbed by mining and ancillary activities is directed to a series of sediment basins designed to provide storage capacity for runoff following a 5-day 90th percentile rainfall event. The operation and maintenance of these structures is undertaken in accordance with the Site Water Management Plan.
- **Clean Water**. Runoff from areas undisturbed by mining and ancillary activities is allowed to flow over and off the Mine Site without active management. Clean water diversion structures are maintained to divert clean water flows around the mining operations.
- **Waste/Contaminated Water**. Any water from the workshop and fuel farm areas treated to manage potential hydrocarbon contamination. Water from the administration area is directed to an on-site septic system for treatment.

1.6.8 Coal Transportation

The despatch of product coal from the Mine is either by rail to the Port of Newcastle or by road to domestic customers.

The despatch of coal by rail requires the product coal to be transported via the Internal Haul Road to the Product Coal Storage Area and Rail Load-out Facility (see **Figure 1.4**). From the product coal stockpiles, the coal is delivered to a rail load-out bin by conveyor and discharged to rail wagons. A rail loop provides for efficient movement of the train to and from the Main Northern Rail Line.

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[3] Operation of the Evaporator was ceased to manage noise emissions as required during these periods.

A small quantity of coal is transported from the Mine by road for delivery to local markets. Road registered trucks enter the Mine via the Site Entrance on Werris Creek Road and travel to and from the Coal Processing Area via the Site Access Road. The majority of truck movements are to and from the south via Werris Creek Road and Taylors Lane. The despatch of coal to the local road network is restricted to 7:00am to 6:00pm Monday to Friday and 7:00am to 2:00pm Saturday.

1.6.9 Hours of Operation, Life of Mine and Employment

Hours of Operation

With the following exceptions, the Mine is approved to operate 24 hours a day, seven days per week.

- Blasting is restricted to between 9.00am and 5.00pm, Monday to Saturday.
- The 2010 *Environmental Assessment* for the Werris Creek Coal Mine identifies that "except under exceptional circumstances, e.g. in the event an emergency supply of coal is requested by a domestic customer, the despatch of coal carrying trucks from the Project Site would be restricted to 7:00am to 6:00pm Monday to Friday and 7:00am to 2:00pm Saturday".

Mine Life

Based on an average production rate of 2.5Mtpa, and slightly lower than expected coal recovery, the remaining life of the Mine is 6 years.

Employment

Approximately 140 personnel are directly employed at the Mine.

1.6.10 Rehabilitation

The Company is implementing a progressive rehabilitation strategy to establish the final landform for two principal uses.

(i) Re-establishing the following woodland vegetation communities.

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

(ii) Class III capable agricultural land[4].

[4] Equivalent to Class 3 Land and Soil Capability in accordance with *The land and soil capability assessment scheme - second approximation. A general rural land evaluation system for New South Wales* (OEH, 2012).

As illustrated by **Figure 1.4**, the Mine has been successful in establishing a stable groundcover over the completed sections of the overburden emplacement. There has also been successful establishment of trees on the slopes of the completed overburden emplacement in accordance with land use (i) above.

A review of Annual Environmental Management Reports (AEMRs) prepared to document rehabilitation progress against targets set in the *Mining Operations Plan* (MOP) (WCC, 2011) have generally indicated achievement of annual targets.

1.7 IDENTIFIED CONSTRAINTS ON DEVELOPMENT

Current and potential constraints affecting ongoing operations at the Mine are as follows.

- As a result of the higher than anticipated strip ratio the volume of overburden is being generated in greater quantity, and at a more accelerated rate, than originally planned.

  Additional overburden emplacement capacity is required to account for the increase in total overburden volume. The mine development sequence requires modification to reduce the mining strip ratio.

- The volume of void water collected within the open cut has the potential to exceed the surface storage capacity. The storage of this excess void water within the open cut could potentially prevent mining of the deepest parts of the open cut for periods.

  Provision for the supply of surplus void water for agricultural purposes to adjacent land both owned by the Proponent and privately owned would provide for an additional and more beneficial use (compared to evaporation) of water generated at the Mine Site.

- Contamination of the coal recovered from the seams previously mined by the Werris Creek Colliery requires additional treatment prior to export.

  Provision of a dry separation plant would allow for the treatment of this coal without washing the coal.

- The approved hours of road transport of coal do not coincide with those of the Whitehaven Coal Preparation Plan (CHPP), 7:00am to 10:00pm, where the bulk of road transported coal is delivered.

  A minor amendment to the Mine's hours of operation for road transport would remove this inconsistency.

1.8 MANAGEMENT OF INVESTIGATION

This document has been prepared by Mr Alex Irwin (B.Sc. Hons), Senior Consultant with R.W. Corkery and Co Pty Limited, and Mr Chris Dickson, B.Sc.), Consultant with the same company. Company personnel who provide information for the Proposal include Mr Andrew Wright, WCC's Environmental Officer, and Mr Jeremy Taylor, WCC's Senior Mining Engineer.

Professional representatives of the Applicant that have assisted with the preparation of this document include, but not limited to:

- Mr Martin Doyle (*Ph.D, B.Sc. (Hons)*) – Principal Air Quality Consultant with SLR Consulting Australia.
- Mr Neil Pennington (*Ph.D, B.Math., B.Sc.*) – Principal Noise Consultant with Spectrum Acoustics.
- Mr Mark Passfield (*B.Sc. (Hons)*) – Director of Strategic Environmental and Engineering Consulting Pty Ltd.
- Ms Fiona Robinson (*M.Eng., B.Eng.*) – Principal of ENVIRON and Mr Simon Gaskell *(M.Sc., B.Sc.)* – Manager at ENVIRON.

2. DESCRIPTION OF THE PROPOSAL

2.1 INTRODUCTION

2.1.1 Objectives of the Modification

The Applicant's objectives in developing the Mine are identified in *Section 2.1* of RWC (2010). The Applicant's objectives in modifying PA10_0059 are as follows.

- To ensure that the Mine remains compliant with existing conditions or commitments, unless modified by this Proposal.
- To reduce, to the maximum extent practicable, the overall environment impact of the Mine.
- To minimise, to the maximum extent practicable, the impact on the local community and other stakeholders.
- To ensure that the ongoing operation of the Mine can continue in a safe and reliable manner.

2.1.2 Overview of the Proposal

The Proposal includes the following activities.

- A small lateral extension of the Out-of-Pit Overburden Emplacement to the west over an area designated for soil stockpiles (~6ha)[5].
- A northerly extension of the 400m to 445m AHD benches of the Overburden Emplacement by approximately 250m[6].
- 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 beneficial agricultural activities surrounding the Mine Site. For the purpose of this assessment, irrigation has considered that the off-site application of void water can be undertaken without adverse impact on soils and receiving waters.
- A minor modification to drainage from the northern section of the Acoustic and Visual Amenity Bund.
- Increase the hours of road transportation for coal products.

Figure 2.1 presents the location of the proposed modifications to the overburden emplacement, surface drainage and the Dry Separation Plant.

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

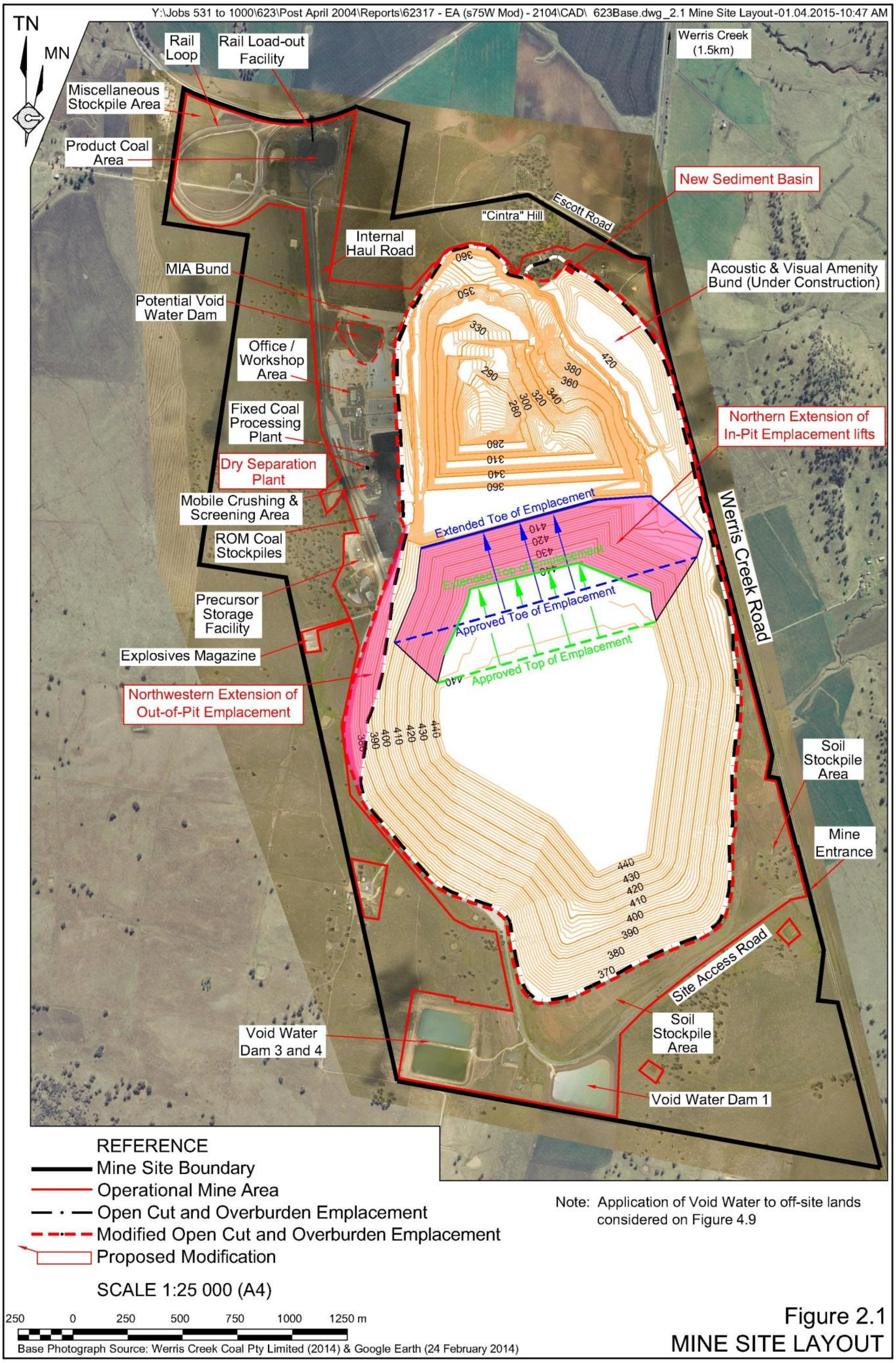


Figure 2.1
MINE SITE LAYOUT

It is noted that the proposed modification does not specify the location or method of void water application. This would be reviewed on a case by case basis as applications for access to the void water are received from land owners or lease holders seeking water for agricultural use. As is discussed in further detail in Section 2.5, approval is sought for void water to be made available for use off the Mine Site, subject to the preparation of *Pre-Agricultural Void Water Use Assessments* (e.g. for irrigation or stock watering) for specific locations and uses. Given the application of void water would be undertaken as an agricultural enterprise on that land, not a mining activity, no change to the approved Mine Site boundary would be required to accommodate this land.

It is noted that a change in the sequence of mining within the approved open cut footprint is planned and will be presented to the Division of Resources & Energy (DRE) of the Department of Trade & Investment, Regional Infrastructure & Services as part of an amended Mining Operations Plan (MOP) following determination of the Proposal. The amended mining sequence is presented in this document to provide context to the proposed modification to the overburden emplacement.

