MAULES CREEK COAL MINE

MINING OPERATIONS PLAN

~~1 December 2017~~November 2018

MAULES CREEK COAL PTY LTD
Therribri Road, BOGGABRI NSW 2382

MOP Title Block

MAULES CREEK COAL MINE		
Mining Operations Plan		
Name of Mine	Maules Creek Coal Mine	
MOP Commencement Date	Date of MOP approval	
MOP Completion Date	1 January 2023	
Mining Authorisations (Lease/License No.)	CL 375, ML1719 and ML1701.	
Name of Authorisation / Authorisation holder(s)	Maules Creek Coal JV that comprises: Aston Coal 2 Pty Ltd (75%), ICRA MC Pty Ltd (15%), J Power Australia Pty Ltd (10%)	
Name of Mine Operator (if different)	Maules Creek Coal Pty Ltd	
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Date	19 / 10 / 2018.	
Version	Final	

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1 INTRODUCTION

1.1 HISTORY OF OPERATIONS

1.1.1 Project Background

The Maules Creek Coal Mine (MCCM) is located on the north-west slopes and plains of New South Wales (NSW), approximately 18 kilometres (km) north-east of Boggabri. The regional centres of Narrabri and Gunnedah are situated approximately 45 km to the north-west and 55 km to the south from the MCCM respectively. The MCCM's regional locality is illustrated in Plan 1A.

The ownership of the MCCM currently lies with Maules Creek Coal Joint Venture (MCCJV), which is a joint venture between Aston Coal 2 Pty Limited (a company 100% owned by Whitehaven Coal Limited [Whitehaven]) (75 percent [%]), ITOCHU Coal Resources Australia Maules Creek Pty Ltd (15%) and J-Power Australia Pty Limited (10%). The MCCM is managed by Maules Creek Coal Pty Ltd (MCC) (a wholly owned subsidiary of Whitehaven) on behalf of the MCCJV.

An Environmental Assessment for the Maules Creek Coal Project (referred to herein as the Project EA) was prepared by Hansen Bailey (2011) and was assessed under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in 2012 and 2013. The NSW Planning Assessment Commission (PAC), as a delegate for the NSW Minister for Planning and Infrastructure, issued the State environmental approval for the MCCM on 23 October 2012 (i.e. Project Approval PA 10_0138). The MCCM Commonwealth environmental approval (i.e. EPBC 2010/5566) was granted on 11 February 2013 by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

The environmental approvals for the MCCM allow for the construction and operation of an open cut coal mine until the end of December 2034. In particular, the approvals authorise the following activities.

- construction and operation of an open cut mining operation extracting up to 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.
- open cut mining fleet including excavator/shovels and fleet of haul trucks, dozers, graders and water carts;
- construction and operation of a Coal Handling and Preparation Plant (CHPP);
- construction and operation of a rail spur, rail loop, associated load-out facility and connection to the Werris Creek to Mungindi Railway Line;
- construction and operation of a Mine Access Road;
- construction and operation of administration, workshop and related facilities;

- construction and operation of water management infrastructure including a water pipeline, pumping station and associated infrastructure for access to water from the Namoi River;
- installation of supporting power and communications infrastructure; and
- construction and operation of explosive magazine and explosives storage areas.

The Project Boundary (as defined by PA 10_0138) is shown on Plan 1A.

A modification to PA 10_0138 was lodged in April 2013 to allow minor adjustments to the alignment of the CHPP infrastructure and the construction and operation of a TransGrid switching yard and transmission line as well as a minor extension of an existing low voltage (11 kilovolt [kV]) transmission line. The modification was granted on 25 July 2013.

A second modification to PA 10_0138 was lodged in February 2014 to adjust the location of the raw water pipeline and associated pump station. The modification was granted on 10 March 2014.

A third modification to PA 10_0138 was approved on 13 January 2017 to allow adjustments to employee transport conditions.

A fourth modification to PA 10_0138 was lodged in September 2017 to remove sound power specific conditioning. The~~e~~is modification ~~is yet to be determined~~ was withdrawn.

Construction of the MCCM commenced in December 2013 and was substantially completed in 2015. The operations phase of the MCCM commenced in June 2014, and coal was first transported from the MCCM via the rail spur in December of 2014.

1.1.2 Authorisation History

Conzinc Rio Tinto of Australia (CRA) Limited was originally granted Authorisations (AUTH) 346 and A 354 over the MCCM area in November 1979. From early 1980, a comprehensive program of exploration drilling, geological evaluation, coal quality testing, baseline environmental studies, mine planning and infrastructure studies were undertaken by Pacific Coal Pty Limited (a subsidiary of CRA Limited) and its successors to establish the economic and technical feasibility of developing a mine within the Authorisations.

The document entitled *Maules Creek Coal Project Environmental Impact Statement* (Maules Creek EIS) (KCC 1989) was prepared by KCC (on behalf of Coal Cliff Collieries Pty Limited) describing the development of a major mining project. The Application and supporting EIS was submitted to the Narrabri Shire Council (NSC) on 24 October 1989, which was later referred to the (then) Minister for Planning for review and determination. Development Consent (DA 85/1819) was granted to KCC on 12 June 1990 by the then Minister for Planning for the "*construction and operation of a surface and underground coal mine, associated transport and coal loading facilities and railway spur line*".

On 4 June 1991, Coal Lease (CL) 375 was granted to Namoi Valley Coal Pty Limited (NVCPL) for a period of 21 years until 4 June 2012 and simultaneously, AUTH 354 was cancelled. During this time, A 346 was also modified by NVCPL to retain surface rights over the northern portion of CL 375 that was proposed for underground mining development. NVCPL became a wholly owned subsidiary of Coal and Allied Pty Limited (CNA) in 1991. CNA is a subsidiary of the larger Rio Tinto Coal Australia (RTCA).

The Development Consent was activated by CNA with the construction of a water storage dam as part of the mine water management system in the early 1990s. Extensive exploration activities occurred over a number of years to define the local geology and develop a viable mine plan.

In February 2010, RTCA, on the behalf of CNA, sold the rights to the Maules Creek Mine to Aston Coal 2 Pty Limited, which at the time was a subsidiary of Aston Resources Pty Limited (Aston Resources). In late 2010, Aston Resources sold 15% of the Maules Creek Coal Mine to ITOCHU Corporation. In October 2011, Aston Resources entered an agreement for the sale of 10% of the MCCM to J-Power Australia Pty Limited.

Aston Resources announced the entering of a Scheme Implementation Agreement in December 2011 whereby they agreed to merge with Whitehaven. The merger was completed in May 2012. As described in Section 1.1.1, the ownership of the MCCM currently lies with MCCJV, which is a joint venture between Aston Coal 2 Pty Limited (100% owned by Whitehaven), ITOCHU Coal Resources Australia Maules Creek Pty Ltd and J-Power Australia Pty Limited. The MCCM is managed by MCC (a wholly owned subsidiary of Whitehaven) on behalf of the MCCJV.

CL 375 has been renewed for a further 21 years until June 2033. In March 2013 MCC was granted Exploration Lease (EL) 8072 and subsequently granted Mining Lease (ML) 1701 over a portion of EL 8072 in October 2014. ML1719 was approved in 11 November 2015, which replaced an area of AUTH346. AUTH346 was renewed as of 21 November 2016 for a further 5 year period.

1.1.3 Previous MOPs

The initial MOP for the MCCM construction phase covered the period from 1 April 2012 to 1 April 2014 (i.e. Edition 1, Revision 1). However, due to an unforeseen delay in the commencement of construction until the end of 2013, it was replaced by the second MOP (i.e. Edition 2, Revision 1), which covered the remaining construction phase activities as well as the first two years of mining operations (i.e. March 2014 to March 2016). The second edition of the MOP was approved by the DRE on 24 February 2014. An amendment to the second MOP was lodged in March 2015 to authorise some minor footprint changes in Year 2 of the operation (i.e. Edition 2, Revision 2).

The third MOP was approved by DRE on 15 February 2016.

1.1.4 MOP Amendment A

An amendment to the third MOP (i.e. Edition 3, Revision 2, Amendment A) was lodged in October 2016 to authorise placement of overburden in the out-of-pit overburden emplacement area to the south (Plan 3A and Plan 3B).

The MOP Amendment A was approved by DRE on 8 November 2016.

1.1.5 MOP Amendment B

A second amendment to the third MOP (i.e. Edition 3, Amendment B) was lodged in December 2016. The MOP Amendment B contained a refined mine design (i.e. refinements to the high wall dam, topsoil stockpiles and drainage) resulting in less native vegetation clearance within the MOP term compared to that reported in MOP Edition 3, Revision 2, Amendment A (approximately 70 ha less total disturbance area).

The second amendment to the third MOP also included a revision to Section 2.3.1 (Resource Definition).

1.1.6 2018 MOP

A new 2018 MOP was lodged in February 2018. This MOP was prepared in accordance with *ESG3: Mine Operation Plan (MOP) Guidelines, September 2013,* and contained proposed rehabilitation phase progressions for the nominated MOP term.

The 2018 MOP was approved by DRG on the 2nd February 2018 for a period up until the 30th November 2018.

1.1.7 Relationship between this MOP Amendment A and other MCCM Management Plans

This MOP Amendment A has been prepared to satisfy the requirements of the mining tenement conditions for the MCCM, which is a Level 1 Mine in accordance with the NSW Department of Industry, Skills and Regional Development (DISRD) – Division of Resources and Energy (DRE) 2013 MOP guidelines (i.e. *ESG3: Mine Operation Plan (MOP) Guidelines, September 2013).* These guidelines are referred to herein as the MOP Guidelines.

The MOP Guidelines require the MOP to include specific details of proposed mining activities, post mining land use and rehabilitation activities during the term of the MOP.

This MOP is the ~~fourth~~ fifth prepared for the MCCM and covers the period from the date this MOP is approved to the 1 January 2023.

PA 10_0138 contains conditions pertaining to the rehabilitation of the MCCM (i.e. Conditions 71 to 74 of Schedule 3), including a requirement to prepare a Rehabilitation Management Plan (RMP) to the satisfaction of the Executive Director Mineral Resources (i.e. Conditions 73 and 74).

This MOP satisfies the requirements of Conditions 73 and 74 of Schedule 3 of PA 10_0138 [i.e. preparation of a RMP]). Section 4.1.2 indicates where in this MOP the content requirements of the RMP are addressed.

The Commonwealth approval for the MCCM (i.e. EPBC 2010/5566) also contains conditions related to rehabilitation and the final landform of the MCCM (i.e. Conditions 25 to 30). In order to address these requirements MCC has prepared a separate stand-alone Mine Site Rehabilitation Plan (MSRP). Despite being stand-alone documents, this MOP and the MSRP are designed to complement and be consistent with each other.

This MOP has also been designed to closely integrate with other relevant MCCM management plans such as the Biodiversity Management Plan (BMP) (required under Condition 52 of Schedule 3 of PA 10_0138), the Threatened Fauna Implementation Plan (Condition 50 of Schedule 3 of PA 10_0138) and the Box-Gum Woodland Endangered Ecological Community Implementation Plan (Condition 48 of Schedule 3 of PA 10_0138) where relevant.

This MOP contains references to these other plans and documents where appropriate and specifically addresses Schedule 3 Condition 73(d) of PA 10_0138, how site rehabilitation is to be integrated with the biodiversity management plan, through adoption and alignment of the plans rehabilitation strategy (section 2.1.5), objectives (sections 4.2 and 4.3), performance and completion criteria (section 6), and monitoring program (section 8).

1.2 CURRENT CONSENTS, AUTHORISATIONS AND LICENCES

Table 1 provides a summary of the key licences, leases and approvals that have been obtained for the MCCM.

Table 1
Consents, Leases and Licences

Approval	Reference	Detail	Validity Dates
Project Approval	PA 10_0138	Pursuant to the Project EA, the PAC approval of the MCCM referred to in Schedule 1 subject to the conditions in Schedules 2 to 5.	23 October 2012 to December 2034
Project Approval Modification	PA 10_0138 (MOD1)	Pursuant to the Maules Creek Project Approval Modification Environmental Assessment, the Modification was granted to allow modifications to infrastructure requirements.	Granted on 25 July 2013
Project Approval Modification	PA 10_0138 (MOD2)	Pursuant to the Maules Creek Project Approval Modification Environmental Assessment, the Modification was granted to allow the design of key water related infrastructure to be optimised.	Granted on 10 March 2014
Project Approval Modification	PA 10_0138 (MOD3)	Pursuant to the Maules Creek Project Approval Modification Environmental Assessment, the Modification was granted to allow adjustment to transport conditions.	Granted 13 January 2017
Coal Lease	CL 375	Covers an area of approximately 4,200 hectares (ha). The southern part of the lease covers rights to mine from the surface to unlimited depth (~2,500 ha). The northern part of the lease covers rights to mine from 20 metre (m) depths to unlimited depth (~1,700 ha).	4 June 1991 to 4 June 2033
Authorisation	AUTH 346	Covers the rights of the northern part of CL 375 from the surface to 20 m depth (~1,700 ha).	Expires 28 February 2021
Mining Lease	ML 1719	Covers the area to the north of the surface rights of CL 375, over a portion of AUTH 346 that will accommodate part of the Northern Overburden Emplacement Area (OEA) for the MCCM.	Granted 11 November 2015 to 11 November 2036
Mining Lease	ML 1701	Covers the area to the west of CL 375 within the Project Boundary that will facilitate the extraction of some coal and accommodate some mine related infrastructure.	Granted 9 October 2014 to 9 October 2035
Exploration Lease	EL 8072	Covers the area to the west of CL 375 that will facilitate the extraction of some coal and accommodate some mine related infrastructure.	~~Expires 12 March 2018~~ Under renewal
~~Environment Protection Licence (EPL)~~	~~EPL 20221~~	~~Applies to activities associated with the MCCM.~~	~~From 2 May 2013~~
Surface Water Licence	90CA834999	Water supply for mining and irrigation one Overshot dam and a 150 millimetre (mm) Centrifugal Pump (previously 90SL1010609).	Expires 09 November 2025
Water Supply Works Approval	90WA801901 DWE Ref no: 90AL801900	Allows construction of a 610 mm Axial Flow Pump located on the Namoi River.	1 July 1 2004 to 30 June 2027