Finally, the Proposal includes a range of minor administrative adjustments to the conditions of PA10_0059 to clarify each in the context of the modified operations. These are identified where relevant through the *Environmental Assessment* with a summary of proposed changes included as Section 5.

2.2 MINING OPERATIONS

2.2.1 Mine Area

The area to be mined would not change as a result of the Proposal and is constrained by the coal reserve of the Werris Creek coal measures.

2.2.2 Mining Methods

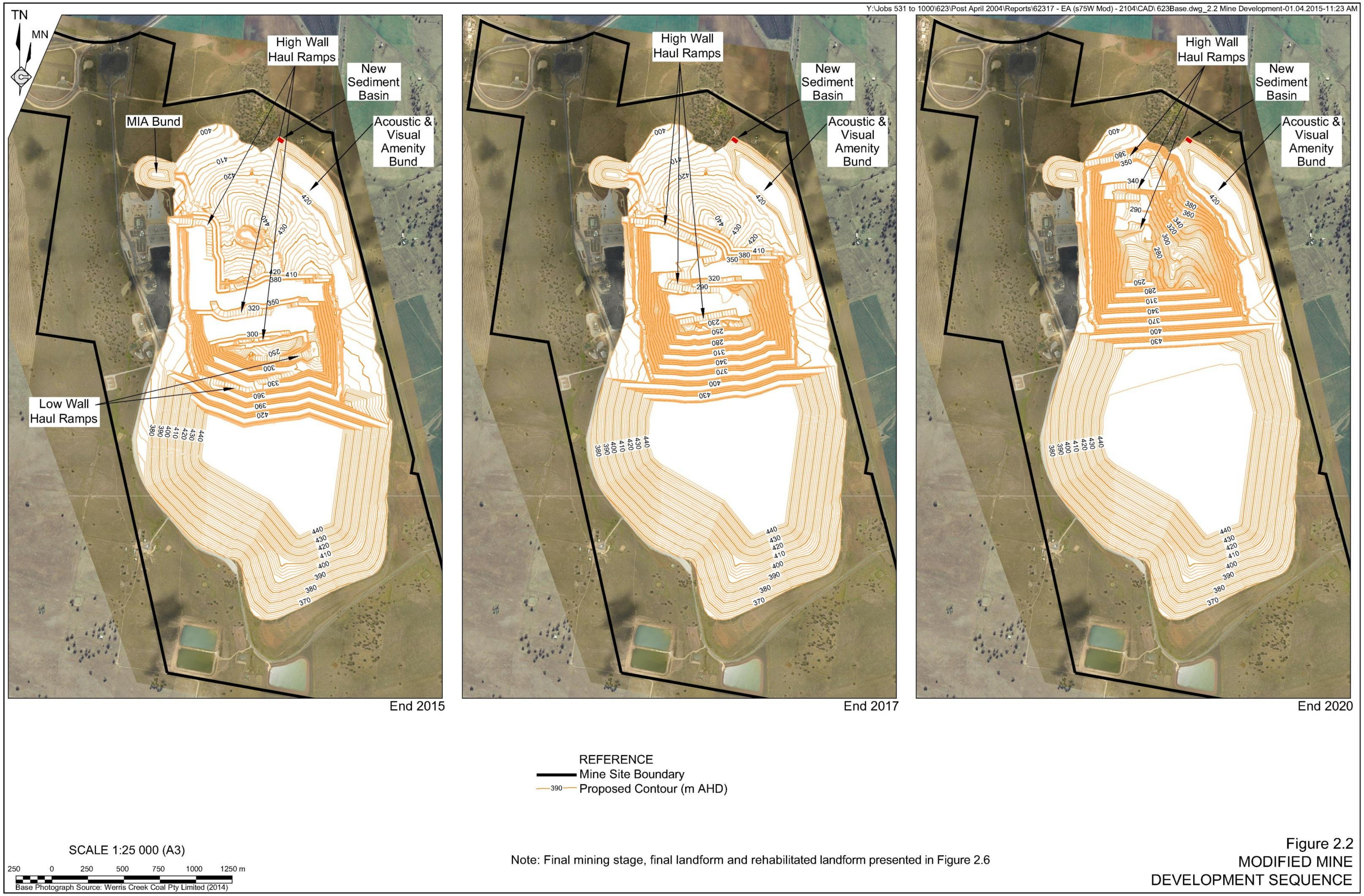
The method of mining is to remain unchanged from that currently undertaken and described in previous environmental assessments (RWC, 2010) and annual reports (WCC, 2014).

2.2.3 Mine Design and Sequence

In order to offset the higher coal to overburden / interburden 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 2015 of **Figure 2.2**).

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 2017) 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 2020 of **Figure 2.2**).



Note: Final mining stage, final landform and rehabilitated landform presented in Figure 2.6

Figure 2.2
MODIFIED MINE DEVELOPMENT SEQUENCE

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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 2017).

This is proposed as a method of increasing the active capacity of the overburden emplacement 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. Other important features of the modified mine design, which can be observed on **Figure 2.2** are as follows.

- Development and mining from wider 80m benches (as opposed to the less productive 50m wide benches).
- Development of 21m benches every 30m of high wall as opposed to the current variation between 10m and 20m high benches of the current mine design.
- A reduction in the overall slope of the active open cut face from 55° to 33°, as a result of the wider (80m) mining benches, which reduces the risk of high wall instability.

2.2.4 Mining Equipment

Table 2.1 presents the current mobile equipment operated at the Mine which remains equivalent to the indicative mining fleet presented in RWC (2010). One minor difference is that as the mine is developed to its deepest point, an additional three haul trucks are likely to be required to enable efficient removal of overburden. Equipment involved in the clearing of vegetation, stripping or replacement of topsoil and subsoil is operated on a campaign basis. Additional equipment used at the mine includes generators (either freestanding or integrated with various items of equipment) and miscellaneous maintenance equipment, e.g. welders.

As discussed in RWC (2010), the number and type of equipment may change over time based on changing requirements for activities. The equipment listed in **Table 2.1** should therefore be viewed as indicative with any major changes to be documented through the AEMR process.

2.2.5 Mining, Production Limit and Mine Life

The Proponent is not applying for any modification to the maximum rate of coal production. However, as a consequence of annual production approaching the maximum rate of 2.5Mtpa more regularly, and the higher than anticipated strip ratio, the overall development and completion of mining is likely to be accelerated from that presented in the 2010 *Environmental Assessment* (RWC, 2010). RWC (2010) anticipated mining operations continuing to 2028 whereas the revised mining and production sequence has mining completed in 2021 and rehabilitation (refer to Section 2.10) in 2022.

Table 2.1
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 Clearing, Overburden Emplacement/Road Maintenance, Coal Stockpile Maintenance	Full Time
Bulldozer (D10)	4		Full Time
Bulldozer (D9)	1		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 Site as replacement for maintenance and repairs of operating trucks.

Source: Werris Creek Coal Pty Limited

A minor administrative modification to PA 10_0059 revolving around coal production is proposed. *Condition 6* of Schedule 2 currently references coal extraction limits to a calendar year. The Applicant currently completes all reporting, both internal and other financial reporting, on a financial year basis and it is requested that the condition is modified to enable all reporting based around production to be consolidated. The following modification to the condition is proposed.

6. The Proponent shall not extract more than 2.5 million tonnes of ROM coal from the site in a ~~calendar~~ financial year.

2.2.6 Mine Dewatering

No change to the method of mine dewatering is proposed. The provision for irrigation of void water once dewatered is discussed in Section 2.5.

2.3 OVERBURDEN AND INTERBURDEN MANAGEMENT

2.3.1 Introduction

The removal of the overburden and interburden represents the main earthmoving component for the mining operation. As identified in Sections 1.6.3 and 1.7, the ability to manage overburden and interburden within the approved mining area under the current mine sequence is a potential constraint on operations at the Mine. The following sub-sections review the characteristics of the overburden and interburden, removal and management, and modifications to the design.

2.3.2 Overburden / Interburden Characteristics

A previous 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. There has been no evidence observed in the 10 years of operation to suggest that this original investigation is incorrect and there remain no specific handling and emplacement requirements for these materials.

2.3.3 Overburden / Interburden Volumes

The approved overburden emplacement is designed to contain approximately 143Mbcm. Recent projections indicate that by 2016 the active capacity (available at the time that overburden is generated and requires disposal) of the overburden emplacement would be reduced to 22.5 million bank cubic meters (Mbcm) and provide only a 15% surplus over the scheduled overburden and interburden to be generated (19.5Mbcm) in that year. Such a small active capacity of the overburden emplacement would impact productivity by imposing significant inefficiencies associated with having to haul overburden from the bottom of the open cut to the top of the overburden emplacement (or vice versa) depending on where the actual space is available for overburden emplacement.

The most recent mining schedule indicates that the active capacity of the overburden emplacement, i.e. the capacity remaining should no further void space be created behind mining, is only 8 weeks. This does not a provide a sufficient buffer should increased volumes of overburden be encountered, or events such as high rainfall resulting in accumulation of water within the open cut restricting access to the lower levels of the open cut for mining or overburden placement. After 2017, the strike length and depth of the pit reduces because mining has passed through the base of the syncline and the coal seams dip upwards to the surface. At this time the strip ratio will reduce and therefore the quantity of overburden handled and emplaced will reduce easing the pressure on the active capacity of the overburden emplacement area.

2.3.4 Overburden / Interburden Design Features

2.3.4.1 Introduction

The progressive development of the modified overburden emplacement is illustrated by **Figure 2.2** (with **Figure 2.6** providing further illustration of the overburden emplacement at the completion of mining and on rehabilitation). The critical design features of the two key 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 considered in the following sub-sections.

2.3.4.2 Out-of-Pit Emplacement (Western Extension)

The out-of-pit emplacement would be extended by approximately 6ha over an area currently assigned to the stockpiling of soil. This is planned for completion during 2016, with any remaining soil contained to be either used for the rehabilitation of the profiled sections of the overburden emplacement or relocated to other areas assigned for the stockpiling of soil. The extension would increase the capacity of the overburden emplacement by approximately 2.0Mbcm, however, importantly this additional capacity would be external to the open cut void and therefore increase the active capacity of the emplacement.

In line with current overburden design principles, the lower to middle slopes of the overburden emplacement extension would be constructed with comparatively gentle slope of 10° or less. Existing contour banks on the rehabilitated landform would be extended to manage surface water runoff and assist in minimising erosion of these slopes.

2.3.4.3 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 would be extended by approximately 250m to the north. The extension would increase the capacity of the overburden emplacement by approximately 13.5Mbcm.

As discussed in Section 2.2.3, the modified in-pit overburden emplacement does not include haulage ramps to the open cut. By transferring the haul ramps to the high wall side of the open cut, the active capacity for overburden emplacement would increase from 8 weeks to approximately 6 months.

In line with current overburden design principles, the advancing northern face of the in-pit emplacement would be constructed with steeper slopes which would ultimately be reduced to 18º (1V:3H) or less in the final landform. Section 2.10 reviews the activities required to create the final 18° slope. On the out-of-pit eastern and western slopes, the slopes of the overburden emplacement would be constructed with comparatively gentle slope of approximately 10°. On the outer slopes and final in-pit (northern) slope, existing contour banks would be extended to manage surface water runoff and assist in minimising erosion of these slopes.

2.3.5 Overburden and Interburden Management Methods

While the volume of overburden / interburden requiring placement within the overburden emplacement is now greater than previously predicted, no change to the total volume of current and approved overburden and interburden removal and placement is proposed.

2.4 PROCESSING OPERATIONS AND STOCKPILE MANAGEMENT

2.4.1 Introduction

The Proponent would continue to process ROM coal as described in Section 1.6.5. The mobile crushing unit operating at the southern end of the Coal Processing Area would also continue to operate to supply coal for domestic markets and the Whitehaven CHPP. No change to the hours of operation is proposed and production rates would remain the same as those currently approved (2.5Mtpa).

As noted in Sections 1.6.5 and 1.7, greater than anticipated contamination of the coal recovered from the seams previously mined by the Werris Creek Colliery requires additional screening of shaly and other non-coal material to ensure export coal specifications are maintained. Coal containing such contaminants is often washed, however, this would introduce a new waste material (tailings) on the Mine. An alternative processing approach, dry-screening, has therefore been proposed which does not require the addition of water nor generate a new waste material.

2.4.2 Dry Separation Processing

Coal recovered from the seams affected by the former underground workings, as well as other coal with rock, ash or other contaminant, would be stockpiled separately prior and post crushing. The coal would be pre-screened to remove the <50mm component which would be co-disposed with the overburden.

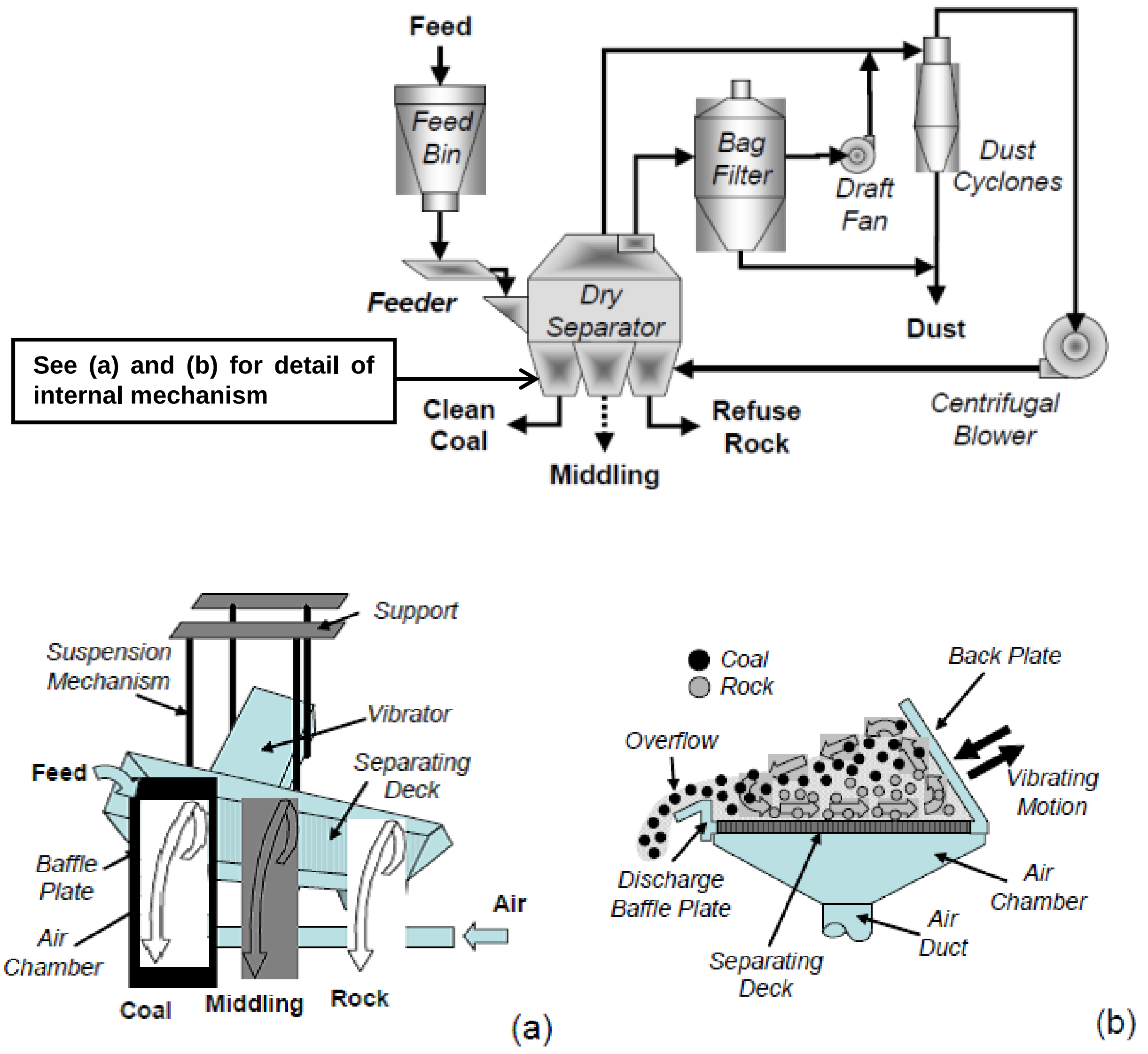
The screened coal would then be loaded to a feed hopper by front-end loader and passed over a vibrating table. The vibration creates a fluidized layer of the material on the table deck which is then passed over an air table separator which incorporates the following.

- A downward sloping deck with a series of (6mm) apertures through which air is blown through.
- A series of baffles along the deck edge to collect and remove the particles as they move towards the edge of the deck.

The lower density (lighter) coal particles, which are lifted more easily by the force of the air move to the top of the fluidized layer and slide first off the downward sloping table. The higher density (heavier) particles of shale and other contaminants are slower to move off the deck and accumulate at the back of the table.

The air is recycled through the plant by the action of a cyclone which creates an exhaust effect. The air is drawn from table through a bag filter where larger diameter dust particles are captured for removal. The action of the cyclone filter removes additional particulate matter before the air is forced back though the apertures of the table by a centrifugal blower.

Figure 2.3 provides a schematic illustration of the dry separation process.



Source: Honaker (2007)

Plate A 180tph Dry Separation Plant (Source: FGX)

Figure 2.3
DRY PROCESSING OPERATIONS

The Proponent anticipates up to 10% of ROM coal could be processed by the dry processing unit, 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. **Plate A** of **Figure 2.1** provides an example of a dry processing plant equivalent in size and configuration to that proposed.

2.4.3 Stockpile Management

The area of the Mine designated for ROM and product coal stockpiling would remain the same. The component of the ROM coal to be dry separated would be placed within separate stockpiles on the ROM Pad, close to the Dry Separation Plant by front-end loader to limit the haul distance for the front-end loader.

The coal produced by the Dry Separation Plant would be transferred to a larger stockpile by front-end loader as it accumulates below the air separator table before being transferred to the Product Coal Storage Area prior to rail load-out. The overburden removed through the Dry Separation Plant would similarly be stockpiled and periodically transferred by front-end loader and placed with other overburden material from mining within the overburden emplacement.

The Product Coal Storage Area extension approved by PA 10_0059 has yet to be constructed and is considered unlikely over the life of the Mine.

2.5 VOID WATER MANAGEMENT

2.5.1 Introduction

As noted in Section 1.6.7, water which accumulates in the open cut void is collected within sumps at the base of the void and periodically pumped to surface void water dams for storage prior to use for dust suppression and/or evaporation. The following sub-sections review the quality of the water, water balance under a variety of rainfall conditions, and proposed strategy for the beneficial agricultural use of void water from the Mine.

2.5.2 Void Water Quality

Samples of void water within the open cut and Void Water Dams 1, 3 and 4 were taken on 11 November 2014 following a rainfall event. Samples of void water were then taken from the open cut on 18 November 2014 after a 1 week period of dry weather. **Table 2.2** provides a summary of the water quality and includes the various triggers for short-term agricultural application (irrigation), livestock watering and aquatic ecosystem protection (95%) of ANZECC (2000). Some minor exceedances of Short-term Exposure Limits for irrigation for electrical conductivity and sodium are identified, however, appropriate management of this water if irrigated would be undertaken to ensure no accumulation of salts within the land to which the water might be applied (see Sections 2.5.4.4 and 4.6.5).

Table 2.2
Void Water Quality

Analyte	Unit	Void Water		Void Water Dams				ANZECC (2000) Criteria		
		(after rain)	(no rain)	1	2	3	4	I (STE)	L	E (95%)
pH		8.02	7.92	8.5	8.41	8.74	8.97	6-8.5	-	6-8.5
Electrical Conductivity	µS/cm	921	929	**1100**	**1070**	994	**1030**	950	-	-
Sodium Adsorption Ratio		3.03	3.23	4.59	NT	4.82	4.74	-	-	-
Total Dissolved Solids	mg/L	512	501	602	NT	546	561	-	4000	-
Hardness as $CaCO_3$	mg/L	244	229	215	NT	173	175	-	-	-
Alkalinity as $CaCO_3$	mg/L	159	160	150	NT	129	121	-	-	-
Sulphate	mg/L	98	118	154	NT	144	145	-	1000	-
Chloride	mg/L	113	117	150	NT	140	147	175	-	-
Calcium	mg/L	78	77	50	NT	43	42	-	1000	-
Magnesium	mg/L	12	9	22	NT	16	17	-	2000	-
Sodium	mg/L	109	113	**155**	NT	**146**	**144**	115	-	-
Potassium	mg/L	9	12	10	NT	10	10	-	-	-
Aluminium	mg/L	<0.01	<0.01	0.02	NT	0.03	0.06	20	5	0.055
Arsenic	mg/L	0.006	0.004	<0.001	NT	0.002	0.001	2	0.5	0.024
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	NT	<0.0001	<0.0001	0.05	0.01	0.0002
Chromium	mg/L	<0.001	<0.001	<0.001	NT	0.012	0.001	1	1	0.001
Copper	mg/L	0.001	0.001	0.001	NT	0.002	0.003	5	1	0.0014
Lead	mg/L	<0.001	<0.001	<0.001	NT	<0.001	<0.001	5	.01	0.0034
Nickel	mg/L	0.006	0.005	<0.001	NT	0.008	<0.001	2	1	0.011
Selenium	mg/L	<0.01	<0.01	<0.01	NT	<0.01	<0.01	0.05	0.02	0.011
Zinc	mg/L	<u>0.024</u>	<u>0.011</u>	<u>0.051</u>	NT	0.006	<u>0.146</u>	5	20	0.008
Iron	mg/L	<0.05	<0.05	<0.05	NT	0.07	<0.05	10	-	-
Mercury	mg/L	<0.0001	<0.0001	<0.0001	NT	<0.0001	<0.0001	0.002	0.002	0.0006
Fluoride	mg/L	0.1	0.2	0.2	NT	0.2	0.1	-	-	-
Ammonia	mg/L	0.15	0.23	<0.01	NT	0.01	<0.01	-	-	0.9
Nitrite	mg/L	0.07	0.08	0.03	0.05	0.05	0.07	-	9.1	-
Nitrate	mg/L	6.23	6.13	2.29	4.86	2.48	4.78	-	90.3	0.7
Kjeldahl Nitrogen	mg/L	6.3	1.3	0.5	0.7	1.1	1	-	-	0.5
Phosphorous	mg/L	0.01	<0.01	<0.01	<0.01	0.06	<0.01	0.8	-	-
Biological Oxygen Demand	mg/L	<2	<2	<2		<2	<2	-	-	85-110

Note 1: I (STE) = Irrigation (Short-term Exposure) L = Livestock Watering E (95%) = Ecosystem Protection (95% species)
NT = Not tested

Bold identifies exceedance of I (STE) criteria underline identifies exceedance of E(95%) criteria

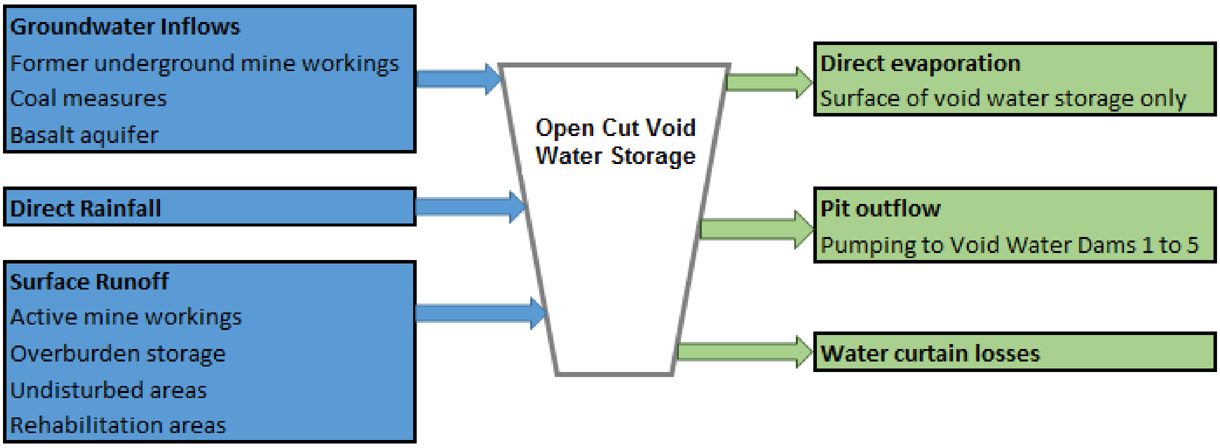
Source: ALS Laboratories

As the void water to be stored at surface is marginally brackish (EC of 900 to 1 1000µS/cm), the void water dams are constructed with compacted clay to achieve a permeability value of <1 x 10^{-9}m/s over 500mm. No discharge from the Mine is currently permitted from the void water dams, although it is worthy of note that the salinity of the water contained within Quipolly Creek and Werris Creek downstream of the Mine has consistently been measured with an Electrical Conductivity exceeding 900µS/cm (WCC, 2014).