Table 1 (Continued)
Consents, Leases and Licences

Approval	Reference	Detail	Validity Dates
Forest Corporation NSW Compensation	N/A	Agreement applies to part of Leard State Forest No. 420 that occurs within CL 375 and any mining lease pursuant to MLA 404 being ML1719.	July 2016 to 30 June 2021
Emergency Tailings Emplacement		Notification of High Risk Activity – Emergency Tailings Emplacement	Notification provided April 2015.
Bore Licence	90WA809078	Bore constructed in the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source.	Commencement 1 November 2006
Bore Licence	90WA809079	Bore constructed in the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source.	Commencement 1 November 2006
Bore Licence	90WA809300	Bore constructed in the Upper Namoi Zone 4 Namoi Valley (Gins Leap to Narrabri) Groundwater Source.	Commencement 1 November 2006
Bore Licence	90WA809127	Bore constructed in the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source.	Commencement 1 November 2006
Bore Water Licence	90WA822412	Previously 90BL255704. 6 ML bore licence for industrial and mining purposes. 306ML Gunnedah – Oxley Basin Mdb Groundwater Source	Granted 7 June 2010 to 6 June 2025
Bore Licence	90WA820120	Previously 90BL001144. Gunnedah – Oxley Basin Mdb Groundwater Source.	Granted 28 February 1939 for perpetuity. Converted 16 January 2012.
Bore Licences	90BL255779 90BL255780 90BL255781 90BL255782 90BL255783 90BL255784 90BL255785 90BL255786 90BL255787 90BL255788 90BL255789 90BL255790	For the purpose of Monitoring Bores.	Granted 25 August 2010 for perpetuity.
Water Access Licence	WAL12811	135 Units with works approval 90CA807230. Upper Namoi Zone 5 Namoi Valley (Gins Leap to Narrabri) Groundwater Source.	Transferred to Aston 16 November 2010 Tenure continuing.
Water Access Licence	WAL29467	6 ML water licence from porous rock water source for construction purposes.	Tenure continuing

Table 1 (Continued)

Consents, Leases and Licences

Approval	Reference	Detail	Validity Dates
Water Access Licence	WAL29588	300 ML water licence from porous rock water source under works approval 90CA826925.	Granted 21 June 2012 for perpetuity.
Water Access Licence	WAL 27385	38 ML water licence from Namoi Groundwater Zone 4.	Granted 24 April 2012 for perpetuity.
Water Access Licence	WAL12479	78 ML water licence from Namoi Groundwater Zone 11 under works approval 90CA807652.	Granted 2 November 2011 for perpetuity
Water Access Licence	WAL27383	0 ML water licence from Namoi Groundwater Zone 11.	Spare WAL. Granted 24 October 2011 for perpetuity.
Water Access Licence	WAL13050	3000 ML water licence from Lower Namoi Regulated River Water under works approval 90WA801901.	Granted 23 August 2011 for perpetuity.
Environment Protection Licence	EPL 20221	The Environment Protection Authority (EPA) issues environment protection licences to the owners or operators of various industrial premises under the *Protection of the Environment Operations Act, 1997* (POEO Act). Licence conditions relate to pollution prevention and monitoring, and cleaner production through recycling and re-use and the implementation of best practice.	Issued 2 May 2013 ~~Application to vary EPL Licence submitted October 2017.~~

1.3 LAND OWNERSHIP AND LAND USE

1.3.1 Land Ownership

A figure showing the non-mine owned freehold land ownership outside of the Project Boundary is provided in Appendix A.

The Leard State Forest covers approximately 43% of CL 375, and also covers a large proportion of the planned open cut mining footprint. The majority of the coal resources within CL 375 are therefore located under land not owned by MCC. A Compensation Agreement with Forestry Corporation of NSW is in place to enable MCCM-related activities in these areas.

Several roads and other Crown Land occur within the Project Boundary. A portion of Crown Land and Leard State Forest within ML1719 were subject to the Right to Negotiate Process in accordance with the Commonwealth *Native Title Act, 1993*. MCC has agreements in place with the applicants of the Native Title Claims to access these lands.

MCC and Boggabri Coal Pty Ltd (BCPL), which operates the neighbouring Boggabri Coal Mine, own and have the necessary agreements for, all other land within the Project Boundary that is proposed to be disturbed.

The Leard State Conservation Area is located to the west of the Project Boundary (Plan 1A). This was reserved as a State Conservation Area under the NSW *National Parks and Wildlife Act, 1974* in 2005. No MCCM-related disturbance in this conservation area is proposed.

1.3.2 Land Use

Land use in the local area is dominated by agricultural operations and open cut mining, with rural residential holdings mainly located to the north and west of the Project Boundary. As described in Section 1.3.1, the MCCM is situated on land largely occupied by the Leard State Forest, which has historically been predominantly used for forestry, recreation and more recently, mining related activities (including biodiversity offsets). Other land within the Project Boundary which is owned by MCC has historically been predominantly used for cattle grazing. The Namoi River alluvial floodplains to the west of the Leard State Conservation Area are used for various agricultural grazing and cropping enterprises.

Two other coal mines and several exploration leases exist within close proximity to the MCCM. These include, but are not limited to, the Boggabri Coal Mine, Tarrawonga Coal Mine and the Goonbri Exploration Lease located to the south and south east of the Project Boundary.

1.4 STAKEHOLDER CONSULTATION

A comprehensive stakeholder consultation program was undertaken for the MCCM during the three to four year period leading up to the granting of the State and Commonwealth environmental approvals in late 2012/early 2013.

Since then, MCC/Whitehaven's consultation program has been ongoing and has evolved as the mine has moved through the pre-construction, construction and operations phases.

Much of the consultation has been associated with obtaining licences, leases, permits required for the MCCM and the preparation of the numerous environmental management plans required under the State and Commonwealth approvals. Local, State and Commonwealth Government agencies that have been involved in this consultation include the following.

- Division of Resources and Geoscience (DRG);
- Department of Planning and Environment (DP&E);
- Department of ~~Primary~~ Industri~~es~~y – Water (D~~P~~oI – Water);
- Office of Environment and Heritage (OEH);
- North West Local Land Services (NWLLS);
- Narrabri Shire Council (NSC);
- Forestry Corporation of NSW;
- Environment Protection Authority (EPA);
- Commonwealth Department of the Environment ~~and Energy~~ (DoE~~E~~);

- Gunnedah Shire Council (GSC);
- Department of Primary Industries (DPI);
- Rural Fire Service (RFS); and
- Roads and Maritime Service (RMS).

In addition to the above, Whitehaven has consulted extensively with local landholders and residents, as well as the Registered Aboriginal Parties and other members of the Aboriginal community in regard to local community and cultural heritage management issues. The Maules Creek Community Consultative Committee (CCC) has been established, as required by Condition 7 of Schedule 5 of PA 10_0138.

Whitehaven has consulted with the DRG, DP&E, OEH, Forests NSW, D~~P~~oI Water, North West LLS and Narrabri Shire Council during the preparation of this MOP, as well as during the preparation of the previous editions of the MOP described in Section 1.1.3. Review comment on the MOP has been received from DRG, DP&E and OEH; and has been incorporated into the document as appropriate.

Specific consultation with regard to rehabilitation has also been conducted. The post mining land use, rehabilitation objectives and completion criteria were included within the draft RMP that was distributed for review and comment by the relevant Government agencies in 2013. These included the DP&E, Forestry Corporation of NSW, NOW, OEH, NWLLS and NSC. Comments received from these agencies were incorporated into the second edition of the MOP where relevant.

Some members of the local community also provided MCC with suggestions during the environmental impact assessment process in relation to rehabilitation practices to be implemented at the Project. These suggestions have been considered and incorporated into this MOP where relevant.

One of the key concerns that has been raised previously by stakeholders is the intention to retain a void within the final landform. Extensive mine planning work and reporting was undertaken by MCC through the final stages of the environmental planning approval process in 2012 and 2013 to provide further justification for the need for a final void. The PAC accepted MCC's justification in relation to retaining a final void in the landscape, however included Condition 74 of Schedule 3 of PA 10_0138, which requires a Final Void and Mine Closure Plan for the MCCM to be completed. The Final Void and Mine Closure Plan is to be initially provided to DRG by the end of December 2020 in draft form, with the final being provided to DRG by the end of December 2026.

Condition 74 of Schedule 3 of PA 10_0138 requires extensive work to be completed to determine the ultimate final landform for the MCCM with an overall aim of developing a final landform that blends in with the landforms for neighbouring mining operations and minimises

the extent of any final void. MCC will progressively carry out the required mine planning and investigative works during the operational phase of the MCCM.

2 PROPOSED MINING ACTIVITIES

2.1 PROJECT DESCRIPTION

2.1.1 Mining and Overburden Placement

MCC holds four mining authorisations relevant to the MCCM. These are: AUTH 346, CL 375, ML 1701 and ML1719. Plan 1A shows the location of these tenements.

As described in Section 1.1.1, the MCCM is an open cut coal mine with an approved maximum ROM coal production rate of 13 Mtpa to December 2034. Mining at the MCCM is conducted as a contemporary excavator operation, supported by a fleet of trucks and ancillary equipment. Prior to mining, vegetation is mulched and mixed with topsoil prior to being stripped from the mining area and either used on available rehabilitation areas or stockpiled for later use. Overburden is then blasted prior to being removed by loader and/or excavator and trucks. The mining fleet is then used to uncover each coal seam to be extracted. Mining is conducted up to 24 hours per day, seven days per week.

Overburden generated by the open cut mining is either placed in mined-out portions of the open cut (when suitable areas become available), or is hauled to the overburden emplacement areas.

2.1.2 Coal Handling and Processing

Construction and commissioning of the CHPP was completed in the first half of 2015.

Coal mined from the open cut is delivered directly or from temporary storage in pit to the ROM pad area, where it is either fed directly into the ROM coal hopper from the rear dump trucks or stockpiled for later feeding to the ROM coal hopper via front end loader and/or rear dump trucks. From the hopper the ROM coal is fed through various sizing stations and either bypassed to the product coal stockpiles or fed via a surge bin to the CHPP for washing.

Since the preparation of the Project EA (Hansen Bailey, 2011), MCC has completed further investigations in relation to the management of fine tailings and reject materials for the MCCM. The Project EA described that the ultrafine tailings reject material from the CHPP would be placed in the tailings drying areas until it reached the desired moisture content, where the material would be removed by excavator into trucks for disposal within the active OEAs.

MCC no longer intends to use the approved tailings drying areas, and has instead installed belt press filters (BPFs) within the CHPP. Tailings underflow from the plant thickener is sent to the BPF building where it is flocculated and deposited into a bank of six BPFs. The BPFs dewater the fine tailings material, forming a material containing approximately 35% moisture. This partially dried material is then transferred via conveyor belt to the main reject material conveyors where it is blended within the coarse and fine rejects streams to form a combined reject and tailings material. This reject and tailings material is then transferred to the rejects bin for collection by mine haul truck and final deposition within the OEA or in pit when areas

become available. Reject material identified as being PAF will be placed within the OEA or in pit to provide a final depth of inert cover of at least 15m.

Product coal generated by the MCCM includes bypass coal (i.e. ROM coal that is crushed and screened but not washed in the CHPP) and washed coal that is processed in the CHPP.

The Product coal is fed via conveyors to the Train Loading Facility. Once loaded, trains travel from the MCCM via the Maules Creek Rail Spur, Shared Rail Spur and the Werris Creek to Mungindi Railway Line to the Port of Newcastle for export.

2.1.3 Mine Infrastructure Area

The Mine Infrastructure Area (MIA) is located to the north of the CHPP (Plan 2A and Plan 2B) and contains the following main items:

- administration, office, and bathhouse buildings;
- heavy and light vehicle parking areas;
- waste water storage tanks;
- potable water storage tanks;
- underground electrical installations;
- a helicopter pad;
- heavy and light vehicle workshops (including hot work and hardstand areas);
- a tyre change area and associated storage areas;
- a stores building and associated laydown areas;
- vehicle wash down facilities;
- bulk oil and fuel storage tanks and refuelling facilities; and
- various types of water management infrastructure.

2.1.4 Environmental Management System

MCC has developed an Environmental Management System (EMS) which includes various environmental strategies, management plans, procedures, forms and registers which provide the framework to manage environmental impacts at the MCCM.

The various environmental management plans included within the EMS provide details of the operational controls and monitoring programs to be implemented to facilitate compliance with the relevant regulatory requirements and statutory approvals.

A list of environmental management plans for the MCCM is provided in Appendix B.

2.1.5 Rehabilitation Strategy

The Rehabilitation Strategy for the MCCM is described in Section 7.16 of the Project EA (Hansen Bailey, 2011). The State and Commonwealth approvals both specify that the rehabilitation of the MCCM must be consistent with the Rehabilitation Strategy (i.e. Condition 71 of Schedule 3 of PA 10_0138 and Condition 26 of EPBC 2010/5566). The Rehabilitation Strategy includes a description of the following aspects:

- rehabilitation objectives;
- rehabilitation techniques;
- final landform and rehabilitation domains;
- decommissioning;
- rehabilitation completion criteria; and
- management and mitigation.

Sections 4 to 8 of this MOP summarise the key elements of the Rehabilitation Strategy as well as providing a description of activities and mine landforms that are relevant to the term of this MOP.

2.2 ASSET REGISTER

Table 2 lists the MCCM domains and their size, and the major assets including buildings and other plant within each domain. MCC has prepared a rehabilitation cost estimate for the MCCM which includes estimated costs for the removal of the various assets from each domain.