2.5.3 Void Water Balance

As discussed in Section 1.6.7, the Mine has in recent years operated with the void water dams at or near capacity with misting evaporators used to maximise storage. This suggests the Water Balance Model (WBM) prepared for the Mine by GSSE (2010) for the purposes of the LOM Project *Environmental Assessment* underestimated the inflows to the open cut void from rainfall (increasing strike length of the pit and increased area of overburden emplacement capturing runoff) and the former underground workings (originally planned to be dewatered but water has been used to manage potential spontaneous combustion).

GSSE (2010) predicted that even without the accelerated evaporation provided by the misting evaporators, there would only be a small surplus of void water (29ML) during wet (90th percentile rainfall) years. In order to more accurately assess the future water management requirements of the Mine, ENVIRON was commissioned by the Applicant to review and update the Mine WBM. **Figure 2.4** presents a schematic illustration of the water in-flows and out-flows considered as part of the WBM for the open cut void of the Mine.



Source: Modified after ENVIRON (2015) – Figure 1

Figure 2.4
VOID WATER BALANCE

Groundwater in-flows were predicted using the calibrated groundwater model for the Mine previously designed by ENVIRON (2014). The 113 year data set of daily rainfall from the Bureau of Meteorology Station (No. 055062) at Werris Creek Post Office was used to provide the direct rainfall in-flow. Inputs for surface runoff were generated by calibrating the original runoff coefficients produced by GSSE (2010), which appear to have been over generalized for assessment of the LOM Project, against observed variation in void water storage. ENVIRON (2015), presented in full as **Appendix 2**, provide a more detailed description of the Conceptual WBM and calibration of inputs.

In order to best understand the likely surplus / deficit of water over the remaining life of the Mine, three mining scenarios were considered. These scenarios coincide with those presented in **Figure 2.2** and represent:

- development of the open cut and rehabilitation at the end of 2015;
- development of the open cut and rehabilitation at the end of 2017 (which includes the decommissioning of Void Water Dam 2 and Void Water Dam 5); and
- development of the open cut and rehabilitation at the end of 2020.

For each mining scenario, a dry (15th percentile), median and wet (90th percentile) rainfall year was considered (as taken from the 113 year data set from BOM Station No. 055062).

Table 2.3 presents a summary of the WBM output for each combination of mining and rainfall scenario. It is noted that this output does not account for the additional evaporation provided by the misting evaporator units.

The Applicant would continue to operate two evaporator units over the void water dams. While some small fluctuation in the volume of water evaporated annually is expected as a result of variable rainfall, this is not expected to impact significantly on the total volume evaporated. On this basis, it is expected that two evaporators, operating 24 hours per day over the longer, warmer spring – summer months and during daylight hours over the cooler, shorter autumn – winter months, would provide for additional evaporation of up to 360MLpa. Accounting for periods of non-operation due to noise management or general maintenance, as well as particularly wet years, a conservative estimate of the average annual evaporation to be used in the WBM for the evaporators is 300ML per annum.

Table 2.3
Void Water Balance

Inputs / Outputs		Year 2015			Year 2017			Year 2020		
		Median	15th %ile	90th %ile	Median	15th %ile	90th %ile	Median	15th %ile	90th %ile
Inputs	Rainfall/runoff	737	570	1 043	835	643	1 192	792	605	1 130
	Groundwater Inflow	54	54	54	47	47	47	22	22	22
	Input (return) from Underground	67	67	67	-	-	-	-	-	-
	Total	**858**	**691**	**1 164**	**882**	**690**	**1 239**	**814**	**627**	**1 152**
Outputs	Evaporation[1]	408	381	329	428	408	374	409	328	358
	Water use	365	365	365	365	365	365	365	365	365
	Total	**773**	**746**	**694**	**793**	**773**	**739**	**774**	**693**	**723**
Balance		**85**	**-55**	**470**	**89**	**-83**	**500**	**40**	**-66**	**429**

Note 1: From surface of void water storages only (does not include additional evaporation from misting evaporator units)

Source: Modified after ENVIRON (2015) – Table 1

Table 2.4 provides a revised summary of the WBM output for each combination of mining and rainfall scenario with the inclusion of this additional evaporation.

Table 2.4
Void Water Balance (with Evaporators)

Inputs / Outputs		Year 2015 Median	Year 2015 15th %ile	Year 2015 90th %ile	Year 2017 Median	Year 2017 15th %ile	Year 2017 90th %ile	Year 2020 Median	Year 2020 15th %ile	Year 2020 90th %ile
Inputs	Rainfall/runoff	737	570	1 043	835	643	1 192	792	605	1 130
	Groundwater Inflow	54	54	54	47	47	47	22	22	22
	Input (return) from Underground	67	67	67	-	-	-	-	-	-
	Total	**858**	**691**	**1 164**	**882**	**690**	**1 239**	**814**	**627**	**1 152**
Outputs	Evaporation (from Void Water Dam Surface)	408	381	329	428	408	374	409	328	358
	Evaporation (from Evaporator Units)	300	300	300	300	300	300	300	300	300
	Water use	365	365	365	365	365	365	365	365	365
	Total	**1 073**	**1 046**	**994**	**1 093**	**1 073**	**1 039**	**1 074**	**993**	**1 023**
Balance		**-215**	**-355**	**170**	**-211**	**-383**	**200**	**-260**	**-366**	**129**

Source: Modified after ENVIRON (2015) – Table 1

Table 2.4 suggests void water additional to dam storage capacity (up to 200ML) is predicted under both median and high rainfall conditions prompting either retention of water within the open cut or an alternative water management strategy. In the event that the evaporator units were removed from operation, although not proposed at this stage, the potential surplus could increase to 500MLpa[7].

Considering the capacity of the void water dams of the Mine are operating close to capacity (of 714ML), the predicted deficits during low and median rainfall years are not anticipated to impact on water availability for dust suppression given the existing volume of water currently available for the Mine to draw down against.

2.5.4 Proposed Void Water Agricultural Use

2.5.4.1 Introduction

On the basis of the WBM predictions (see **Tables 2.3** and **2.4**), the volume of void water generated could exceed the capacity of the void water dams under median and high rainfall scenarios. In order to alleviate the storage capacity shortfall, the Applicant proposes to make

[7] This would only occur if the volume of water to be transferred to an off-site user significantly exceeds that volume which is currently being evaporated.

this water available to the owners or users (under lease) of land adjoining or surrounding the Mine Site for irrigation and/or other agricultural use (i.e. stock watering). Notably, the Applicant has been approached by neighbouring land owners with respect to water availability, with the proposal to make this water available supported by the Mine Community Consultative Committee (which represents the interests and concerns of the local community) (refer to Section 3.2.1.1).

At this point, the Applicant has only fielded expressions of interest in the use of available void water with no specific location identified or confirmed. Hence, the Proposal presented in this *Environmental Assessment* is not for a prescribed irrigation program, rather for the inclusion of a condition within PA 10_0059 that allows for void water to be supplied to third party users, subject to the satisfaction of specific requirements for each individual supply contract. The Applicant notes that any irrigation or other agricultural use of void water would be undertaken by the land owner / user (referred to hereafter as "the Irrigator"[8]) in accordance with the approved land use. Furthermore, obtaining relevant/necessary licences or approvals would be the responsibility of the Irrigator to obtain and manage.

While specific areas for irrigation have not been prescribed, in order to illustrate that void water irrigation may be undertaken without adversely impacting on the local environment, the *Environmental Assessment* incudes a *Void Water Irrigation Assessment* (VWIA) (SEEC, 2015). The VWIA models the application of void water to land, using parameters derived from sampling and analysis of two soil types indicative of the local setting. In summary therefore, this document, and the VWIA included as **Appendix 5**, has been prepared to:

(a) demonstrate that irrigation of the void water is a feasible use of this water, i.e. could be undertaken without adverse impact on the land to which it is applied;

(b) delineate the relative responsibility(ies) of the Applicant as the supplier of water and the irrigator as the user of water; and

(c) provide for suitable controls that are enforceable to ensure that appropriate controls are in place (both by the Applicant and Irrigator) to ensure water application is undertaken appropriately for the nominated land area and does not impact adversely on the land or catchment.

2.5.4.2 Feasibility of Irrigation

Irrigation is a common land use within the local setting, in particular to the south of the Mine Site on land in the Quipolly Creek area. It is acknowledged that the water used for irrigation in this locality is sourced primarily from the alluvium associated with the creek, which is a different source of water to that which accumulates within the open cut void (mixture of in-flows from rainfall, coal seams and interburden and underlying Werrie basalt).

[8] It is noted that water could be sourced for the purpose of stock watering as well.

In order to demonstrate the feasibility of irrigating the quality of water accumulated in the open cut void, Strategic Environmental and Engineering Consultants (SEEC) has modelled the application of this water to local land using the EPA endorsed *Effluent Reuse Irrigation Model* (ERIM)[9]. Soil indicative of the land surrounding the Mine Site was sampled (on the "Escott" property to the west and "Cintra" property to the north) and used for modelling purposes.

While the exact method for the application of void water to land would be finalised in conjunction with the land owner / lease holder (see Section 2.5.4.3) and following a site-specific assessment (see Section 2.5.4.4), the modelling of SEEC (2015) has confirmed that irrigation at a rate of approximately 6.25ML/ha/year could be accommodated. On this basis, in the event of a 90th percentile rainfall year, resulting in a surplus of up to 200ML, the Applicant would require irrigation to an area of up to 32ha. Section 4.7 provides the detail of the ERIM inputs and outputs as part of an assessment of impact.

2.5.4.3 Management of Irrigation - General

Unless modified by contract between the Applicant and Irrigator, the Applicant would be responsible for the accumulation and storage of void water on the Mine Site (within void water dams or the open cut) and initial pumping transfer (to the Mine Site boundary) of this water. The Irrigator would be responsible for the delivery of this water to irrigation infrastructure or off-site water storage and irrigation of the water in accordance with additional approvals or licences (as required).

The Applicant proposes that any irrigation program be managed in accordance with the following.

(1) **The Applicant** would extend the quarterly surface water monitoring program to include those analytes critical to the assessment of impact on soil salinity and nutrient levels.

(2) A potential **Irrigator** would provide a proposal to the Applicant for supply. This would require information on the intended use, location, method of application and rate of application.