Table 2
Register of Assets at the Maules Creek Coal Mine during the term of this MOP

Domain	Domain Size at end of MOP	Assets	Asset Description
1E – Infrastructure Area	27~~64~~ ha	Northern Access Route	10 ha in area
		Main Infrastructure (refer to Section 2.1.3 for detail)	17~~86~~ ha in area. Includes infrastructure related to workshop, power reticulation, explosives storage, CHPP and associated infrastructure, MIA and fuel storage areas.
		Rail Infrastructure	88 ha in area.
3B – Water Management	63 ha	Dams and Drains	
4E – Overburden Emplacement	600 ha	Waste Dump	
5E - Stockpiled Material	149 ha	Topsoil Stockpiles	
6I – Void 7E - Rehabilitation	309 ha 3~~03~~4 ha	Mining Area Rehabilitation	

2.3 ACTIVITIES OVER THE MOP TERM

2.3.1 Resource Definition

Resource definition will continue to be undertaken at the MCCM to further define the coal reserves within the MOP area of CL 375 to support the mining proposed as part of the MOP. The focus of this work is likely to involve between 200 and 300 holes are planned to be drilled within CL375 over the MOP period. The drilling will include a combination of hammer (125 mm) and core drilling (99 mm) to a maximum depth of approximately 350 metres. This ancillary mining activity would occur within the approved mining area shown on Plan 3B (Project Disturbance Boundary) i.e. would not involve additional disturbance.

2.3.2 Remaining Construction Activities

The remaining construction activities that are scheduled to be undertaken during the term of this MOP will occur in the MIA and will include construction/installation of the following:

- heavy and light vehicle workshops, including hot work and hardstand areas;
- administration and operations buildings;
- raw and mine water storage;
- potable water storage;
- underground electrical installation;

- tyre change area and associated storage areas; and
- stores building and associated laydown areas.

A new go-line/deployment area is planned to be established in pit during the term of the MOP.

2.3.3 Mine Operations

In accordance with the current BMP, vegetation clearing activities in mining areas will be conducted during an annual ten week clearing campaign from the 15th February to the 30th April each year, except under exceptional circumstances and with the approval of the Secretary of the DP&E.

The Land Disturbance Protocol (LDP) will be applied prior to the clearing of any native vegetation, in particular vegetation clearing activities in advance of mining. The LDP is used to manage the clearing process and to document all licensing, safety and management requirements. It is an environmental checklist that must be completed for each stage of clearing by the person responsible for the clearing activities, the relevant technical expert (e.g. Electrical Engineer to confirm no presence of cables, etc.) and signed off by the Environmental Superintendent or a delegate and final signoff by the Site Manager.

The planned vegetation clearing areas for the 2018-2022 calendar years covered by this MOP are shown in Plan 3A and Plan 3B respectively.

Stripping and stockpiling of soil resources in the open cut areas to be cleared will be conducted as outlined in the Soil Management Protocol, a summary of which is provided in Section 3.2.4.

Overburden removal from the open cut will be undertaken during the term of the MOP using excavators/loaders and a supporting truck fleet.

Based on the waste removal requirements at steady state production rates, there will be a requirement for up to an average of four blasts per week. These blasts will be fired during the hours of 9:00 am to 5:00 pm Monday to Saturday, excluding Sundays and public holidays unless prior approval from the relevant Government agencies is given.

The MCCM requires the storage of explosives and other related materials. These storage facilities have been designed and sited within the Project Boundary in accordance with the relevant Australian Standards (AS) 2187.1:1998 *Explosives – Storage, Transport and Use*.

The explosives storage facilities include a magazine facility for the storage of high explosives and detonators, and an Ammonium Nitrate (AN) storage facility.

The magazine facility is located to the north of the MIA and consists of a fenced and bunded compound that contains separate magazines for storage of detonators and high explosives.

The AN storage facility is located beyond the north eastern extent of the active mining area. It consists of a fenced compound that contains storage containers for Ammonium Nitrate emulsion, Ammonium Nitrate prill, mineral oil, and polystyrene balls. During the MOP period the AN storage facility will be relocated to an area closer to the magazine facility. There is also a reload area and hardstand for bulk explosive trucks.

2.3.4 Overburden Emplacements

The location and extent of the overburden emplacement areas during the period covered by this MOP are shown on **Plans 3A-3E.** The overburden emplacement areas will continue to develop to the final extent approved under Project Approval PA 10_0138.

A summary of the key findings of the geochemical test work conducted prior to and since approval of the MCCM is provided in Section 3.2.1. During mining operations the identification of Potentially Acid Forming (PAF) overburden and rejects is undertaken through the use of drill hole sampling. Further discussion of the monitoring and management measures to be used is provided in Section 3.2.1.

2.3.5 Processing Residues and Tailings

Depending on its quality, coal is either fed into the CHPP or into the raw coal bypass system. The product handling system uses a linear travelling slewing and luffing stacker to distribute the coal to the product stockpiles. From the stockpiles the product coal is reclaimed and conveyed to the train load-out facility where it is loaded onto trains.

The coarse reject materials generated at the CHPP and the processed tailings generated by the BPF's are diverted to a storage bin prior to being loaded into trucks and transported for co-disposal in the overburden emplacement areas, or to suitable areas of the open cut.

2.3.6 Power and Communications

The power requirement for the MCCM is estimated to be approximately 12 megawatts (MW) per year once the operations ramp up to the approved 13 Mtpa production rate. Power is supplied by TransGrid infrastructure including a 132 kilovolt (kV) high voltage transmission line and a TransGrid switch station.

MCC has constructed a 132/22 kV substation adjacent to the TransGrid switch station which provides a 22 kV power supply to the MCCM.

A 22kV switch yard has also been constructed to distribute power, via underground cables, to a number of Kiosk Substations in the MIA and the CHPP areas including pumping stations.

Communications for the MCCM are via a microwave link that that has been installed on the mine site. An underground fibre optic network has also been installed to connect the various infrastructure required for the day to day operations of the mine.

2.3.7 Water Management System

A Water Management Plan has been developed for MCCM in accordance with Condition 40 of Schedule 3 of PA 10_0138.

The water management structures used during the operational phase of the MCCM will be constructed on a staged basis during the mine life and will be used to store, control erosion and sediment from disturbed areas and divert clean water catchments around operations wherever possible. The permanent water management structures that have been built to date include sedimentation dams, a raw water dam, a mine water dam, clean water drains and dirty water drains and are illustrated on Plan 2.

Where practicable, runoff from undisturbed catchments has been diverted around the construction and operational areas via diversion drains and banks to discharge water runoff back into the natural watercourses. Runoff from disturbed areas is retained on-site in sediment dams and allowed to settle prior to discharge into the natural system or pumped to the mine water dam and re-used on site.

Prior to disturbance of land, appropriate erosion and sediment controls are established. A number of sediment dams have been constructed to collect runoff from disturbed areas. Disturbed area runoff accumulating in these dams is used for dust suppression or pumped to the mine water dam for re-use on site. Excess water accumulating in the dams can been treated or allowed to settle and discharge to receiving waters in accordance with the EPL conditions (once water quality is to an acceptable quality).

A combination of temporary and permanent clean and dirty water drains have been established to divert runoff from undisturbed areas and collect runoff from disturbed areas. Additional erosion and sediment control measures have been used for other small disturbance areas including silt fences, hay bales, rock checks and other measures consistent with current best practice standards.

Further detail of the erosion and sediment control measures adopted at the MCCM is provided in the Water Management Plan, with an overview provided in Section 3.2.3 of this MOP.

2.3.8 Waste Management

Waste materials generated at the MCCM are managed in accordance with the legal and strategic framework for managing wastes in NSW including the:

- POEO Act;
- *Waste Avoidance and Resource Recovery Act, 2001*; and
- *Protection of the Environment Operations (Waste) Regulation, 2005*.

Waste streams include general waste, hazardous waste and sewage. Under the EPL for the site, MCC is required to monitor, remove, track and report wastes on a regular basis.

All domestic rubbish, effluent or rubbish items at the MCCM, including plant maintenance (sump oil, bitumen, kerosene, etc.), is collected and disposed of at the nearest authorised waste disposal site or an alternative site agreed with the NSC.

End of life mine tyres are also collected, recorded and placed within the overburden emplacement at a suitable depth to ensure appropriate coverage under the final landform.

2.3.9 Decommissioning and Demolition Activities

Decommissioning activities during the term of the MOP will be limited to the relocation of AN storage facilities. Activities relating to decommissioning of the MCCM will be included in future MOPs.

2.3.10 Temporary Stabilisation

Temporary or interim rehabilitation is used to provide cover to minimise erosion and dust impacts.

The Northern OEA will be fully developed at Year 10 of operations. During this ten year timeframe areas of the southern and western faces of the Northern OEA will be temporarily rehabilitated with a cover crop and other non-invasive grass species to provide soil surface cover to minimise dust, visual impacts and erosion potential prior to final shaping and rehabilitation. Further details of the temporary cover/interim rehabilitation methodology (including typical seed mix species and rates) is provided in Section 5.4.4.

2.3.11 Progressive Rehabilitation and Completion

During this MOP term, approximately 3~~00~~34ha are scheduled to be available for rehabilitation, refer Plans 3A-3E.

2.3.12 Material Production Schedule during MOP Term

Table 3 presents the anticipated material production schedule for the term of this MOP. This schedule is based on the anticipated timing and mine plan schedule that is proposed and may be subject to change.

Table 3
Material Production Schedule during the MOP Term

Material	Unit	2018	2019	2020	2021	2022
Stripped Topsoil	m^3	310,000	200,000	110,000	55,000	22,000
Stripped Subsoil	m^3	165,000	135,000	0	0	0
Rock/ overburden	m^3	84,000,000	85,000,000	86,000,000	87,000,000	88,000,000
ROM Coal	Mt	13	13	13	13	13
Reject Materials	Mt	0.6	0.6	0.6	0.6	0.6
Product	Mt	12.4	12.4	12.4	12.4	12.4

3 ENVIRONMENTAL ISSUES MANAGEMENT

3.1 ENVIRONMENTAL RISK ASSESSMENT

The ESG 3 MOP Guideline requires the MOP to include identification and/or review of environmental issues and risks associated with activities conducted within the MCCM mining tenements. Similarly, the Commonwealth approval EPBC 2010/5566 requires the identification and description of potential risks to successful management and rehabilitation on the mine site, including weed invasion, and a description of the contingency measures that will be implemented to mitigate these risks.

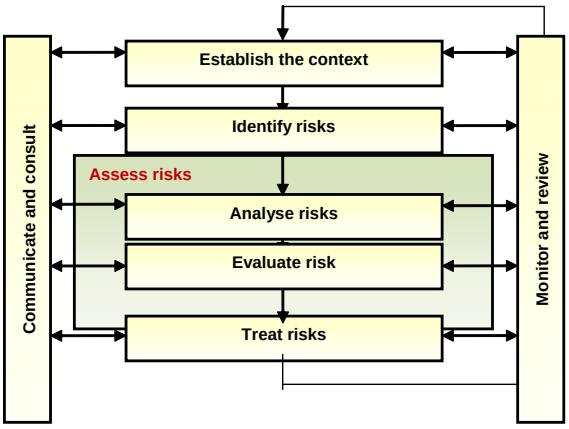
In order to address these aspects, a review of the risk assessment conducted for the Project EA (Hansen Bailey, 2011) has been previously undertaken, and a specific evaluation of rehabilitation-related risks conducted. A description of the findings of these reviews is provided below. The review was undertaken generally in accordance with AS/NZ ISO 3100:2009 *Risk Management – Principles and Guidelines*.

A qualitative risk-based approach was adopted, which focused on evaluating the likelihood and consequence of environmental impacts occurring and identifying the management measures that will reduce the potential impact. This approach allowed for the potential interactions between MCCM aspects (or hazards) and environmental factors (or receptors) to be considered on the basis of potential risk, therefore enabling the prioritisation of management measures to achieve an overall acceptable level of environmental risk.

Typically an environmental risk assessment includes:

- establishment of a risk assessment framework (definition of consequences and likelihood and establishment and validation of risk matrix);
- systematic identification of environmental factors, related hazardous events, their causes and environmental aspects;
- initial characterisation of environmental risks based on standard management practices (inherent risk);
- identification of additional management options to reduce risks to acceptable levels; and
- analysis of residual risk following implementation of the additional management options.

The overall environmental risk assessment process used is shown below.



Risk-based Environmental Impact Assessment Process

The aspects and hazards associated with the MCCM were identified through a review of the conceptual closure design, relevant approval conditions for the MCCM, the baseline studies and environmental impact assessment conducted for the Project EA (Hansen Bailey, 2011) and rehabilitation methods and performance in the Industry and at Whitehaven's other mines. The identified aspects and hazards were classified in accordance with the following qualitative definitions:

High Significance

potential impacts require a high level of mitigation and/or management for potential impact to comply with guidelines and standards; and/or

potential impacts have direct/permanent loss of environmental attributes of conservation significance and/or social attributes of significance; and/or

potential impacts have a high risk rating.

Medium Significance

potential impacts require moderate management measures to comply with guidelines and standards; and/or

potential impacts will be localised and medium term, with moderate loss to environmental attributes of conservation significance and/or social attributes of significance; and/or

potential impacts have a medium risk rating.

Low Significance

potential impacts will be minor requiring minimal management measures to comply with guidelines and standards; and/or

potential impacts will be localised and short-term, with minimal loss to environmental attributes of conservation significance and/or social attributes of significance; and/or;

potential impacts have a low risk rating.

The environmental factors and rehabilitation related aspects considered for the risk assessment undertaken for the MOP are outlined in Table 4.

Table 4
Environmental Factors and Hazards

Environmental Factor (Receptors)	Rehabilitation-related Hazard (Stressor)
• Landforms and Closure. • Surface Water. • Groundwater. • Flora and Vegetation. • Fauna. • Soil Resources.	• Clearing and rehabilitation earthworks. • Discharge. • Physical Presence. • Physical Interaction. • Fire. • Leaks and Spills.

The risk assessment process involved the identification of the following for each environmental factor:

- hazard (stressor);
- source of hazard;
- event;
- potential impacts;
- inherent risk;
- proposed controls; and
- residual risk.

A risk assessment framework (including factor-specific definitions of consequences and likelihood and establishment and validation of risk matrix) was used to assess rehabilitation-related risks of the MCCM. The risk assessment framework defines the type and duration of potential impacts based on five categories of consequence (i.e. minor, moderate, serious, major and critical). Similarly, there are five categories of likelihood of an event causing a particular impact. Risk is categorised as high, medium or low based on the scoring of likelihood and consequences.

Table 5 and Table 6 were used to assign a consequence factor/ranking[1] and likelihood factor/ranking[2] to each potential impact. The inherent risk ranking was calculated by

[1] Consequence is defined as a measure of the expected degree of gain, harm, injury or loss (impact) from the most severe event associated with a risk issue.