(3) Unless existing soil data is considered representative, **the Applicant** would commission soil sampling at the nominated site. The results of the soil analyses, and most recent void water analysis, would be input into a site specific run of ERIM to confirm application can be undertaken.

(4) A *Pre-Agricultural Void Water Use Assessment* would be prepared by **the Applicant**.

(5) A contract between **the Applicant** and **Irrigator** would be reached including relative responsibilities for water quality, storage, transfer and use of the water. The contract would also specify the proposed water use, area of application, method of application (direct irrigation or transfer to secondary off-site storage), maximum application rates and other terms following the completion of a *Pre-Agricultural Void Water Use Assessment*.

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9 The void water is not effluent as described in the *Protection of the Environment Operations Act 1997*, however, the salinity of the void water exceeds the relevant trigger for stream water quality for a NSW upland stream (350µS/cm) (ANZECC, 2000). For this reason, SEEC took a conservative approach to assessment by treating the water as effluent and applying the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004).

(6) For irrigation to land in the local area, surface pipes would be installed or relocated from the most appropriate void water dam (considering proximity) to the site of the proposed irrigation. Unless modified by the terms of contract, **the Applicant** would provide for the installation of pipe infrastructure, would be responsible for the operation of pumps on the Mine Site and would monitor pipe infrastructure located on the Mine Site. The **Irrigator** would be responsible for the operation and monitoring of the irrigation equipment, infrastructure (e.g. secondary dam) and pipework off the Mine Site.

(7) Irrigation would be the responsibility of the **Irrigator** undertaken generally in accordance with contractual terms and the site specific *Pre-Agricultural Void Water Use Assessment* (refer to Section 2.5.4.4).

(8) **The Applicant** would undertake annual sampling/testing of the irrigation area to confirm operation in accordance with the *Pre-Agricultural Void Water Use Assessment*.

2.5.4.4 Management of Irrigation – Site Specific

Each application for void water would be reviewed by the Applicant. As noted in Section 2.5.4.3 (3), the Applicant would complete site-specific modelling of the area (using ERIM or another EPA endorsed modelling program) to which the void water would be applied. On the basis that the site-specific assessment confirms application of void water could be undertaken sustainably, the Applicant would prepare an *Pre-Agricultural Void Water Use Assessment* (see Section 2.5.4.3 (4)) which would be provided to the EPA and DP&E for review and endorsement prior to commencement. As indicated above the *Pre-Agricultural Void Water Use Assessment* would provide specific information on the soil, method of irrigation and other relevant details.

2.6 TRANSPORTATION

2.6.1 Introduction

The majority of coal produced would continue to be sold to export markets and delivered via the Main Northern Railway Line from Werris Creek Coal Mine to the Port of Newcastle. The Company has approval to transport up to 50 000t of coal by road from the Mine. This coal was initially supplied to local markets and other domestic customers but has declined due to transport restrictions through certain local government areas imposed by PA 10_0059 (Schedule 2 Condition 8b). The Mine retains the capacity to deliver to the Whitehaven Coal Handling and Processing Plant (CHPP) at Gunnedah.

No changes to rail transport operations are proposed. The following sub-sections describe the road transport operations as these are the subject of the Proposal (increased hours of operation).

2.6.2 External Road Network

The majority of heavy vehicles exiting the Mine Site would continue to turn right onto Werris Creek Road and right again at Taylors Lane to the south of the Mine Site. The trucks would travel west on Taylors Lane before joining the Kamilaroi Highway. The majority of vehicles are now expected to make a right hand turn and travel towards Gunnedah although it is possible that occasional deliveries may require a left hand turn at the Kamilaroi Highway (noting that transport through Mudgee and the Hunter Valley are prohibited by PA 10_0059). Domestic supplies destined for Tamworth or further north on the New England Highway would turn left from the site onto Werris Creek Road and make their way through the town of Werris Creek. **Figure 2.5** presents the primary transport route from the Mine Site to the Whitehaven CHPP. Traffic Types and Levels

The delivery of coal to the Gunnedah CHPP and domestic markets would be by a range of truck configurations carrying an average of 30t. Based on the despatch of 50 000t of coal per year and an average truck capacity of 30t, this equates to approximately 1 700 truck loads (3 400 movements) per year.

Table 2.5 provides an analysis of weekday coal haulage from the Mine to the Gunnedah CHPP between 3 February and 7 April 2014 which would be indicative of future campaigns.

Table 2.5
Campaign Based Haulage Truck Movement

Traffic Period (2014)		Operating Days	Deliveries						Coal (t)
			Total	Min	Max	Average	85th %ile	95th %ile	
3 Feb	28 Feb	16	414	18	35	26	33	-	12 397
3 Mar	31 Mar	21	638	11	47	30	39	47	19 668
1 Apr	7 April	5	134	7	34	27	-	-	3 959
Total		**41**	**1 186**	**7**	**47**	**28**	**34**	**43**	**36 024**

On the basis of the 2014 data, between 10 and 50 deliveries are expected per week day (4 to 10 on Saturdays), with an average of 28 (56 movements). Greater than 43 deliveries (86 movements) would only exit the Mine on 5% of days during the haulage campaign.

2.7 FACILITIES AND SERVICES

With the exception of the Dry Separation Plan described in Section 2.4.2, and irrigation infrastructure as described in Section 2.5.4, no additional facilities or services are proposed.

2.8 MINE LIFE AND HOURS OF OPERATION

On the basis of current mine design, mining of the Werris Creek coal measures would be completed in 2021, with rehabilitation to be completed during 2022.

The Mine is approved to operated 24 hours a day seven days per week, with blasting restricted to between 9.00am and 5.00pm, Monday to Saturday.

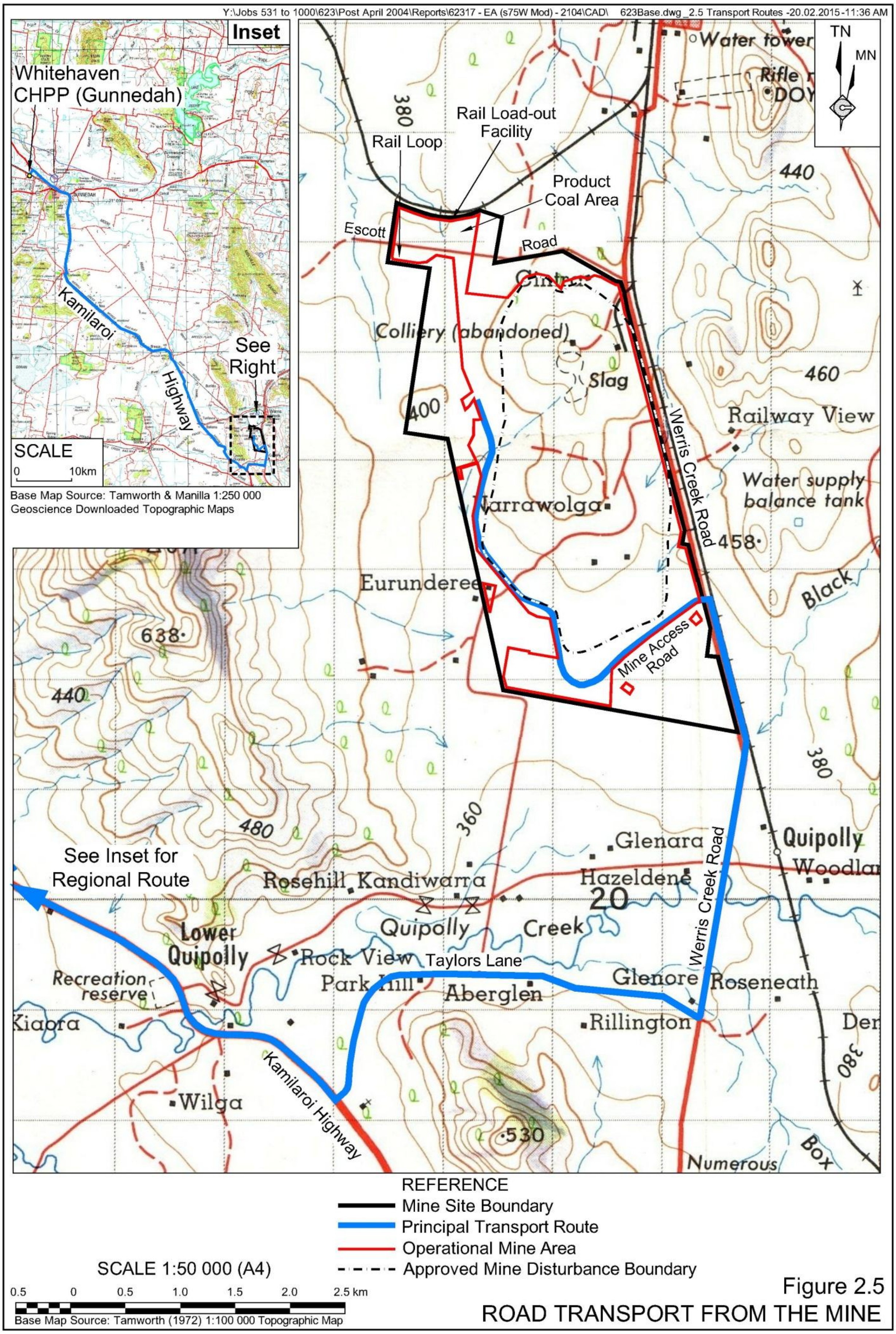

Figure 2.5
ROAD TRANSPORT FROM THE MINE

In order to better coordinate operations with the Whitehaven CHPP, which is approved to undertake domestic coal screening and despatch between the hours of 7:00am and 10:00pm Monday to Friday and 7:00am to 6:00pm Saturday, it is proposed to increase the hours of road transport to these hours. An additional benefit of the extended transport hours would be the ability of the Applicant to condense campaign transport operations from the Mine by 20% to 30% (by virtue of an increase in the available hours for transport each day/week of 35%). This would have benefits both to the Applicant (reduced haulage contract costs) and road users (reduced periods when coal carrying trucks operated between the Mine and Whitehaven CHPP).

2.9 EMPLOYMENT, CAPITAL COST AND ECONOMIC CONTRIBUTIONS

WCC currently employees 140 full-time equivalent personnel and it is not envisaged that this would change significantly as a result of the Proposal. Personnel would be required to operate the Dry Separation Plant, however, it is likely that these would be reassigned from the current workforce. Of the workforce, the majority (60) of Proponent employed personnel reside locally in the Liverpool Plains Shire including Quirindi, Werris Creek, Willow Tree, Wallabadah, Currabubula and Spring Ridge. The majority of the regular contractors are also based in Werris Creek, Quirindi, Tamworth and Gunnedah.

The Proponent has committed to employing locally where possible and would continue to contribute financially or in-kind to local community events and services. This includes the contribution of $300 000 to local Werris Creek and Quirindi projects between 2010 and 2017.

The Proponent would continue this proven commitment to Werris Creek and the Liverpool Plains Shire more generally over the remaining life of the Mine.

2.10 REHABILITATION, FINAL LANDFORM AND DECOMMISSIONING

2.10.1 Introduction

The Proponent would continue to implement a progressive approach to the rehabilitation of disturbed areas at the Mine to ensure that areas where mining or overburden placement are completed, these area are quickly shaped and vegetated to provide a stable landform. The progressive formation of the post-mining landform and the establishment of a vegetative cover would also minimise the visibility of mine-related activities from surrounding properties and from the Werris Creek Road and the town of Werris Creek.

2.10.2 Objectives

The Proponent's rehabilitation objectives remain unchanged from those of the approved operations. Particular emphasis would be placed on the re-establishment of native woodland vegetation that are commensurate with the White Box Yellow Box Blakely’s Red Gum (Box Gum) Woodland endangered ecological community, which has been identified on the Mine Site. The restoration of woodland vegetation communities would compensate for those areas disturbed by the mine development, link currently isolated remnant pockets of the Box Gum community, and provide a greater area and more diverse native fauna habitat and wildlife corridors.