[2] Likelihood is defined as a measure of the chance of an impact at that selected level of severity actually being incurred.

multiplying the consequence factor and the likelihood factor (Table 7).

The inherent level of risk posed by rehabilitation related aspects to the relevant environmental factors was assessed assuming no controls in place.

The key environmental factors (those representing a medium or high inherent risk level) were subjected to further assessment in order to determine the extent and significance of environmental impacts.

To ensure the risks for each of the key factors was reduced to 'As Low as Reasonably Practicable' (ALARP), best practicable environmental management was applied to all key environmental factors to determine appropriate refinements of the MCCM design and controls to reduce the risks as far as practicable.

Appendix C presents the rehabilitation-related risk assessment conducted for this MOP and the MSRP.

3.2 ENVIRONMENTAL RISK MANAGEMENT

As described in Section 2.1.4, various environmental management plans and monitoring programs have been prepared in accordance with the State and Commonwealth approvals for the mine site, and are listed in Appendix B. The implementation of these plans and programs will be used to minimise and monitor environmental impacts during mining operations. The following sub-sections provide a description of the measures that will be used to manage the rehabilitation-related aspects identified in the risk assessment (Section 3.1) as well as the various 'other' risk areas identified in Section 3.2 of the ESG 3 MOP Guideline (where relevant).

Table 5
Consequence Factor

Relevant Consequence ~~Criteria~~ Factor	Negligible ~~1~~	Minor ~~2~~	Moderate ~~3~~	Significant ~~4~~	Serious ~~5~~
Soils and rehabilitated landforms	• Local impacts only, and which can be readily remediated; or • Negligible impact on soil characteristics or landform; or • Local and minor changes in recharge patterns within sub-catchments; or • Minor disturbance of well-represented landform habitats.	• Local contamination requiring a long-term remediation effort; or • Local, short-term change in soil characteristics; or • Local and major change in recharge patterns within sub-catchments; or • Widespread and minor changes in recharge patterns; or • Local loss of well-represented landform habitat.	• Local contamination that cannot be readily remediated; or • Local, long-term change in soil characteristics; or • Widespread, short-term change in soil characteristics; or • Major widespread changes in sub-catchment recharge patterns; or • Widespread loss of well-represented landform habitats; or • Local loss of a unique landform habitat.	• Widespread contamination requiring a significant long-term remediation effort; or • Widespread, long-term change in soil characteristics; or • Minor changes in regional recharge patterns; or • Widespread loss of a unique landform habitat.	• Widespread contamination that cannot be readily remediated; or • Major changes in regional recharge patterns; or • Regional loss of a unique landform habitat.
Flora	• Local and temporary decrease in abundance of flora or impact on community structure; or • Local and temporary impacts to functioning of plants.	• Widespread, short-term decrease in abundance of flora or impact on community structure; or • Local, long-term decrease in abundance of flora or impact on community structure.	• Widespread, short-term decrease in abundance of flora or impact on community structure; or • local, long-term decrease in abundance of flora or impact on community structure.	• Widespread and long-term decrease in abundance of flora or impact on community structure.	• Widespread and permanent decrease in abundance of flora or impact on community structure.

Table 5 (Continued)
Consequence Factor

Relevant Consequence ~~Criteria~~ Factor	Negligible ~~1~~	Minor ~~2~~	Moderate ~~3~~	Significant ~~4~~	Serious ~~5~~
Fauna	• Widespread, temporary behavioural impact; or • localised long-term behavioural impact or • Local, long-term decrease in abundance; or • Widespread, temporary decrease in abundance.	• Widespread and long-term behavioural impact or • Local, long-term decrease in abundance; or • Widespread but short-term decrease in abundance.	• Local, long-term impact on population; or • Widespread, short-term impact on population.	• Widespread, long-term impact on population.	• Extinction in the immediate region.
Surface and Groundwater quality and quantity	• Local, temporary reduction in quality and quantity; or • Minor reduction in quality and quantity.	• Minor reduction in water quality which is widespread but short-term; or • localised, long-term reduction in water quality; or • Large reduction in water quality which is local, short-term.	• Widespread, long-term reduction in water quality.	• Regional, short-term reduction in water quality.	• Regional, long-term reduction in water quality.

Table 6
Likelihood Factor~~/Ranking~~

Likelihood ~~Category~~Factor	~~Likelihood Factor~~	Description
Almost Certain	~~5~~	Very likely to occur on an annual basis or during construction.
Likely	~~4~~	Likely to occur more than once during the life of the proposed development.
Possible/Occasional	~~3~~	May occur during the life of the proposed development.
Unlikely	~~2~~	Not likely to occur within the life of the proposed development.
Rare/Improbable	~~1~~	Highly unlikely, but theoretically possible.

Table 7
Risk Rating Classification

		Consequence ~~Category~~ Factor				
		Negligible	Minor	Moderate	Significant	Serious
Likelihood Factor	Almost Certain	Low	Medium	High	High	High
	Likely	Low	Medium	High	High	High
	Possible/Occasionally	Low	Medium	Medium	High	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Rare/Improbable	Low	Low	Low	Medium	Medium

3.2.1 Geology and Geochemistry

The MCCM geochemical assessment undertaken by RGS Environmental Pty Ltd (RGS) as part of the Project EA (Hansen Bailey, 2011) resulted in the following key findings:

- overburden materials and most potential coal reject materials at the MCCM are likely to have negligible (<0.1%) total sulphur content and are therefore classified as Non Acid Forming (NAF) barren;
- overburden also appears to have excess acid buffering capacity typical of a moderate Acid Neutralising Capacity value;
- most overburden materials and NAF potential coal rejects are predicted to generate slightly alkaline and relatively low salinity runoff and seepage following surface exposure;
- overburden materials are predicted to be non-sodic (and as such non-dispersive) and may be suitable for revegetation and rehabilitation activities (in final surfaces or as a growth medium); and

- a small proportion of the potential coal reject materials are classified as Potentially Acid Forming – High Capacity and these materials may generate acidic and more saline runoff and seepage if exposed to oxidising conditions.

The identification of PAF material will initially occur through drill hole sampling. Seams identified as potentially acid forming from the drill hole sampling will be disposed of according to the PAF material management criteria below. Annually a selection of seams will be sampled at the reject screen, and ultrafine reject will be sampled at the underflow sampling unit of the thickener to ensure the results are in-line with the drill hole results.

PAF material will be placed (buried) in the out-of-pit overburden emplacement areas or within mined-out sections of the open cut. PAF material will be disposed of in a location (refer below) to minimise further oxidation and leaching into the surrounding environment.

Management of overburden and coal reject materials would include:

- use of drainage and containment structures;
- pre-stripping topsoil from areas to be mined for use in final rehabilitation activities;
- placement of overburden within the overburden emplacement areas in a manner that limits the risk of surface erosion;
- placement of NAF coal reject materials in the open cut pit and/or co-disposed with overburden;
- burial of PAF coal reject materials from the selected coal seams ensuring at least 15m final coverage of inert material. Out-of-pit co-disposal of PAF rejects in encapsulation cells may need to be considered until sufficient capacity in the open pit becomes available;
- burial of PAF roof and floor materials from selected coal seams that do not report as dilution to the CHPP ensuring at least 15m final coverage of inert material; and
- covering carbonaceous waste materials (i.e. not PAF) as soon as practical with at least 5 m of non-carbonaceous NAF overburden material to minimise the length of exposure to oxidising conditions.

In order to assess the performance of these management measures, surface water flows and seepage from the overburden emplacement areas and areas where rejects have been emplaced will be monitored for pH, Electrical Conductivity (EC), total suspended solids (TSS) and dissolved metals (including arsenic, molybdenum and selenium).

3.2.2 Material Prone to Spontaneous Combustion

Spontaneous combustion in coal and other carbonaceous materials is the result of self-heating which can occur from an exothermic reaction such as oxidation.

Spontaneous combustion is considered to have a very low risk of occurrence at the MCCM, consistent with the operational experience to date and experience of neighbouring mining operations. Notwithstanding, a Spontaneous Combustion Management Plan focusing on

spontaneous combustion prevention, detection and control/incident management has been developed for the MCCM and will be implemented in the unlikely event of an occurrence.

3.2.3 Erosion and Sediment Control

The Water Management Plan contains a detailed description of the erosion and sediment control measures that will be adopted at the MCCM. A description of the overall approach to erosion and sediment control, and aspects of particular relevance to the period covered by this MOP is provided below.

Surface runoff water from areas that are disturbed by mining operations (including out-of-pit overburden emplacements and haul roads) is considered to be sediment laden runoff (dirty water) and may contain high sediment loads. Mining and dumping operations will be managed so that runoff from these areas is not significantly affected by coal contact and hence will not contain contaminated material or high salt concentrations.

Activities that have the potential to cause erosion and sediment laden runoff at the MCCM include:

- vegetation clearing and topsoil stripping;
- stockpiling of topsoil;
- construction of roads and infrastructure;
- construction of OEAs; and
- re-routing drainage lines via clean water diversions.

Potential impacts from these activities include:

- increased surface erosion from disturbed and rehabilitated areas through the removal of vegetation and stripping of topsoil;
- increased sediment and pollutant loads entering the natural water system; and
- siltation or erosion of watercourses and water bodies.

Sediment laden runoff produced from these activities must be managed so that downstream water quality is within the adopted water quality compliance criteria. Topsoil stockpiles will be located within the approved MCCM disturbance boundary and will not be located within any drainage line and will be developed considering the potential for erosion and sediment issues. Further detail on the management of topsoil stockpiles is provided within the Soil Management Protocol (Appendix D).

Sediment and erosion control measures at the MCCM will be designed to manage clean surface water and sediment laden runoff from mining and pre-strip areas. Sediment mobilisation and erosion will be minimised by:

- installing appropriate erosion and sediment controls prior to disturbance of any land;
- limiting the extent of the disturbance to the practical minimum;
- reducing the flow rate of water across the ground particularly on exposed surfaces and in areas where water concentrates;
- progressively rehabilitating disturbed land and constructing drainage controls to improve stability of rehabilitated land;
- treating rehabilitation areas to promote infiltration;
- protecting natural drainage lines and watercourses by the construction of erosion control devices such as diversion banks, channels and sediment retention dams;
- installing appropriate erosion and sediment controls around all soil stockpiling areas;
- installing suitable control measures in areas with steep gradients, as required (e.g. rock riprap, geotextile fabric); and
- restricting access to rehabilitated areas.

The design of erosion and sediment control measures at the MCCM will be based on the principle of ensuring that runoff from disturbed areas is separated from clean area runoff and collected in sediment dams for treatment.

The sediment dams will be designed in accordance with current recommended design standards in the following guidelines:

- Managing Urban Stormwater, Soils and Construction (Landcom, 2004); and
- Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and Quarries (DECC, 2008).

Sedimentation dams, dirty water drains and contour banks will be used to direct runoff from disturbed areas away from the undisturbed areas. Each of the dirty water drains will direct water into sedimentation dams, which provide additional settlement of runoff prior to overflow into natural drainage lines.

The general arrangement of the proposed main surface water control structures for the period covered by this MOP are shown on Plan 2, Plan 3A and Plan 3B.

Rehabilitated land will be re-shaped where required to minimise down slope flows, and contour banks or other structures will be installed where appropriate. These structures will carry water around the slopes to sediment dams where it will either be pumped back into the mine water management system, or released offsite if a rainfall event occurs that exceeds the design capacity of the sediment control system. Water captured in the sediment control system may also be released offsite at any time, provided water quality meets the relevant EPL conditions and requirements of Condition 38, Schedule 3 of Project Approval 10_0138.

3.2.4 Soil Types, Suitability and Management

Soil management procedures have been developed and are documented in the MCCM Soil Management Protocol (Appendix D). These procedures enable soil resources within disturbance areas to be characterised, stripped, stockpiled and re-used appropriately.

The soil management procedures have been developed to meet the requirements of the State and Commonwealth approvals for the MCCM. In particular, the requirements of Condition 39 of Schedule 3 of PA 10_0138 (i.e. preparation of a soil management protocol), and Conditions 26(b), 27(c) and 27(d) of EPBC 2010/5566.

The procedures/management measures contained in the Soil Management Protocol are presented in Appendix D.

3.2.5 Flora and Fauna

Overview

The BMP describes the vegetation communities and threatened species recorded within the vicinity of the Project Boundary. Plan 1B shows the mapped vegetation community boundaries.

The MCCM has approval to remove approximately 544 ha of native vegetation (458 ha of Woodland and 86 ha of Derived Native Grassland) classified as the White Box – Yellow Box – Blakely's Red *Gum Grassy Woodland and Derived Native Grassland* (listed as a Critically Endangered Ecology Community [CEEC] under the EPBC Act and an Endangered Ecological Community [EEC] under the NSW *Threatened Species Conservation Act* [TSC Act]). This vegetation community is referred to herein as the Box-Gum Woodland EEC/CEEC.

MCCM will manage weeds and feral animals if found onsite in accordance with the BMP and the NSW Biosecurity Act 2015. The Biosecurity Act 215 introduced the "General Biosecurity Duty" (GBD) which requires all land managers and users to ensure as far as is reasonably practicable, that biosecurity risks are prevented, eliminated or minimised. In additional to MCCM's GBD responsibility; weed management will be implemented aligned with the North West Regional Strategic Weed Management Plan (NWRSWMP) 2017 – 2022 (North West Local Land Services, 2017) and weed control measures will be guided by published control measures (e.g. DPI, 2014). The NWRSWMP introduces a risk management approach (based on the weed invasion curve stages of prevention, eradication, containment and asset protection) to prioritise weeds for management based on those weeds that are "State Level Determined Priority Weeds for the North West Local Land Services Region" and additional "Regional Priority Weeds".

Management of Biodiversity at the MCCM

The BMP describes the actions to be taken to minimise the impact of the MCCM on native flora and fauna species and to manage the impacts of exotic flora and fauna. It describes the activities to be undertaken on areas to be cleared, prior to the removal of trees in order to

minimise the impact to fauna species, and it also documents the measures used to control the potential impact of weeds and feral animals on the remaining biodiversity within the MCCM Project Boundary and in nearby areas of the Leard State Forest. A summary is provided below.