The Proponent's rehabilitation objectives are divided into three specific categories, namely:

- integrating landscapes;
- achieving sustainable growth and development; and
- establishing the final land use.

The specific objectives associated with each category are as follows.

Integrated Landscapes

- To provide a vegetated corridor across Proponent owned land and the Quipolly Creek Catchment linking with sub-regional habitat corridors.
- To reduce the visibility of mine-related activities from adjacent properties, Werris Creek and the local road network.
- To create a final landform sympathetic to the surrounding topography.
- To provide a low maintenance, geotechnically stable and safe landform with minimal erosion.

Sustainable Growth and Development

- To achieve a soil profile capable of sustaining the specified final land use.
- To establish native vegetation with the species diversity commensurate to each relevant ecological community.

Final Land Use

- To re-instate an area of Rural Land Capability Class III commensurate with the agricultural land use on and around the Mine Site.
- To 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 Site.

2.10.3 Final Land Use

The Proposal would not result in any change to the principal uses of the rehabilitated landform, namely.

(i) Re-establishing the woodland vegetation communities commensurate to:

  – Box Gum Woodland and Derived Native Grassland (EEC equivalent);

- Brigalow-Belah Woodland (EEC equivalent); or
- Shrubby White Box Woodland.

(ii) Class III capable agricultural land.

2.10.4 Final Landform

The overall final landform concept for the Mine would not change as a result of the Proposal, however, there would be several minor modifications.

- The hill rising to 445m AHD would extend further to the north (towards Werris Creek). The upper surface of the hill would remain generally flat, however, would be shaped with minor rises and swales to create an undulating terrain. Slopes around the constructed plateau would be approximately 10° or shallower.
- The area of land to be rehabilitated back to Class III land over the Product Coal Storage area would be reduced as a result of this area now remaining undisturbed. Notably, there would be no reduction in the area of Class III land in the final landform as the area that will remain undisturbed is currently classified as Class II land.

Figure 2.6 illustrates the final stage of mining (Panel 1), final landform prior to rehabilitation (Panel 2) and rehabilitated final landform (Panel 3).

2.10.5 Strategic Rehabilitation Management

2.10.5.1 Rehabilitation Domains

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 2.6 identifies the domains relevant to the Mine and **Figure 2.6** (Panel 2) identifies these in relation to the proposed rehabilitation of the Mine.

The following subsections provide a description of each of the domains.

2.10.5.2 Primary Domains

Domain 1 – Infrastructure Areas

This domain would include the Administration and Workshop Area, the Coal Processing Area, the Rail Load-out Facility, the Product and ROM Coal Storage Areas, the Explosives Magazine, the Precursor Storage Facility and any other miscellaneous buildings or roads (excluding haul roads).

Table 2.6
Primary and Secondary MOP Domains

Code[1]	Primary (Operational) Domains	Code[1]	Secondary (Post Mining Land Use) Domains
1	Infrastructure Area	A	Infrastructure
3	Water Management Area	B	Water Management Area
4	Waste Rock Emplacement Area	E	Woodland
5	Stockpiled Material	G	Rural Land Capability Classification I to VIII
6	Void (Open cut void)	J	Conservation and Biodiversity Offset Area
9	Conservation and Biodiversity Offset Area		
10	Rural Land		
Note 1: Sourced from ESG3: Mining Operation Plan Guidelines, September 2013 – Table 4.			

Domain 3 – Water Management Areas

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

Domain 4 – Waste Rock Emplacement Area

This domain would include all overburden emplacement areas both in-pit and out-of-pit, as well as the Acoustic and Visual Amenity Bund.

Domain 5 – Stockpiled Material

This domain would include remaining stockpiles of soil or other materials set-aside for rehabilitation but not required.

Domain 6 – Void (Open Cut Void)

The final void area would include the post-mining void and perimeter required for creation of the final landform, low wall, high wall and any associated access.

Domain 9 – Conservation and Biodiversity Offset Area

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

Domain 10 – Rural Land

This domain is limited to areas where agricultural operations would continue during the life of the Mine. In summary, this domain would not be impacted by Mine-related activities and land management would be similar to the pre-mining land management operations.

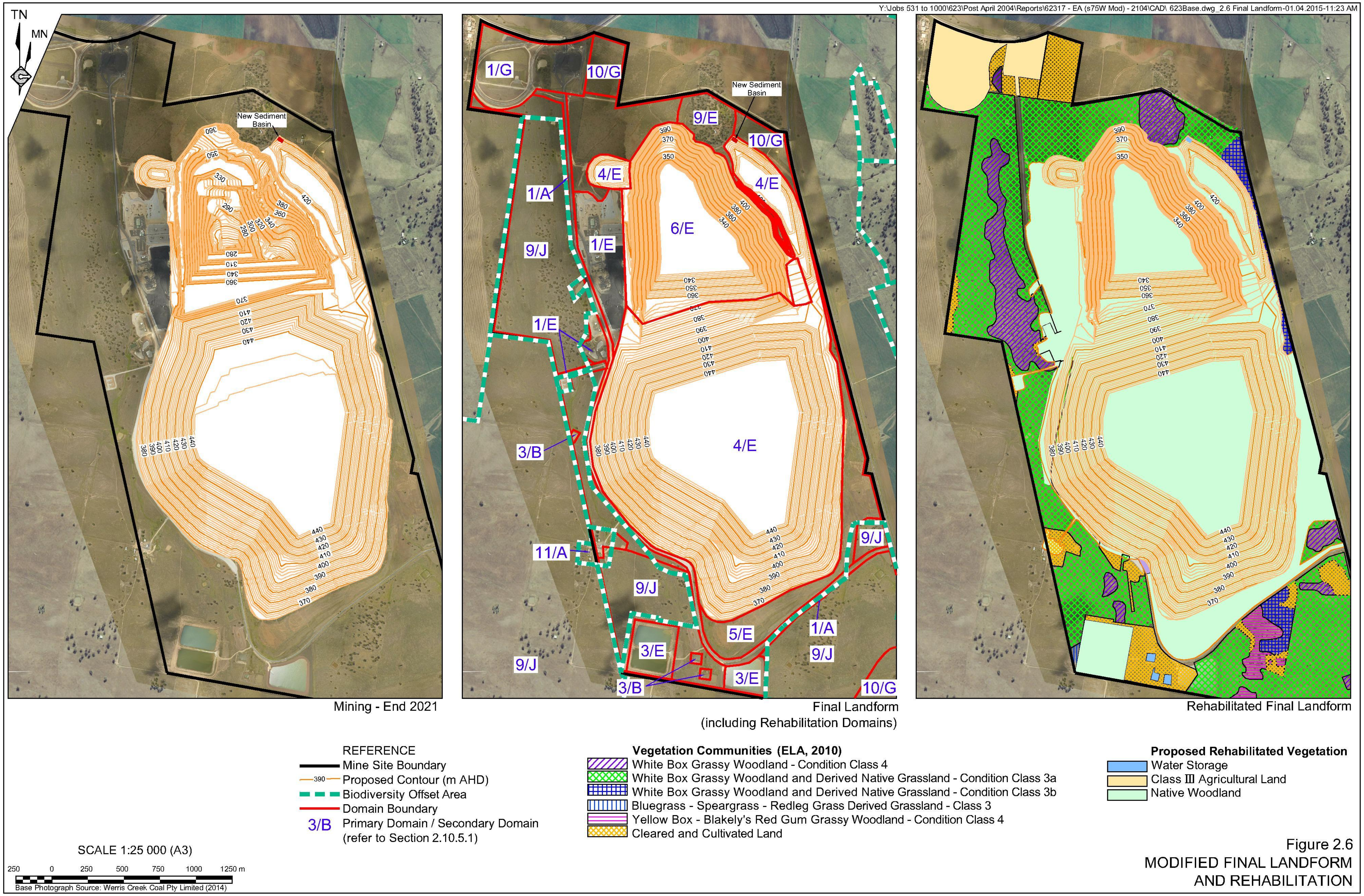

Figure 2.6
MODIFIED FINAL LANDFORM
AND REHABILITATION

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2.10.5.3 Secondary Domains

Domain A – Infrastructure

This domain includes those items of infrastructure that would remain following mine closure for a lawful land use, namely a land use permitted without consent or following granting of development consent.

Domain B – Water Management Areas

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

- diversion drains aligned around the overburden emplacement;
- sediment basins down-slope of previous areas of disturbance; and
- the clean water (farm) dams located to the south of the Site Access Road.

Domain E – Woodland

This domain includes those areas of the Mine Site that would be rehabilitated to woodland vegetation communities.

Domain G – Rural Land Capability Classification I to VIIII

This domain includes those areas of the Mine Site that would be rehabilitated in a manner suitable for agricultural purposes, including grazing and cropping. This domain is predominantly associated with the Product Coal, Storage Area, Rail Load-out Facility and Rail Loop.

Domain J – Conservation and Biodiversity Offset Areas

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

2.10.5.4 Rehabilitation Hierarchy

The rehabilitation hierarchy for the Mine is aligned to the rehabilitation objectives in Section 2.10.2 and outlined in the MOP, Rehabilitation Management Plan (RMP) and *Biodiversity and Offset Management Plan* (BOMP) (WCC, 2013). This hierarchy aligns with *ESG3: Mining Operations Plan (MOP) Guidelines, September 2013* (DRE, 2013) and will form the basis for an amended MOP to be prepared following determination of the Proposal. A summary of each phase on which the rehabilitation hierarchy is based is as follows. Specific activities associated with each phase of rehabilitation relevant to the Proposal, and not identified in the current MOP, are outlined in Section 2.10.6.

Decommissioning

Decommissioning is not specifically covered in the MOP, as only a small percentage of land is disturbed by infrastructure. Specific details of decommissioning completion criteria would be covered in the *Mine Closure Plan*. In general, the decommissioning phase of the rehabilitation hierarchy involves the cessation of usage of infrastructure, as well as its demolition, removal and any remediation of the land that may be required.

Integrated Landscapes

The integrated landscapes phase of the rehabilitation hierarchy (which is equivalent to the *Landform Establishment* phase under DRE, 2013) involves the earthworks required to cover and/or profile all or part of each domain to create a landform suitable for the proposed final land use and is sympathetic to the adjacent topography. This stage would also include the construction of any drainage structures needed for the area.

Sustainable Growth and Development

This phase is equivalent to the growth medium development and ecosystem and land use establishment phases of DRE (2013). In summary these phases of rehabilitation incorporate the following.

- 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 may include fertiliser or ameliorant application and ripping or scarifying the surface.
- 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 native vegetation on the constructed landform, an initial cover of native ground cover (grasses) will be established. Revegetation will then comprise of planting native trees, 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.

Final Land Use

The final land use phase (equivalent to the ecosystem and land use sustainability phase of DRE, 2013) of the rehabilitation hierarchy occurs once monitoring shows that there is adequate vegetation over the area. An area may be in this stage for a long period of time, depending on what the final land use outcome is.

2.10.5.5 Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy

The strategic rehabilitation completion criteria, associated performance indicators and monitoring strategy for each rehabilitation phase are summarised in **Table 2.7**.