- **Vegetation Clearing:** Vegetation clearance will be staged over the life of the mine and therefore pre-clearance and clearance activities will be implemented for each stage of clearing. Disturbance of vegetation will be limited to the minimum necessary for each stage of the clearing. Clearance for mining will take place in strips/stages and will occur no more than 12 months in advance of the proposed mine plan during operations.

  As described in Section 2.3.3, the LDP form is used to manage the clearance process and to document all licensing, safety and management requirements.

  In accordance with the current BMP, vegetation clearing activities in mining areas will be conducted during an annual ten week clearing campaign from the 15th February to the 30th April each year, except under exceptional circumstances and with the approval of the Secretary of the DP&E.

  For each clearing campaign the limits of clearing will be marked either by high visibility tape, fencing or an equivalent boundary marker that will be installed any time prior to clearing.

  Prior to clearing, a pre-clearing flora survey will be conducted to search for threatened plant species that have potential to occur, based on habitat available.

  Habitat features that have a high potential to support native fauna species will be identified prior to any clearing activities. These include significant rock outcrops and crevices, large boulders, nests and in particular trees bearing hollows that have potential to contain species such as bats, gliders, possums, reptiles and birds. Trees containing hollows or nests that have a high potential to contain fauna will be identified, recorded, and flagged with fluorescent marking tape.

  Within one week prior to clearing trees, a pre-clearing fauna survey will be conducted by the suitably qualified ecologist for the presence of fauna species in order to identify and minimise impacts to resident fauna.

  A two-stage clearing process will be used to minimise potential impacts on fauna. Details of the process are provided in the BMP.

  Vegetative material cleared at the mine site will be incorporated into the soil used for rehabilitation or as mulch (except where collected and used as habitat features).

- **Weed Management:** MCCM will implement weed management in accordance with the BMP throughout the life of the operation as required based on seasonal conditions that determine the abundance of weed species and infestations. As described above; weed management will be implemented aligned with the NWRSWMP and guided species specific published weed control measures.

- **Maximising Salvage of Habitat Resources:** MCCM will salvage habitat resources in accordance with the BMP throughout the life of the operation to be reused in rehabilitation and biodiversity offset areas dependent of the availability, accessib~~l~~eility and integrity of hollow-bearing trees, hollow-bearing logs and bush rocks.

  Seed Collection, Management and Storage: MCCM will implement seed management in accordance with the BMP throughout the life of the operation as required based on seasonal conditions. In addition, seed collection, management and storage will be undertaken in consideration of the relevant industry guidelines (Florabank, 1999).

- **Feral Animals Management:** MCCM will implement feral animal management in accordance with the BMP throughout the life of the operation as required based on seasonal conditions that determine the abundance of feral animal species and locations. As described above; weed management will be implemented in accordance with the NSW Biosecurity Act 2015 and aligned with relevant industry guidelines and codes of practice (i.e. Local Land Service Pest Control Orders).

3.2.6 Slopes and Slope Management

The Soil Management Protocol (Appendix D) details amelioration of overburden and topsoil to be undertaken with the aim of minimising dispersion, increasing surface water filtration rates and resistance to erosion. This will better support vegetation communities and minimise surface water runoff. The final landform will also have a slope gradient overall of 10 degrees where areas have been shaped to a traditional mining landform as this has been demonstrated to be stable at adjacent mine sites when combined with effective soil amelioration and revegetation. Trial areas on the northern emplacement will be shaped to a landform design applying geomorphic principles. These will predominantly be in the north western section of the final landform.

3.2.7 Air Quality

The MCCM construction and mining activities include various works that have the potential to contribute to dust generation and particulate matter emissions from the site. Such activities include site clearing, vehicle movement, soil handling, coal handling, drilling and blasting.

The Air Quality and Greenhouse Gas Management Plan developed for the MCCM details the management measures and monitoring program to mitigate any adverse impacts to neighbouring receivers.

3.2.8 Surface and Groundwater Management

As described in Sections 2.3.7 and 3.2.3, the Water Management Plan provides a consolidated plan for the management of surface water and groundwater resources at the MCCM. It contains a surface water management plan, which provides a summary of relevant baseline data, a description of the overall MCCM water management strategy, the site water management system and site water balance, performance criteria and the surface water monitoring program. It also contains a groundwater management plan which includes a

compilation of baseline groundwater data, a description of potential impacts on groundwater resources and mitigation measures to minimise their effect.

The Water Management Plan also contains a surface water and groundwater response plan, and a description of the reporting and review mechanisms to be implemented at the MCCM.

3.2.9 Contaminated Land Management

Measures and processes that will be adopted to minimise the potential for land contamination at the MCCM include:

- use of bunded diesel and oil tanks;
- construction and use of compacted gravel and/or concreted hardstand areas;
- use of oil/water separators;
- the adoption of 'dry' spill clean-up and workshop cleaning processes; and
- the establishment of a bioremediation pad on site to allow progressive and rapid remediation of any contaminated soil on site.

Potential future areas of contamination are likely to be associated with maintenance workshops, designated storage areas and refuelling and filling points for:

- fuels; and
- hydraulic/ lubricating oils and waste oils.

Phase 1 and Phase 2 Assessments in accordance with requirements of the *Contaminated Land Management Act, 1997* and the POEO Act will be undertaken and Remedial Action Plans prepared to document remediation works for any hydrocarbon impacted areas will be developed and implemented, as required.

3.2.10 Hazardous Materials Management

The MCCM involves the use of a range of hazardous materials which are managed and disposed of in accordance with the *Waste Classification Guidelines* (DECCW 2009), the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Division 2007, the *SEPP 33 – Hazardous and Offensive Development Application Guidelines* (DUAP 1994) (SEPP 33 Guidelines) and the *Hazardous Industry Planning Advisory Papers* developed under SEPP 33.

Transport, storage, handling, disposal and storage of hydrocarbon products (such as diesel, oils, and greases) will occur in a manner that minimises the potential for pollution and complies with the requirements of the *Work Health and Safety Act, 2011* (as the relevant legislation for dangerous goods) and AS1940 – *The Storage and Handling of Flammable and Combustible Liquids*.

3.2.11 Bushfire Management

The MCCM is located partially within the Leard State Forest which is densely vegetated and therefore presents a bushfire risk. The Leard State Conservation Area lies to the west of the Project Boundary and also consists of dense forest vegetation. It has a similar bushfire hazard to the Leard State Forest.

The area surrounding the Project Boundary and the Leard State Forest is predominantly agricultural land, dominated by grazing and cropping activities which present a lower bushfire hazard.

Condition 69 of Schedule 3 of PA 10_0138 requires MCC to ensure that the MCCM is suitability equipped to respond to any fires on site and assist the NSW Rural Fire Service, Forestry Corporation NSW, emergency services and National Parks and Wildlife Service as much as possible if there is a fire in the surrounding area.

Bushfire management within the Project Boundary will be undertaken as part of the Project's Bushfire Management Plan and will include provisions for the following:

- perimeter asset protection zones; and
- maintaining perimeter tracks according to specifications.

The Bushfire Management Plan describes the management measures to ensure that the mine site is protected safely.

4 POST MINING LAND USE

4.1 REGULATORY REQUIREMENTS

4.1.1 Commonwealth

Environmental Protection and Biodiversity Conservation Act, 1999

The Commonwealth approval for the MCCM (i.e. EPBC 2010/5566) contains several conditions related to the rehabilitation strategy and final landform. These are listed in Table 8.

In order to address these requirements MCC has prepared a separate stand-alone MSRP. Despite being stand-alone documents, this MOP and the MSRP are designed to complement and be consistent with each other where possible.

Table 8
EPBC Approval Requirements

Applicable Condition	Requirement	Level	Comment
Condition 25	*To mitigate the impacts to the White Box-Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland and the habitat of the regent honeyeater, swift parrot and greater long-eared bat, the person taking the action must, within 12 months of the commencement of construction, submit to the Minister for approval a mine site rehabilitation plan for the progressive rehabilitation and revegetation of no less than 1665 ha of native forest and woodland (less the portion included in the biodiversity corridor identified in condition 3) in the project area including 544 ha using species consistent with a White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This approved mine site rehabilitation plan must be implemented.*	Whole Site	Refer to the MSRP
Condition 26	*The person taking the action must:* *a. rehabilitate the site to be consistent with the proposed rehabilitation strategy as provided in the Environmental Assessment and, as required under the NSW State Government approval dated 23 October 2012 (Application 10_0138); and* *b. not replace top soil and sub soil layers at a depth less than the minimum depths determined through pre-stripping soil surveys as described in condition 27(c)* *Note: the NSW State Government Project Approval dated 23 October 2012 (application number 10_0138) conditions require pre-stripping soil surveys and inventories to inform the availability, rehandling, stockpiling and management of soils, and maximising the salvaging of soil to be used, in the rehabilitation of the site.*	Whole Site	Refer to the MSRP and the Soil Management Protocol (Appendix D)

Table 8 (Continued)
EPBC Approval Requirements

Applicable Condition	Requirement	Level	Comment
Condition 27	*The mine site rehabilitation plan must include, at a minimum, the following information:* *a. targets and performance indicators to achieve effective restoration of potential habitat for the regent honeyeater, swift parrot and greater long-eared bat and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, including weed management;* *b. details of the vegetation communities to be rehabilitated and the timing of progressive rehabilitation (commencing as soon as practicable following disturbance);* *c. detailed soil depths surveys and analysis to inform the effective placement and restoration of soils across the disturbance sites and soil sampling at no less than one sample point per 20 ha of each soil type identified. Sampling must identify; type, depth, water holding capacity, structure and physio-chemical properties of each of the soil and subsoil layers;* *d. processes and methodology for the removal, storage and re-layering of the top soil and sub layers underlying the disturbed sites being prepared for rehabilitation. These processes and methodologies must ensure the replacement of top soil and sub soil layers:* • *meet the minimum depth requirements determined from sampling outcomes as identified in condition 27(c); and* • *replicate other existing soil parameters including, but not limited to, soil type, water holding capacity, structure and physio-chemical properties.* *e. a process to report annually to the department the rehabilitation management actions undertaken and the outcome of those actions, and the mechanisms to be used to identify the need for improved management;* *f. a description of the potential risks to successful management and rehabilitation on the MCCM site, including weed invasion, and a description of the contingency measures that would be implemented to mitigate these risks;* *g. details of long-term management and protection of the mine site, including details of the commitment of funds to achieve this.*	Whole Site	Refer to the MSRP

Table 8 (Continued)
EPBC Approval Requirements

Applicable Condition	Requirement	Level	Comment
Condition 28	*The mine site rehabilitation plan must be subject to an independent review by a qualified ecologist prior to being submitted to the Minister for Approval. The findings of the independent review must be published on the proponent's website.* *Note: for consistency, the person taking the action may develop a single mine rehabilitation plan to align with the requirements, including timing of reporting, of the NSW State Government approval dated 23 October 2012 (Application 10_0138) and this approval.* *The Offset Management Plan and the Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.*	Whole Site	Refer to the MSRP
Condition 29	*The person taking the action must undertake rehabilitation to ensure that final landform provides the optimum opportunity for the successful restoration of native forest and woodland including the critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community.* *Note: for consistency, the proponent may develop a single mine rehabilitation plan to align with the requirements of the NSW Government and this approval. The Offset Management Plan and the Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.*	Whole Site	Ongoing
Condition 30	*The person taking action must undertake rehabilitation to ensure the final void and landform minimises the extent of any resulting pit lake, avoids salt scalding and ensures that drained waters do not adversely affect the downstream environment and avoids any impacts on matters of national environmental significance.* *Note: the State approval conditions for the MCCM 10_0138 require the preparation and implementation of an updated Final Void and Mine Closure Plan that considers interactions with the adjoining mines, including interaction between final voids, opportunities for integrated mine planning with adjoining mines to minimise environmental impacts, all reasonable and feasible landform options for the final void (including filling) and predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality).*	Void Domain	Ongoing

4.1.2 State

Environmental Planning and Assessment Act, 1979

Conditions in PA 10_0138 that specifically relate to MCCM rehabilitation and mine closure are detailed in Table 9**.**

Table 9
Project Approval 10_0138 Requirements

Applicable Condition	Requirement	Level	Addressed in MOP
Schedule 3 Condition 39	*The Proponent shall:* *(a) develop a detailed soil management protocol that identifies procedures for* • *Comprehensive soil surveys prior to soil stripping;* • *Assessment of top-soil and sub-soil suitability for mine rehabilitation; and* • *Annual soil balances to manage soil handling including direct respreading and stockpiling;* *(b) maximise the salvage of suitable top-soils and sub-soils and biodiversity habitat components such a bush rocks, tree hollows and fallen timber for rehabilitation of disturbed areas within the site and for enhancement of biodiversity offset areas;* *(c) ensure that coal reject or any potentially acid forming interburden materials must not be emplaced at elevations within the pit shell or out of pit emplacement areas where they may promote acid or sulphate species generation and migration beyond the pit shell or out of pit emplacement areas;* *(d) ensure that no water can drain from an out of pit emplacement area to any watercourse or to any land beyond the lease boundary; and* *(e) ensure that any coal barrier between the final void and any future surrounding mining operations minimises exchange of any contained groundwaters in the pit shell.*	Whole Site	Section 3.2.4 and Appendix D
Schedule 3 Condition 71	*The Proponent shall rehabilitate the site to the satisfaction of the Executive Director Mineral Resources. This rehabilitation must be generally consistent with the proposed Rehabilitation Strategy described in the Project EA and comply with the objectives in Table 17.*	Whole Site	Sections 4.2 and 4.3
Schedule 3 Condition 72	*The Proponent shall rehabilitate the site progressively, that is, as soon is reasonably practical following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies shall be employed when areas prone to dust generation cannot yet be permanently rehabilitated.* *Note: it is accepted that some parts of the site that are progressively rehabilitated may be subject to further disturbance at some later stage of the development.*	Whole Site	Section 5.4