Table 2.7
Strategic Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy

Page 1 of 2

Rehabilitation Objective	Completion Criteria	Performance Indicator	Monitoring Strategy
Integrated Landscapes	The landform morphology fits in with the surrounding landscape.	Slopes are at or less than 10° for out-of-pit emplacement area and less than18° for final void.	*Annual Rehabilitation Plan* prepared by mine surveyors.
	The rehabilitated area does not represent an erosion hazard.	Erosion does not exceed 0.3m (gully) deep.	Quarterly visual inspection by Environmental Officer.
Sustainable Growth Development – Woodland Ecological Community	Appropriate native plant species richness is present for the restored ecological community.	Native plant species numbers (per 400m²) to approximate: • White Box Grassy Woodland*: 23 • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 30 • Rough-barked Apple riparian forb/grass open forest: 25 • Brigalow Woodland: 20 • White Box – White Cypress Pine shrubby open forest: 26 • Rusty Fig – Wild Quince – Native Olive dry rainforest: 35 • Plains Grass Grassland: 17 or analogue site as established.	Vegetation monitoring by ecologist to determine native plant species richness.
	Appropriate density/structure of native overstorey species is present.	Over Storey cover range between: • Box Gum Woodland: 0-25% • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 6-40% • Brigalow Woodland: 0-25% or analogue site as established.	Vegetation monitoring by ecologist to determine over storey structure.
	Appropriate density/structure of native mid storey species is present.	Mid Storey cover range between: • Box Gum Woodland: 0-5% • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 6-25% • Brigalow Woodland: 0-5% or analogue site as established.	Vegetation monitoring by ecologist to determine mid storey structure.
	Appropriate native groundcover is present.	Bare ground and litter does not exceed: • Box Gum Woodland: 55% • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 55% • Brigalow Woodland: 65% • Plains Grass Grassland: 50% or analogue site as established.	Vegetation monitoring by ecologist to determine native plant species richness.

Table 2.7 (Cont'd)
Strategic Rehabilitation Completion Criteria, Associated Performance Indicators and Monitoring Strategy

Page 2 of 2

Rehabilitation Objective	Completion Criteria	Performance Indicator	Monitoring Strategy
Sustainable Growth Development – Agricultural Land	The existing pasture/crop meets the required land capability class.	Land capability for pasture achieves at least Class III Land Capability.	Land capability assessment by an Agronomist.
Land Use	The area and its sustainability is consistent with the intended land use.	Establish areas of rehabilitation consistent with approved final land form/use outlined in this document.	*Biodiversity and Offset Management Plan* to be audited every 3 years. Land capability assessment by an agronomist.
	There are no potential hazards that are not consistent with the intended land use.	The site is free of safety or environmental hazards including: • holes, tunnels or unstable areas; • mining infrastructure or debris; or • hazardous materials.	Quarterly visual inspection by Environmental Officer.
	The soil pH is representative of the intended land use.	pH levels are within the range generally acceptable for plant growth (5.0 to 8.5) until data from analogue sites is available.	Annual soil analyses by Environmental Officer.
	Exotic weeds or vegetation is not competing or impacting on the intended land use.	Noxious weeds within rehabilitation or biodiversity offset areas are being managed until data from analogue sites is available.	Quarterly visual inspection by Environmental Officer.
	Feral pests are not impacting on the intended land use.	Feral pests within rehabilitation or biodiversity offset areas are being managed until data from analogue sites is available.	Quarterly visual inspection by Environmental Officer.
Source: Modified after WCC (2011) - Table 10			

The rehabilitation criteria have been broadly defined to align with the rehabilitation objectives outlined in Section 2.10.2 and the rehabilitation hierarchy discussed in Section 2.10.3.4. The rehabilitation criteria aim to achieve the following.

- The ongoing refinement of completion criteria and monitoring programs that would facilitate lease relinquishment following mine closure.
- Alignment with rehabilitation and biodiversity offset area objectives.
- The facilitation of continuous improvement in restoration management practices of the rehabilitation and biodiversity offset areas.

The completion criteria and performance indicators are to be reviewed and revised in accordance with DRE (2013) following determination of the Proposal as part of the preparation of a MOP amendment. The rehabilitation monitoring strategy is likely to remain generally be in accordance with the current monitoring program, the purpose of which is to ensure the sustainable re-colonisation and ongoing management of native flora and fauna, and a guide to continual improvement of rehabilitation practises.

2.10.6 Rehabilitation Methods and Procedures

2.10.6.1 Introduction

The rehabilitation procedures to be implemented would not vary significantly from those currently implemented and documented in the BOMP, MOP and annually updated in AEMR for the mine. The following sub-sections identify those components of the Mine where rehabilitation would be modified as a result of the Proposal and provides a summary of the methods to meet the objectives described in Section 2.10.2, principal land uses described in Section 2.10.3 and final landform described in Section 2.10.4 (see **Figure 2.6**) by following the rehabilitation hierarchy set out in Section 2.10.5.

2.10.6.2 Decommissioning Activities

Decommissioning activities would be undertaken upon cessation of mining and processing activities. The only additional structure or facility requiring decommissioning and removal prior to final rehabilitation of the Mine would be the Dry Separation Plant.

The re-use at another site or sale of the Dry Separation Plant would be the preference of the Proponent. Should such a relocation or sale not eventuate, the structure would be separated into smaller sections with parts on-sold as scrap metal and any useable elements transported to a storage facility off site.

2.10.6.3 Integrated Landscapes

The Proposal would result in a variation to the area of the overburden emplacement, however, this would still be profiled so as to integrate with the surrounding landforms and the rehabilitated final void, Mine Infrastructure Area and MIA Bund (see **Figure 2.6**). The rehabilitation procedures would, however, remain the same as described in the current MOP.

- Materials suspected of being chemically unfavourable for revegetation would be buried a minimum of 2m below the final rehabilitated land surface.
- Where practicable, the exposure of large rocks on the final surface would be minimised by placing a layer of friable or weathered materials between the subsoil and topsoil and the more competent overburden and interburden materials below.
- The overburden emplacement would be profiled to create final slopes with gradients of 10°or less.

- The open cut void will be backfilled to 5m above the recovering groundwater table, currently estimated to be 330m AHD (RCA, 2010).
- The final faces of the open cut void would be left with a slope angle not exceeding 18°.
- The MIA and MIA Bund would be profiled to create final slopes with gradients of 10° or less.
- Where possible, the landform would be shaped to form undulating profiles, sympathetic to the natural landforms of the surrounding environment.
- Contour banks would continue to be progressively installed on the rehabilitated landform.

2.10.6.4 Sustainable Growth and Development

Soil Management

The rehabilitation procedures for soil management during the sustainable growth and development stage of the rehabilitation hierarchy would remain the same as current practice.

- Soil would be placed on the shaped landform. Soil would be preferentially sourced from areas being stripped in advance of mining or, if no such materials are available, from previously established stockpiles.
- The soil would be respread in accordance with the recommendations outlined in the MOP.
- Soil would not be respread when moist, to avoid excessive compaction, or too dry to avoid excessive dust and wind erosion.
- The subsoil would be first spread with topsoil then spread over the subsoil layer on an even but roughened surface which would be ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping would also assist the keying of the soil, maximise aeration and infiltration and minimise erosion.
- If required, soil would be ameliorated prior to revegetation to prevent surface crusting, increase moisture and organic content, and/or buffer surface temperatures to improve germination.
- Finally, previously cleared and stockpiled vegetation would then be spread over those areas designated for native woodland re-establishment as coarse woody debris and stag trees.

The thickness of subsoil and topsoil replaced has been determined based on the:

i) thicker soil layers being replaced in areas designated for agricultural land uses; and

ii) volumes of the various soils stripped on the Mine Site.

A comprehensive description of soil stripping and reapplication depths is provided in the MOP for the Mine.

An inventory of soils would continue to be maintained at the mine to ensure that adequate soil resources remain available for completion of mine rehabilitation.

Revegetation

The rehabilitation procedures for revegetation during the sustainable growth and development stage of the rehabilitation hierarchy would remain the same as current practice.

Agricultural Land

The areas designated for agricultural land (see Panel 3 of **Figure 2.6**) would be sown with a mixture of pasture species appropriate to the season. The seed mixture would be determined by the intended crop or agricultural activities proposed for the land.

Woodland Vegetation Communities

All areas of the final landform designated for the establishment of woodland vegetation communities (see Panel 3 of **Figure 2.6**), would be excluded from stock.

Woodland revegetation would be undertaken via a combination of direct seeding and planting. Seed and plants would, subject to commercial availability and seasons, be of local provenance. Species selection would include a combination of over-storey, middle-storey and under-storey strata and be selected from the species lists provided in the BOMP.

The Proponent has successfully commenced rehabilitation of the woodland vegetation communities on the southern and eastern slopes of the overburden emplacement (see **Figure 1.4**).

2.10.6.5 Final Land Use

During the final land use stage of the rehabilitation hierarchy, the established vegetation would be monitored in accordance with the procedures summarised in **Table 2.7** and the BOMP.

2.10.7 Rehabilitation Maintenance and Post-Mining Management

2.10.7.1 Rehabilitation Maintenance

The Proponent would maintain an ongoing rehabilitation monitoring program in accordance with existing procedures.

2.10.7.2 Post-Mining Management

The overall success of mine rehabilitation would continue to be measured by qualified ecologists who would be able to make comparisons of rehabilitated areas with control plots established in the Biodiversity Offset Area. This work has already commenced in accordance with the BOMP. This process is to be further defined in the *Mine Closure Plan* for the site which would be completed prior to mine cessation.

2.10.8 Noxious Weed Management

The Proponent would continue to monitor environmental and noxious weeds on a regular basis with an external weed spraying contractor engaged to undertake weed management campaigns across the site.

2.10.9 Biodiversity Offset

The Proposal, including the off-site irrigation areas, would not require any additional disturbance to native vegetation of threatened species habitat and therefore no additional biodiversity offsetting is required.

2.11 DEVELOPMENT ALTERNATIVES

2.11.1 Introduction

An analysis of any feasible alternatives to carrying out a proposed development is a required component of the *Environmental Assessment*. The fact that the Mine has been operating to a specific design for almost 10 years effectively reduces the range of alternatives that need to be considered given the knowledge and experience gained to date. The consideration of feasible alternatives to the activities proposed relate principally to:

- overburden emplacement design (Section 2.11.2);
- acoustic and visual amenity bund design (Section 2.11.3);
- alternate water management options (Section 2.11.4); and
- coal washing (Section 2.11.5).

2.11.2 Overburden Emplacement Design

The overburden emplacement has been designed to minimise the footprint of the mining operation by maximising the volume of overburden and interburden replaced within and over the open cut void. The visibility of the overburden emplacement from vantage points surrounding the Mine has always been a consideration in the design of this structure and some consideration was given to further extending the out-of-pit component of the emplacement to retain the 400m to 445m AHD section to its current extent.

Southerly or Westerly Extension

Consideration to increasing the disturbance footprint of the overburden emplacement to the south and west was considered by the Proponent. As noted above, this would have allowed the extent of the 400m to 445m AHD section of the overburden emplacement to remain at its currently designed northerly extent. In doing so, the visibility of the overburden emplacement from vantage points to the north would remain unchanged from those previously assessed.

However, by increasing the lateral extent of the overburden emplacement, additional disturbance to derived native grassland communities aligned with the Grassy White Box Woodland community would be required. Notably, these areas currently form a component of the approved Biodiversity Offset Area, creating both an ecological and an administrative constraint (as restrictions on development associated with the BOA are to be included on the title of the relevant properties). Furthermore, the emplacement would have to move closer to properties and residences to the south of the Mine Site, with the resultant affect on visual amenity. Finally, the lateral extension of the overburden emplacement would require relocation of the Site Access Road.

The Proponent considers that the change in visibility of the overburden emplacement as a result of the northerly extent of the 400m to 445m AHD lifts would result in less significant impacts than a lateral extension, which would impact both on visual amenity and biodiversity. Impacts on visual amenity are assessed further in Section 4.5.

Alternative to Upper Plateau

The DRE has requested consideration be given to modifying the overburden emplacement design to limit the occurrence of an upper plateau as this style of landform is not a common feature of the local setting.