Table 9 (Continued)
Project Approval 10_0138 Requirements

Applicable Condition	Requirement	Level	Addressed in MOP
Schedule 3 Condition 73	*The Proponent shall prepare and implement a Rehabilitation Management Plan to the satisfaction of the Executive Director, Mineral Resources. This plan must:*	Whole Site	This MOP
	(a) be prepared in consultation with the Department, Forests NSW, NOW, OEH, Namoi CMA and Council;		Section 1.1.3
	(b) be submitted to the Executive Director, Mineral Resources within 6 months from the date of this approval;		Section 1.1.5
	(c) be prepared in accordance with any relevant DRE guideline;		Sections 1.1.5, 3.2.5 and 4.1.4
	(d) describe how the rehabilitation of the site would be integrated with the implementation of the biodiversity management plan;		Section 3.2.5
	(e) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);		Section 6
	(f) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, and address all aspects of rehabilitation including mine closure, final landform, and final land use;		Section 5
	(g) include interim rehabilitation where necessary to minimise the area exposed for dust generation;		Sections 5.4
	(h) include a program to monitor, independently audit and report on the effectiveness of the measures, and progress against the detailed performance and completion criteria; and		Section 8
	(i) build to the maximum extent practicable on the other management plans required under this approval.		Section 1.1.5
	Note: In particular the BMP and Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.		
Schedule 3 Condition 74	*The Proponent shall prepare and implement an updated Final Void and Mine Closure Plan (as a component of the overall Rehabilitation Management Plan required under Condition 73 of Schedule 3) to the satisfaction of the Executive Director, Mineral Resources, following consultation with the Director-General. A draft plan must be prepared and submitted to the Executive Director, Mineral Resources by the end of December 2020 and a final plan must be prepared and submitted to the Executive Director, Mineral Resources by the end of December 2026. Each version of the plan must:*	Whole Site	Separate management plan to be prepared by 2020
	(a) e subject to independent review and verification by suitably qualified, experienced and independent person/s (including a groundwater expert) whose appointment has been approved by the Director-General;		

Table 9 (Continued)
Project Approval 10_0138 Requirements

Applicable Condition	Requirement	Level	Addressed in MOP
Schedule 3 Condition 74 (Cont.)	*(b) identify and consider:* • *Options for continued mining beyond current MCCM life;* • *Interactions with the final landform of adjoining mines (including any direct or indirect interaction between final voids);* • *opportunities for integrated mine planning with adjoining mines to minimise environmental impacts of the mines' final landforms;* • *all reasonable and feasible landform options for the final void (including filling);* • *predicted stability of the proposed landforms; and* • *predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality);* *(c) include a detailed proposed landform design; and* *(d) demonstrate that the proposed final landform:* • *satisfies the relevant objectives in Table 17;* • *minimises the extent of any resulting pit lake;* • *avoids salt scalding;* • *maximises the capacity of emplaced spoil to drain to the natural environment; and* • *ensures that drained waters do not adversely affect the downstream environment.*		

Mining Act, 1992

This MOP has been prepared to satisfy the requirements under the *Mining Act, 1992* in relation to disturbance activities being undertaken within the MCCM mining tenements. Condition 3 of CL 375 requires a MOP to be prepared prior to mining operations. Condition 3 is reproduced below in Table 10**.**

Table 10
Coal Lease Conditions Relating to the Mining Operations Plan

Applicable Condition	Requirement	Level	Addressed in MOP
Condition 3	*Mining Operations Plan* *(a) Mining operations must not be carried out otherwise than in accordance with: a Mining Operations Plan (MOP) which has been approved by the Director-General.* *(b) The MOP must:* *(i) identify areas that will be disturbed by mining operations;* *(ii) detail the staging of specific mining operations;* *(iii) identify how the mine will be managed to allow mine closure;* *(iv) identify how mining operations will be carried out onsite in order to prevent or minimise harm to the environment;* *(v) reflect the conditions of approval under:* • *The Environmental Planning and Assessment Act 1979;* • *The Protection of the Environment Operations Act 1997;* • *And any other approvals relevant to the development including conditions of the lease; and* • *have regard to any guidelines adopted by the Director-General.* *(c) The leaseholder may apply to the Director-General to amend an approved MOP at any time;* *(d) it is not a breach of this condition if:* *(i) The operations constituting the breach were necessary to comply with a lawful order or direction given under the Mining Act 1992, the Environmental Planning and Assessment Act 1979, Protection of the Environment Operations Act 1997 or the Occupational Health and Safety Act 2000; and* *(ii) The Director-General had been notified in writing of the terms of the order or direction prior to the operations constituting the breach being carried out.*		**Section 2** **Section 2** **Section 5** **Sections 3 and 5** **Section 4**

Table 10 (Continued)
Coal Lease Conditions Relating to the Mining Operations Plan

Applicable Condition	Requirement	Level	Addressed in MOP
Condition 3 (Cont.)	*(e) A MOP ceases to have affect 7 years after date of approval or other such period as identified by the Director-General. An approved amendment to the MOP under condition 5 does not constitute an approval for the purpose of this paragraph unless otherwise identified by the Director-General.*		
Condition 7	*Any disturbance as a result of activities under this lease must be rehabilitated to the satisfaction of the Director-General.*	Whole Site	**This MOP**

4.1.3 Local

Narrabri Local Environmental Plan, 2012

The Project Boundary is situated over land that is currently zoned as Rural Zone RU(1) Primary Production and RU(3) Forestry under the Narrabri Local Environmental Plan, 2012.

Final land use for the Project Boundary will need to consider the objectives of the land zoning under the Narrabri Local Environmental Plan, 2012.

4.1.4 Plans and Guidelines

Additional plans, guidelines and codes of practice applicable to mine closure and rehabilitation associated with the MCCM are listed in Table 11.

Table 11
Additional Plans and Guidelines Applicable to the MCCM

Standard/Guideline Requirements	Purpose
ESG3: MOP Guidelines, September 2013	Details a process for monitoring and managing progression towards successful rehabilitation outcomes.
Strategic Framework for Mine Closure ANZMEC & MCA (2000)	Provides a framework of issues to be considered as part of a mine closure plan. The strategy for mine closure for the MCCM as outlined in this MOP has been developed in consideration of six key objectives.
DoEE (2010)	National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.
A Guide to Managing Box Gum Grassy Woodlands	Covers the underpinning science and management requirements of Box Gum Grassy Woodlands
Leading Practice Sustainable Development Program for the Mining Industry: • Mine Rehabilitation. • Mine Closure and Completion. DITR (2009a, 2009b)	These handbooks identify the key issues affecting rehabilitation, sustainable development in the mining industry and provide information and case studies that illustrate a sustainable basis for the industry.
Namoi Catchment Action Plan 2010 – 2020	The Namoi Catchment Action Plan provides for the future strategic direction of natural resource management in the Namoi Catchment. It is an overarching ten year plan developed to guide the implementation of natural resource management activities by community, industry and government partners together.
Minimum Construction Requirements for Water Bores in Australia, 2011	Sets out requirements for decommissioning groundwater piezometers.

4.2 POST MINING LAND USE GOAL

As described in Section 2.1.5, the State and Commonwealth approvals both specify that the rehabilitation of the MCCM must be consistent with the Rehabilitation Strategy (i.e. Condition 71 of Schedule 3 of PA 10_0138 and Condition 26 of EPBC 2010/5566). The aspects covered in the Rehabilitation Strategy are listed below. Section references are also included to the where additional information is contained in this MOP.

- Rehabilitation objectives (Section 4.3).
- Rehabilitation techniques (Section 5.4).
- Final landform and rehabilitation domains (Sections 4.2 and 5).
- Decommissioning (Section 5.4.1).
- Rehabilitation completion criteria (Section 6).
- Management and mitigation (Section 5).

Consistent with the description contained in the Project EA, and as per the requirements of the State and Commonwealth approvals, the proposed post mining land use for the Project is

to return the area to a mixture of native vegetation communities including grassy woodland, shrubby woodland/open forest, riparian forest, native forest and woodland.

Plan 4 shows the broad final landform and rehabilitation concept for the MCCM. The concept is consistent with the one depicted in the Project EA. The landform will also include the construction of trial areas using geomorphic landform design principals during the MOP term with the objective of blending into the surrounding environment. It should be noted however that it will be refined and more detail will be provided in future revisions of the MOP during the mine life.

4.3 REHABILITATION OBJECTIVES

Condition 71 of Schedule 3 of PA 10_0138 includes a table (i.e. Table 17), which lists the overall rehabilitation objectives for the MCCM. These are repeated below in Table 12.

Table 12
Rehabilitation Objectives

Feature	Objective
Mine Site	• Safe, stable and non-polluting. • Constructed landforms drain to the natural environment.
Final Void	• Minimise the size and depth of the final void as far as is reasonable and feasible. • Minimise the drainage catchment of the final void as far as is reasonable and feasible.
Surface Infrastructure	• To be decommissioned and removed, unless the Executive Director Mineral Resources agrees otherwise.
All land, other than the final void	• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of: – local native plant species; and – a landform consistent with the surrounding environment, in accordance with the Revised Biodiversity Offset Strategy and the BMP (i.e. Conditions 45 and 53 of Schedule 3 of PA 10_0138 respectively).
Community	• Ensure public safety. • Minimise the adverse socio-economic effects associated with mine closure.

Note: Appropriate non-native sterile plants may be used for stabilisation and dust suppression purposes on a temporary basis, if required.

The key rehabilitation objective of the MCCM is the establishment of native forests and woodlands with a conservation final land use. Condition 25 of Commonwealth approval EPBC 2010/5566 requires rehabilitation within the Project Boundary to include no less than 1,665 ha of native forest and woodland in the project area, including 544 ha using species consistent with a White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived Native Grassland CEEC. As discussed in Section 4.2, the current broad final landform and rehabilitation concept for the MCCM is shown on Plan 4.

Overall, MCCM rehabilitation will create landforms that are safe, stable, non-polluting, provide adequate post-mining drainage, and have a shape that is consistent with the types of naturally occurring landform features that occur in the region.

5 REHABILITATION PLANNING AND MANAGEMENT

5.1 DOMAIN SELECTION

The Rehabilitation Strategy presented in the Project EA includes a description of the final landform concept, which incorporates a description of the major rehabilitation 'domains' that would be created over the mine life. The domains were identified based on their physical characteristics, location and proposed post-mining land use.

As part of the development of mine plans and preparation of MOPs, Whitehaven has refined the domains into the following primary and secondary domains (Table 13). The Primary domains are based on the key land management units for the years of mining operations. The Secondary domains have been delineated based on indicative post mining land use objectives.

Table 13
Primary and Secondary Domains Identified in the MCCM Project Boundary

Primary/Operational Domains	Code	Secondary/Post mining land use Domains	Code
Infrastructure Area	1	Rehabilitation Area -Woodland	E
Water Management Area	3	Water Management Area	B
Overburden Emplacement Area	4	Final Void	I
Stockpiled Material	5		
Void (Open cut void)	6		

The five domains for the MCCM will be:

- 1E – Infrastructure Area with a post mining land use of rehabilitated woodland;
- 3B – Water Management;
- 4E – OEA with a post mining land use of rehabilitated woodland;
- 5E – Stockpiled material (vegetation and topsoil) with a post mining land use of rehabilitated woodland.
- 6I – Void with a post mining land use of final void; and

A brief description of the domains and identification of corresponding rehabilitation objectives of each domain are described below in Section 5.2.

5.2 DOMAIN REHABILITATION OBJECTIVES

5.2.1 Infrastructure Area Domain

The Infrastructure Area Domain (1E) is located in an area that, prior to mining, consisted of cleared agricultural land, woodlands and isolated pockets of remnant vegetation and derived grassland. This domain includes the CHPP, site administration offices, equipment and

maintenance sheds, loading facilities, coal stockpiles, mine access road and the transport corridor between the MIA and the Boggabri Coal Mine rail spur.

Upon mine closure, mine-related infrastructure in this domain will be decommissioned and the landscape rehabilitated. A key rehabilitation objective for this domain will be to stabilise the batters and slopes surrounding this infrastructure to a stable landform minimising erosion concerns for the downstream waterways.

The final land capability of this domain will incorporate a mixture of classes including Class III, V and Class VI lands. A substantial area of this domain adjoins land that contains remnant native vegetation that is adjacent to, or will form part of, the MCCM biodiversity offset areas (Plan 1B). The rehabilitation strategy for this domain will, where practical, revegetate the decommissioned areas of the mine access road and rail spur corridor to maximise its ecological contribution to the biodiversity offset areas. It is envisaged that this domain will include a significant proportion of the 544 ha area to be rehabilitated with species consistent with a White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived Native Grassland Ecological Community (i.e. as required by Condition 25 of Commonwealth approval EPBC 2010/5566). Specific details will be provided in subsequent revisions of the MOP and MSRP as the mine proceeds.

5.2.2 Overburden Emplacement Area Domain

The OEA Domains (4E) consists of the areas within the Project Boundary used for overburden emplacement (i.e. the out-of-pit overburden emplacements as well as the in-filled sections of the open cut). The rehabilitation objective for this domain is to develop a free draining final landform designed to integrate with the surrounding catchments by channelling water towards natural drainage lines of Back Creek.

The domain will be progressively rehabilitated over the life of the mine. This will assist in minimising the mine disturbance area that is open at any one time and will reduce the environmental impacts of the mining operations (i.e. reduced dust emissions, and impacts on visual amenity and biodiversity).

The final shape of the OEA will be designed to integrate with the surrounding undisturbed topography as much as possible. The final rehabilitated batters will have an ~~maximum~~ overall slope of 10 degrees, which will assist in maximising the long term stability and sustainability of the landform. There will also be areas shaped applying contemporary geomorphic design principles that will provide a natural looking landform appearance. The final batter slope and top surface configuration of the overburden emplacement area landform will be a key factor in determining which areas will be rehabilitated with species consistent with a White Box – Yellow Box – Blakely's Red Gum Grassy Woodland, derived Native Grassland CEEC, and native forest. Generally speaking, it is expected that only the flatter areas and shallower parts of the overburden emplacement area will be used for this purpose.

5.2.3 Water Management Domain

The Water Management Domain (3B) will be situated immediately adjacent to the Infrastructure Area Domain and will include the various dams, channels and bunds used to manage and contain water runoff from this area. The primary objective for this domain will be to construct and stabilise the water management structures so that they can be used during the mine life and post closure (where necessary) to meet the water management objectives for the MCCM (i.e. segregation and containment/treatment of dirty water, and diversion of clean water around mine disturbance areas).

5.2.4 The Void Domain

Based on the currently approved 21 year mine life for the MCCM, the final void domain (6I) will be located in the southern and eastern portion of the Project Boundary. Plan 4 shows the conceptual location of the final void.

The Rehabilitation Strategy states that at the conclusion of mining the pit walls of the final void will be blasted to a slope of approximately 37 degrees. Catchment areas that are not free draining will report to the final void.

Condition 74 of Schedule 3 of PA 10_0138 requires the proponent to prepare and implement a Final Void and Mine Closure Plan. A draft is required to be submitted to the Executive Director ~~of DRE~~ Mineral Resources by the end of December 2020, and a final plan must be submitted by the end of December 2026.

The Final Void and Mine Closure Plan must identify and consider:

- options for continued mining beyond the 21 year mine life;
- interactions with the final landform of adjoining mines;
- opportunities for integrated mine planning with adjoining mines to minimise environmental impacts;
- all reasonable and feasible landform options for the final void (including filling);
- the predicted stability of the proposed landforms; and
- predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality).

It must also include a detailed proposed final landform, and demonstrate that it:

- satisfies the relevant rehabilitation objectives;
- minimises the extent of any resulting pit lake;
- avoids salt scalding;
- maximises the capacity of emplaced spoil to drain to the natural environment; and

- ensures that drained waters do not adversely affect the downstream environment.

Department of Industry – Water, or equivalent, will be consulted during the preparation of the Plan particularly in regards to potential water management and licensing requirements for any ongoing surface water and groundwater take.

5.2.5 Stockpiled Material Domain

The Stockpiled Material Domain (5E) incorporates the MCCM soil and vegetation stockpiles. Section 3.2.4 and Appendix D provide details of the soil stripping and stockpiling processes that will be adopted. The BMP provides details of the methods and processes for salvaging, stockpiling and reusing vegetation that is cleared during the land clearing process (i.e. for re-use as habitat features in rehabilitation areas). Salvaged vegetative material may include hollow trees, woody ground debris, and trees and fallen logs without hollows. Large flat or creviced rocks may also be collected and stockpiled for later re-use.

The soil and vegetation stockpiles will be used progressively during the mine life. They will be located in available land within the Project Boundary, and will be accessed as required to stockpile material and to reclaim it for use in rehabilitation. Once the stockpile areas are no longer required, the disturbance areas will be rehabilitated into native forests and woodlands. While in place, the soil stockpiles will be managed in accordance with the Soil Management Protocol and the vegetation stockpiles will be managed in accordance with the BMP.

5.3 REHABILITATION PHASES

The main rehabilitation phases, adapted from DRG's ESG 3 MOP Guidelines (2013), for post mining land use are summarised in Table 14 and will include:

- Decommissioning – Infrastructure removed, contamination remediated, electricity decommissioned, heritage building retained;
- landform establishment – characterisation and reshaping of material;
- growth medium development – placement of topsoil, and integration of ameliorants as required, upon reshaped material;
- ecosystem and land use establishment – revegetation of growth medium;
- ecosystem and land use sustainability – Floristics and structure, recruitment and recovery, fauna presence, growth, ecosystem resilience; and
- relinquished lands – Demonstrated ultimate success of rehabilitation process.

The conceptual mine plans presented in the MCCM 2011 Environmental Assessment categorise areas into Rehabilitation and Previous Rehabilitation that broadly represent the DRG ESG 3 rehabilitation phases of Landform Establishment and Growth Medium Development/Ecosystem and land use establishment/Ecosystem and land use sustainability, respectively.

Table 14
Summary of Rehabilitation Phases Proposed for Completion at the End of the MOP

Domain / Rehab Phase	Infrastructure Area (1E)	Water Management (3B)	Overburden Emplacement Area (4E)	Stockpiled Material (5E)	Void (6I)
Active Mining Area	✓	✓	✓	✓	✓
Decommissioning	×	×	×	×	×
Landform establishment	×	×	✓	×	×
Growth medium development	×	×	✓	×	×
Ecosystem and land use establishment	×	×	✓	×	×
Ecosystem and land use sustainability	×	×	×	×	×
Relinquished lands	×	×	×	×	×

A summary description the rehabilitation methodology relevant to these phases is provided in Section 5.4.

5.4 REHABILITATION METHODOLOGY

5.4.1 Decommissioning

Decommissioning and removal of all infrastructure items from the mine site will take place during the mine closure phase, or as required during the mine life when infrastructure items are no longer required. Any infrastructure including dams, levee banks, roads and buildings, which are beneficial for future use by post mine landowners, will be left in place in accordance with the relevant stakeholder or landowner agreements. Any remaining infrastructure will have approval from the relevant authority. Licensing arrangements under the Water Management Act 2000, or equivalent, will be confirmed during rehabilitation planning and prior to any landowner agreements being finalised. Decommissioning of the MCCM infrastructure area will include removal of equipment and infrastructure, remediation of any land contamination, ripping, topsoiling (if necessary) and seeding.

5.4.2 Landform Establishment

The final outer surfaces of the mine landforms will be designed to be safe, stable, provide an adequately drained post-mining landform, and have a shape that is consistent with the types of naturally occurring landform features in the region. They will also be designed to provide a final surface that facilitates revegetation and growth of species that occurred in the native woodland and forest communities that were present prior to the commencement of mining.

In some instances, parts of the mine landforms will be constructed in their final configuration from the outset (e.g. some batters of the Northern OEA and some cut and fill areas associated with the mine-related infrastructure). However for the majority of the OEA working batters and

berms will need to be pushed back/down (or in-filled with overburden in the case of the open cut) to form the final mine landform surface. Micro-relief features and permanent water management structures (e.g. drop structures between batters and final bunds) will also be installed as part of this process. As described in the Rehabilitation Strategy (Section 4.2), the final rehabilitated batters of the overburden emplacement will have a combination of slopes shaped to an ~~maximum~~ overall slope of 10 degrees, in addition to areas applying natural geomorphic landform design that will require linear contour construction, and the walls of the final void will be blasted to a slope of approximately 37 degrees, or less.

The designs of final landforms will be refined as part of the overall mine planning process, in a manner that is consistent with the overall rehabilitation and mine closure concept for the MCCM.

5.4.3 Growth Medium Development

Rehabilitation of the MCCM will involve replacement of soil in areas where it has been stripped, and surface conditioning in areas where the soil was left *in situ*.

Ripping will be undertaken as required such as to address compaction and/or to incorporate ameliorants such as gypsum. Subsoil and/or topsoil will then be spread over the ripped area using a grader or dozer. The depth and layering of respread soil will be based on the results of the pre-disturbance soil testing program (refer to Appendix D for detail, and Section 3.2.4 for a summary of this program).

The respread soil surface will be scarified prior to, or during seeding.

Some soils and mine spoils may have physical and chemical characteristics that will otherwise limit plant establishment and have a high potential for erosion. The pre-disturbance soil testing program (Appendix D) will be used to determine whether these materials can be ameliorated (and the required application rates), or whether they should be left *in situ* or buried within the overburden emplacement areas.

5.4.4 Ecosystem and Land Use Establishment

Erosion Control

Erosion control measures will be used at the MCCM rehabilitation areas in order to manage wind erosion, dispersive soils and spoils, provide soil surface cover, and to minimise the creation of concentrated surface water flow conditions. Erosion control works will include, but are not necessarily limited to the measures listed below.

- Amelioration of dispersive spoil to minimise the risk of rill, gully and tunnel erosion and to allow the infiltration of surface water (reduce the amount and velocity of surface water). This will be determined during the soil testing program outlined in the Soil Management Protocol (Appendix D).

- Contour scarification of compacted surfaces to encourage infiltration and surface roughness.
- Use of cover crops potentially including salt tolerant sterile annual grasses, native grasses and native legumes to minimise raindrop and sheet erosion of reshaped areas.
- Use of inert rock mulches of appropriate stone sizes and cover where effective and appropriate.
- Vehicle access will be predominantly restricted to designated tracks on mine landforms that have been revegetated to minimise ground disturbance (e.g. erosion and/or compaction).
- Engineered temporary channel banks, slope drains and energy dissipaters in areas where concentrated surface flow may occur to reduce erosion if necessary. Drainage and sediment control structures will be designed in accordance with Table 6.1 of *Managing Urban Stormwater: Soils and Construction* Volume 2E – Mines and Quarries (DECC, 2008).
- Structural erosion controls may be used on overburden emplacement areas if necessary until vegetation cover is sufficient to provide adequate erosion protection.
- In the larger drainage systems such as clean water drains and modified natural drainage systems, erosion control methods such as cross vanes, rock vanes and J-hook vanes will be used to provide channel bed and bank protection.
- Temporary cover or interim rehabilitation will be used where required to minimise erosion and dust impacts, as well as inhibiting the establishment of weeds. This will typically involve the annual application throughout the MOP term of a temporary sterile cover crop (i.e Vampire Ryecorn) for short term uses, and native grasses for longer term requirements (refer Table 15 below).

The management of erosion and sediment control for all mining and associated disturbances is detailed further in the Water Management Plan, and for initial clearing activities via the Land Disturbance Protocol, which is contained in the BMP.

Vegetation to be Established

Woodland rehabilitation will be established and placed under long term security at MCCM in accordance with the BMP, and PA 10_0138 Conditions 44, 48(a), 49 and 54(c), similar to the following vegetation types that occur in the Project area:

- White Box – White Cypress Pine grassy woodland;
- Silver-leaved Ironbark heathy woodland;
- White Box - Narrow-leaved Ironbark – White Cypress Pine grassy open forest;
- White Box - Narrow-leaved Ironbark – White Cypress Pine shrubby open forest; and
- Dwyer's Red Gum – Ironbark woodland.

The placement of these vegetation types will depend on final slopes, drainage and subsoil and topsoil characteristics. No less than 544 ha of the post-mine landforms will be revegetated with species consistent with the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived Native Grassland CEEC in accordance with Condition 25 of Commonwealth approval EPBC 2010/5566 and Conditions 44 and 48(a) of PA 10_0138. Where appropriate, suitably qualified specialists/ restoration ecologists will be commissioned to provide direction about the rehabilitation and restoration of Box-Gum Woodland EEC/CEEC.

With respect to areas proposed to be revegetated during the term of the MOP, the lower (~200m) slope of the Northern OEM will be revegetated, given confirmation of above, with White Box – Narrow-leaved Ironbark – White Cypress Pine Grassy Open Forest (CEEC – that will contribute to the 544ha Box Gum Woodland required by EPBC Condition 25), and the upper slope revegetated to Narrow-leaved Ironbark – White Cypress Pine Shrubby Open Forest (together with the Box Gum Woodland contribute to the 1665ha Box Gum Woodland required by EPBC Condition 25).

It is anticipated that natural seed germination from the soil seed bank will need to be assisted with direct seeding and the planting of seedlings. Species used in revegetation will consider a range of species such as grasses, herbs, forbs, low shrubs, mid-sized shrubs and trees as per Table 15**.**

MCCM will consider use of native or self-sterile cover crops (i.e. Vampire Ryecorn) in accordance with the MSRMP and BMP if required to improve initial soil surface stabilisation of rehabilitation areas.

Table 15
Indicative Revegetation Species List

Common Name	Scientific Name	Common Name	Scientific Name
Overstorey		**Understorey**	
* White Box	*Eucalyptus albens*	* Smooth Darling Pea	*Swainsona galegifolia*
* Yellow Box	*Eucalyptus melliodora*	* Barb-wire Grass	*Cymbopogon refractus*
* Blakely's Red Gum	*Eucalyptus blakelyi*	* Silk Blue-grass	*Dicanthium sericeum*
Narrow-leaved Ironbark	*Eucalyptus crebra*	* Daises	*Brachysome spp.*
Narrow-leaved Grey Box	*Eucalyptus pilligaenensis*	* Everlasting Daises	*Chrysocephalum spp.*
Inland Grey Box	*Eucalyptus microcarpa*	* Kangaroo Grass	*Themeda triandra*
Dwyer's Red Gum	*Eucalyptus dwyeri*	* Wallaby Grass	*Austrodanthonia indutai*
Midstorey		*Winter Apple	Eremophila debilis
*Sticky Hop-Bush	Dodonaea viscosa ssp. Angustifolia	Blue Trumpet	Brunoniella australis
*Wilga	Geijera parviflora	Three-awn Speargrass	Aristida vagans
Belah	Casuarina cristata	Slender Stackhousia	Stackhousia viminea
-	Allocasuarina spp.	Yellow Burr-daisy	Calotis lappulacea

Black Tea-tree	Melaleuca bracteata	-	Rostellularia adscendens var. adscendens
Silver Wattle	Acacia dealbata	Plains Grass	Austrostipa aristiglumis
Hickory Wattle	Acacia implexa	-	Panicum spp.
White Cypress Pine	Callitris glaucophylla	-	Austrodanthonia spp.
Buloke	Allocasuarina leuhmanii	-	Bothriochloa spp.

* Specifically associated with the Box-Gum Woodland EEC/CEEC.

6 COMPLETION/RELINQUISHMENT CRITERIA

The Project EA (Hansen Bailey, 2011) included a table of preliminary rehabilitation criteria, and indicated that the criteria will be further developed and agreed in consultation with the relevant Government agencies and community. It also stated that these criteria will continue to be revised and developed to demonstrate that the rehabilitation objectives have been achieved, and that the achievement of the completion criteria will be monitored and reported to relevant stakeholders.

Table 16 provides the completion criteria of the three secondary domains identified in Table 13, namely rehabilitated woodland, water management and final void.