The Applicant has previously considered an alternative design to the upper lifts and advancing face of the overburden emplacement which would limit the area of upper plateau on the overburden emplacement. A more distinct 'hill-top' would be constructed adjacent to where the southeastern, southern and southwestern slopes of the overburden emplacement crest. This would then fall away gradually to the north with stabilised gullies constructed to divert runoff from the hilltop. **Figure 2.7** provides a conceptual illustration of this alternative overburden emplacement design.

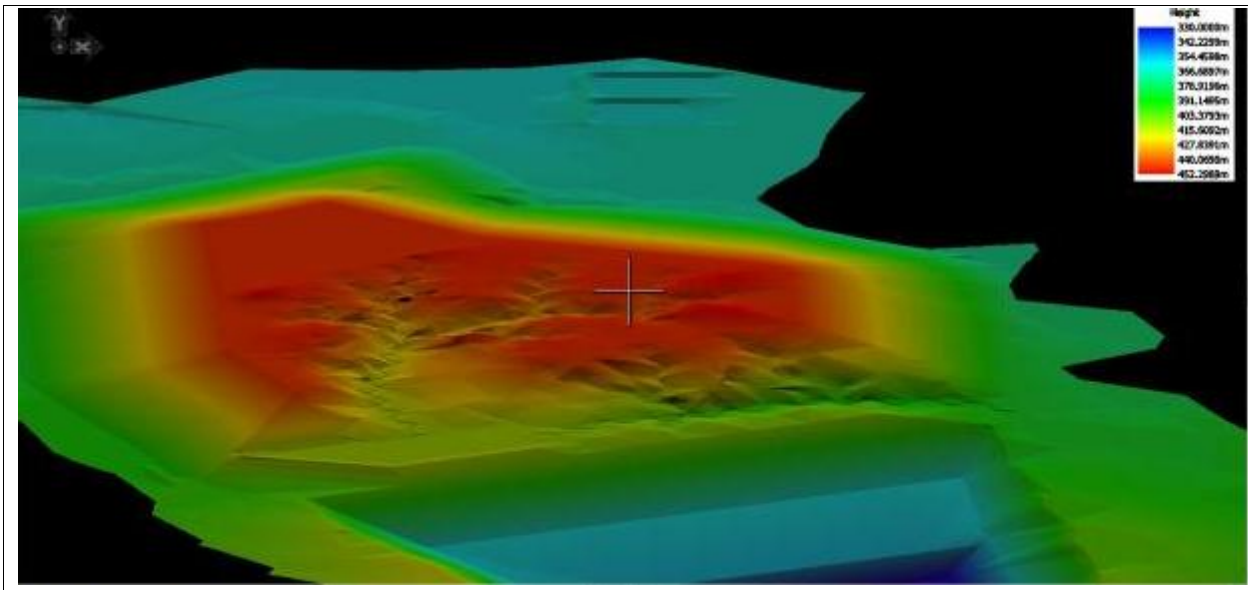

Figure 2.7
ALTERNATIVE OVERBURDEN EMPLACEMENT CONCEPT

Unfortunately, to accommodate this design, the overburden emplacement would require an increase in elevation of at least 10m. This contradicts commitments made in the 2010 EIS (RWC, 2010) on which PA 10_0059 was granted and plans approved by the DRE as part of the Mining Operations Plan for the Mine.

Furthermore, the appearance of the advancing face of the overburden emplacement would not appear significantly different to that of the current design given the distance between the overburden emplacement and residential vantage points to the north. That is, given most residential vantage points are below an elevation of 445m AHD, it is the northern slope of the overburden emplacement that is visible, not the upper plateau.

On the basis of the above, while a redesign of the overburden emplacement to minimise the occurrence of an upper plateau has been considered, it is not considered feasible given the constraints imposed by the height restriction on the overburden emplacement and limited effect on the views available from vantage points surrounding the Mine Site.

2.11.3 Acoustic and Visual Amenity Bund Extension

The DPE requested consideration of modification to the Acoustic and Visual Amenity Bund, either through lateral or vertical extension, as a means of possibly reducing noise levels received at receivers beyond the Mine Site.

Lateral extension to the northwest, effectively merging the bund with "Cintra Hill", would have little impact on the noise levels received at receivers to the east of the Mine Site as the existing bund design already provides for a noise barrier between mining noise sources and these residences. A lateral extension of the bund might have some effect in reducing noise levels at receivers to the north of the Mine Site, however, as is presented in Section 4.2, compliance with noise criterion at receivers to the north of the Mine Site has been achieved since 2010 and is predicted for the modified operations. Also of relevance is the fact that an extension onto "Cintra" Hill would require disturbance to native vegetation mapped as White Box Grassy Woodland (and Endangered Ecological Community) (Eco Logical, 2010). Therefore, on the basis that the extension would have limited benefit to the local noise environment, but detrimentally impact on biodiversity, this alternative modification has been rejected.

A vertical extension of the Acoustic and Visual Amenity Bund would potentially reduce the noise levels received to the east of the Mine Site, although the quantum of noise reduction during the maximum inversion conditions (12°/100m) is likely to be much less than under other conditions. The vertical extension of the bund is, however, constrained by the area available for construction between the open cut and Werris Creek Road. In order to maintain the gentle 10° slopes, a commitment made as part of the LOM Project (RWC, 2010), the bund would have to be constructed closer to Werris Creek Road (extension to the west is limited by the open cut itself). It is considered that the currently design set-back distance between the bund and the road (between 20m and 30m) has been minimised. Steepening the slopes of the bund (to enable an elevation increase without increasing the area of impact) would affect landform creation and rehabilitation (some of which has already been completed), reducing the amenity of the landform while under construction and when completed. It is considered that the minor benefit that would be achieved through a marginal reduction in occasional and seasonal maximum noise levels received at a handful of residential receivers, would be outweighed by the more permanent reduction in amenity generated by increasing the height and steepness of the created landform which occurs in a prominent location along Werris Creek Road.

On balance, it is assessed that there is no reason for the Acoustic and Visual Amenity Bund to be extended, as the benefits would be relatively minor, temporary and affect only selected receivers, whereas the consequential impacts would be more permanent and irreversible.

2.11.4 Water Management Options

2.11.4.1 Introduction

Several alternative strategies for managing excess void water have been considered by the Proponent. These are presented, along with the reason for rejection of each in favour of the current proposal to irrigate on lands adjacent to the Mine.

2.11.4.2 Additional Surface Void Water Dams

The construction of additional surface water dams was considered. The obvious advantage of this alternative would be that it provides a tangible increase in the storage capacity of the Mine Site.

However, a number of disadvantages or negative environmental impacts have been identified with this alternative.

- The disturbance footprint of the Mine Site would be increased. In order to provide for the storage of excess water generated by a 90th percentile rainfall year when mining is at the lowest point in the open cut, it has been estimated that an additional area of at least 15ha for the construction and management of a dam(s) would be required.
- These dams, as above ground structures without natural inflow, would have limited use post-mining and require rehabilitation.
- The construction of these dams could be redundant if high rainfall years are not encountered. Given the water balance presented and proposed continued water management strategy which maximises the use and evaporation of void water, if median rainfall years or less are encountered, there may not be a need for additional dams. This would result in disturbance without any notable benefit.

By contrast, the proposed irrigation method of managing excess water would not require any significant disturbance, could be undertaken without adverse impact on the soil and receiving catchment, provide a positive impact on the land use where would be applied, and allow for a more flexible approach to the management of excess void water. That is, the method need only be implemented in the event of high rainfall resulting in excess water.

2.11.4.3 Additional Evaporator Units

The use of additional evaporator units would potentially allow for the removal of surplus void water which accumulates within the open cut. This option has been considered, however, is considered a less preferred use of the water.

While the void water is marginally brackish (see Section 2.5.2), it remains a resource for agricultural activities, irrigation or stock watering. Therefore, the use of this water for irrigation or other off-site agricultural purposes, subject to ensuring no short or long-term impacts on soils or receiving waters, is considered more beneficial than removal through evaporation. Section 4.6.5 provides assessment of the likely impacts on soil and receiving waters.

2.11.4.4 In-pit Storage of Void Water

As is currently management practice, in the event that the capacity of the void water dams is reduced, void water may be retained in the base of the open cut. However, as the open cut approaches and mines through the lower coal seams at the base of the synclinal formation, the opportunity to store water within the open cut is significantly reduced as the active mining area occurs at the lowest points in the open cut. This would prevent access to the exposed coal seams, which in turn would affect coal recovery and mine progression.

2.11.4.5 Alternative Mine Site Water Use

The Applicant already maximises the use of void water on the Mine Site. In addition to the watering of roads, hardstands and other trafficked areas by water trucks, areas associated with the former underground mine and clearing ahead of mining (pre-strip) have sprinkler systems implemented to reduce the potential for dust lift-off.

The potential to use similar sprinklers to irrigate areas of the rehabilitated overburden emplacement has been considered. However, given the primary objective of rehabilitation is the reinstatement of a sustainable grassy woodland vegetation community, the watering of these areas is likely to be counter-productive to this objective for the following reasons.

- The additional water would promote the growth of weed species which may otherwise struggle to establish under the natural rainfall regime.
- The additional water may result in some dependence of the native vegetation on this additional water. On cessation of this irrigation towards or at the end of mining could then lead to significant die-off. This would be especially significant for native tree species.
- Runoff from rehabilitation areas would no longer be able to be discharged from dirty water dams significantly increasing the volume of water to be managed by the void water system.
- The void water is marginally brackish and exceeds the relevant trigger for stream water quality for a NSW upland stream (350µS/cm) (ANZECC, 2000). As the rehabilitation landform is not proposed for a land use of grazing or irrigation, this criterion is considered the most appropriate and would preclude the application of brackish void water.

2.11.4.6 Off-site Transfer of Water (via Pipeline)

The Proponent considered the construction of pipeline infrastructure to supply water to private properties adjacent to the Mine. This option was initially rejected on the basis that the volume of water likely to be taken by local properties would not be significant when considered against the large volumes of void water generated and maintained on the Mine Site.

The Applicant has recently been made aware of community discussions with the EPA regarding the potential for Mine supply of water local land owners. WCC has included in consideration the ability to supply water for agricultural use to adjacent privately owned properties in addition to land owned by the Mine.

2.11.4.7 Off-site Transfer of Water (via Road)

The Proponent also considered the possibility of providing the excess void water to other users which would be transferred from the Mine by road (water tankers). The relatively small volume of water likely to be taken was an important factor in rejecting this option, which would also:

- increase in the number of truck movements to and from the Mine; and
- increase the potential for contamination of roadside land and water in the event of a spillage or leakage from the truck.

2.11.4.8 Discharge to Quipolly Creek

The Proponent was approached by a local land owner who enquired as to the potential for water to be returned to Quipolly Creek. This option for managing excess water was considered and would simplify the management of the excess volume. This option will not proceed, however, on the basis that:

- the void water is marginally brackish (see **Table 2.2**) and exceeds the ANZECC (2000) default trigger for slightly disturbed ecosystems for upland rivers in southeast Australia (350µS/cm);
- the void water contains elevated concentrations of Nitrogen, in particular nitrate, which exceeds the ANZECC (2000) default trigger for slightly disturbed ecosystems for upland rivers in southeast Australia; and
- additional assessment of the affect of any release on the hydrology, chemistry and geomorphology of Quipolly Creek would be required for the consideration of the NSW Environment Protection Authority.

2.11.5 Coal Washing

An alternative to the dry separation process of removing impurities from the coal, a washing process could have been introduced to the Mine. This option has been rejected in favour of the dry separation process as by washing the coal, a new waste stream (coal tailings) would be introduced to the Mine Site. If tailings were to be co-disposed with overburden, further design work would be required to ensure that the overburden emplacement was of sufficient capacity (total and active) to accommodate the new waste stream. If to be disposed of separately, new areas of disturbance would be required and increased rehabilitation liabilities incurred for the construction of tailings dams.