Table 16
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Decommissioning of Infrastructure						
All mine-related infrastructure removed from the site and disposed of at an appropriate facility, relocated to another Whitehaven site, or sold.	Communications, power supply, water supply, and water management services and infrastructure removed.	All infrastructure components dismantled and/or removed from the site unless otherwise agreed with the Administering Authority and landholder.	MOP Section 5.2.1	No	No	To commence
	Offices, workshops and other buildings removed.		MOP Section 5.2.1	No	No	To commence
	Fuel, chemical, explosive storage tanks and containers removed.		MOP Section 5.2.1	No	No	To commence
	Roads and rail infrastructure removed.		MOP Section 5.2.1	No	No	To commence
All hazardous materials removed and contaminated areas remediated.	Hazardous materials such as hydrocarbons, chemicals and explosives removed from site.	All hazardous materials removed from the site and appropriately disposed of.	MOP Section 3.2.9 Contaminated Land Management Act 1997 POEO Act	No	No	To commence

Table 16 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Decommissioning of Infrastructure (Cont.)						
	Areas where hazardous materials have been stored or transferred have been assessed for contamination and remediated if required.	Land contamination assessments and remediation (if necessary) conducted in accordance with the relevant legislative requirements.	MOP Section 3.2.9 Contaminated Land Management Act 1997 POEO Act	No	No	To commence
Groundwater bores and piezometers decommissioned and sealed if no longer required for monitoring or water supply purposes.	Groundwater bores and piezometers stand pipes removed and sealed.	Bentonite seal installed, standpipe and piezometer 'cap' removed and cement grout installed to the surface.	MOP Section 4.1 Guideline for Mineral Exploration Drilling: Drilling & Integrity of Petroleum Production Wells (2016) Minimum Construction Requirements for Water Bores in Australia (2012)	No	No	To commence

Table 16 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Landform Establishment						
Mine landform integrates and generally blends in with surrounding landscape and is stable.	Minimal active erosion.	Absence of gullies > 300 mm wide or deep, or gullies stable.	MOP Section 4.2, 5.4.3 and 5.4.4	No	Yes	To commence
	Minimal active erosion.	Absence of tunnel erosion intake or outlets points.	MOP Section 4.2, 5.4.3 and 5.4.4	No	Yes	To commence
		Landform has an ~~average~~ overall slope of 10 degrees and trial areas applying geomorphic landform design.	MOP Section 5.4.2	No	Yes	To commence
Water quality non-polluting and appropriate for conservation end land use.	Water quality.	Oil/grease ≤ 10 milligrams per litre (mg/L).	CL 375, ML 1719, ML1701	No	Yes	Ongoing
		EC < 600 micro Siemens per centimetre (µS/cm).	CL 375, ML 1719, ML1701	No	Yes	Ongoing
		pH between 6.5 and 8.5 as per the EPL.	CL 375, ML 1719, ML1701	No	Yes	Ongoing
		TSS < 50 mg/L.	CL 375, ML 1719, ML1701	No	Yes	Ongoing
Phase – Growth Medium Development						
Develop a growth media that will support a mixture of native vegetation communities including grassy woodland, shrubby woodland/ open forest.	Soils ameliorated to sustain native ecosystems.	The depth and layering of respread subsoil and topsoil equal the results of the pre-disturbance soil testing program.	MOP Section 5.4.3	No	Yes	To commence
		Soil based criteria equal analogue sites (to be determined based on sampling results). Will include: • pH; • Organic matter; and • Phosphorous.	MOP Section 5.4.3	No	No	To commence
	Absence of dispersive soil and spoil.	Greater than 75% of soil samples will have an Exchangeable Sodium Percentage ≤ 6%.	MOP Section 4.2, 5.4.3	No	Yes	To commence

Table 16 (Continued)
Rehabilitation Completion Criteria

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~**Phase – Ecosystem Establishment**~~						
~~Woodland rehabilitation established consistent with analogue vegetation communities.~~ ~~Note: Local benchmarks[1] will be developed in consultation with OEH. in 2018[2] for the purpose of the completion criteria from analogue vegetation communities.~~	~~Native Species Richness~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Overstorey Cover~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Mid-storey Cover~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Grasses)~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Shrubs)~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Other)~~	~~Increase to at least 10% of lower benchmark.~~	~~MCCM BMP Table 6.10~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Exotic Plant Cover~~	~~Decreasing number and cover of exotic species~~	~~MCCM BMP Table 6.10~~ ~~Biosecurity Act 2015~~	~~No~~	~~Yes~~	~~Not commenced~~

Table 16 (Continued)
Rehabilitation Completion Criteria

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~**Phase – Ecosystem Sustainability**~~						
~~Woodland rehabilitation established consistent with analogue vegetation communities.~~ ~~Note: Local benchmarks[1] have will been developed in consultation with OEH. in 2018[2] for the purpose of the completion criteria from analogue vegetation communities.~~	~~Native Species Richness~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Overstorey Cover~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Mid-storey Cover~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Grasses)~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Shrubs)~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Native Groundcover (Other)~~	~~Increase to at least 80% of lower benchmark.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~Exotic Plant Cover~~	~~Less than 10% of domain area~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
	~~% Canopy Recruitment~~	~~Natural regeneration of Eucalypt canopy species present.~~	~~MCCM BMP Table 6.12~~	~~No~~	~~Yes~~	~~Not commenced~~
~~**Phase – Relinquishment**~~						
~~Unrestricted fauna movement across the rehabilitation.~~	~~Presence of a range of fauna assemblages throughout the rehabilitation.~~	~~A consistently observed increase in fauna species richness and/or abundance within each rehabilitation domain across at least half of the monitoring sites in that domain.~~	~~MCCM BMP Table 6.11~~	~~No~~	~~Yes~~	~~Not commenced~~

Table 16 (Continued)
Rehabilitation Completion Criteria

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~Site will be restored to a landform capable of sustaining the post-mining land uses.~~	~~Achievement of completion criteria.~~	~~All relevant completion criteria for the land proposed for relinquishment are acknowledged to be met by DRG (or contemporary equivalent).~~	~~This document~~	~~No~~	~~Yes~~	~~Not commenced.~~

~~[1] Benchmark is the required standard for each respective Performance Indicator established for specific native vegetation communities (Biometric vegetation communities) in NSW, as determined by the Office of Environment and Heritage. Lower benchmarks are used for completion criteria as they best align to establishing systems such as areas under rehabilitation.~~

~~[2] Completion Criteria will be updated and finalised with OEH by 30 September 2018 including:~~

~~1. Alignment of completion criteria with Section 7.16 and Preliminary Completion Criteria of the Maules Creek EA 2009,~~
~~2. Inclusion of sufficient parameters/indicators such that successful completion of each rehabilitation phase can be demonstrated,~~
~~3. Inclusion of defined trigger points to inform trajectory analysis, and~~
~~4. Defined reference sites and site specific benchmarks.~~

~~Once finalised, Completion Criteria will be incorporated into an amended MOP that will be provided to agencies for consultation, and DRG for approval.~~

Domain Objective	Performance Indicator	Completion Criteria							Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Ecosystem Establishment		**Time since Initial Revegetation**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**				
Woodland rehabilitation revegetation for White Box grassy woodland (BVT	BVT 226 and PCT 1383 Native Species Richness	**Mean Target**	1	2	3	4	5	5	Powerpoint Presentation used to consult with OEH in September	No	Yes	Not commenced
		Minimum Target	1	1	2	3	3	4				
	BVT 226 and PCT 1383 Native Overstorey Cover	**Mean Target**	1%	3%	4%	5%	6%	8%		No	Yes	Not commenced
		Minimum Target	0%	0%	0%	0%	0%	0%				

Domain Objective	Performance Indicator	Completion Criteria							Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592) as consulted with OEH September 2018	BVT 226 and PCT 1383 Native Mid-storey Cover	**Mean Target**	0%	1%	1%	1%	1%	2%	2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"	No	Yes	Not commenced
		Minimum Target	0%	0%	0%	0%	0%	0%				
	BVT 226 and PCT 1383 Native Groundcover (Grasses)	**Mean Target**	2%	4%	6%	8%	10%	12%		No	Yes	Not commenced
		Minimum Target	2%	3%	5%	6%	8%	9%				
	BVT 316 and PCT 592 Native Species Richness	**Mean Target**	1	2	4	5	6	7		No	Yes	Not commenced
		Minimum Target	1	2	3	4	5	6				
	BVT 316 and PCT 592 Native Overstorey Cover	**Mean Target**	2%	4%	6%	8%	10%	12%		No	Yes	Not commenced
		Minimum Target	0%	0%	0%	0%	0%	0%				
	BVT 316 and PCT 592 Native Mid-storey Cover	**Mean Target**	1%	3%	4%	5%	6%	8%		No	Yes	Not commenced
		Minimum Target	0%	1%	1%	1%	2%	2%				
	BVT 316 and PCT 592 Native Groundcover (Grasses)	**Mean Target**	2%	3%	5%	6%	8%	9%		No	Yes	Not commenced
		Minimum Target	1%	2%	3%	4%	5%	6%				

Table 16 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria					Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Ecosystem Sustainability		**Benchmarks**	**RBS* (80%) BVT NA 226**	**BVT NA 226**	**PCT BBS 1383****	**Local Reference**				
Woodland rehabilitation revegetation for White Box grassy woodland (BVT 226 and PCT 1383) and Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest (BVT 316 and PCT 592) as consulted with OEH September 2018	BVT 226 and PCT 1383 Native Species Richness	**Mean Target**	18	23	33	60	Powerpoint Presentation used to consult with OEH in September 2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"	No	Yes	Not commenced
		Minimum Target	13	18	28	55				
	BVT 226 and PCT 1383 Native Overstorey Cover	**Mean Target**	Not Applicable	25%	17%	13%		No	Yes	Not commenced
		Minimum Target	Not Applicable	6%	Not Applicable	Not Applicable				
	BVT 226 and PCT 1383 Native Mid-storey Cover	**Mean Target**	Not Applicable	5%	2%	4%		No	Yes	Not commenced
		Minimum Target	Not Applicable	0%	Not Applicable	Not Applicable				
	BVT 226 and PCT 1383 Native Groundcover (Grasses)	**Mean Target**	Not Applicable	40%	45%	38%		No	Yes	Not commenced
		Minimum Target	Not Applicable	30%	Not Applicable	Not Applicable				
		Benchmarks	**RBS* (80%) BVT NA 316**	**BVT NA 316**	**PCT BBS 592****	**Local Reference**				
	BVT 316 and PCT 592 Native Species Richness	**Mean Target**	24	30	35	Not Applicable	Powerpoint Presentation used to consult with OEH in September 2018 titled "WHC-OEH Woodland Revegetation Completion Criteria Meeting 25Sept18. pptx"	No	Yes	Not commenced
		Minimum Target	19	25	30	Not Applicable				
	BVT 316 and PCT 592 Native Overstorey Cover	**Mean Target**	Not Applicable	40	59	Not Applicable		No	Yes	Not commenced
		Minimum Target	Not Applicable	25	Not Applicable	Not Applicable				
	BVT 316 and PCT 592 Native Mid-storey Cover	**Mean Target**	Not Applicable	25	30	Not Applicable		No	Yes	Not commenced
		Minimum Target	Not Applicable	6	Not Applicable	Not Applicable				
	BVT 316 and PCT 592 Native Groundcover (Grasses)	**Mean Target**	Not Applicable	30	22	Not Applicable		No	Yes	Not commenced
		Minimum Target	Not Applicable	20	Not Applicable	Not Applicable				
Phase – Relinquishment										

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Unrestricted fauna movement across the rehabilitation.	Presence of a range of fauna assemblages throughout the rehabilitation.	A consistently observed increase in fauna species richness and/or abundance within each rehabilitation domain across at least half of the monitoring sites in that domain.	MCCM BMP Table 6.11	No	Yes	Not commenced

* Leard Forest Regional Biodiversity Strategy Stage 2 (Umwelt, 2017) Table 2.3 Strategic Biodiversity Performance Measures and Preliminary Completion Criteria on Page 31 for Active Revegetation

** Based on OEH (2017) Visual Information Database for Export of Plant Community Types (PCT) Benchmarks for Brigalow Belt South (BBS) 1383 White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions and 592 Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion.

7 REHABILITATION IMPLEMENTATION

7.1 STATUS AT MOP COMMENCEMENT

At the commencement of this MOP, all domains will be classed as 'active' with only minor rehabilitation activities completed in association with exploration activities and the tidy up following the completion of particular construction activities. The landform at the commencement of the MOP is shown on Plan 2.

7.2 PROPOSED REHABILITATION ACTIVITIES DURING THE MOP TERM

Table 17 shows the annual total disturbance and rehabilitation for each year included in this MOP.

Table 17
Disturbance and Rehabilitation Progression during the MOP

Year	Total Disturbance Area (ha)	Total Rehabilitation Area (ha) (per year)	Cumulative Rehabilitation Area	Rehabilitation Phase
Start of MOP (2018)	1,494	0	0	N/A
End of 2018	1,~~603~~598	30	30	Landform Establishment
End of 2019	1,6~~7~~60	~~12~~70	1~~5~~00	Growth Medium Development
End of 2020	1,6~~88~~73	~~1~~90	1~~6~~90	Ecosystem and Land Use Establishment
End of 2021	1,~~71~~695	74	2~~36~~4	Ecosystem and Land Use Establishment
End of MOP (2022)	1,7~~2~~702	70	3~~0~~34	Ecosystem and Land Use Establishment

7.3 SUMMARY OF REHABILITATION ACTIVITIES DURING THE MOP TERM

Table 18 shows the rehabilitation phases for each domain, indicating rehabilitation to be completed during the term of this MOP.

With respect to Rehabilitation Phase progression from Growth Medium Development to Ecosystem Establishment in any given MOP year, MCCM will endeavour to maximise the area progressed subject to when topsoil placement is complete and favourable weather conditions for vegetation establishment.

Table 18
Primary and Secondary Domains, Rehabilitation Phases and Areas at Commencement and Completion of MOP

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)[1]
Infrastructure Area	Rehabilitated Woodland	1E	Active	264	274
			Decommissioning	0	2
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**264**	**274**
Overburden Emplacement	Rehabilitated Woodland	4E	Active	554	~~600~~572
			Decommissioning	0	0
			Landform Establishment	0	~~0~~69
			Growth Medium Development	0	~~0~~265
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**554**	**~~600~~906**
Water Management	Water Management	3B	Active	66	63
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**66**	**63**
Void	Final Void	6I	Active	501	309
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**501**	**309**
Stockpiled Material	Rehabilitated Woodland	5E	Active	109	149
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**109**	**149**
Rehabilitation	Rehabilitated Woodland	7E	Active	0	0

Table 18 (Continued)
Primary and Secondary Domains, Rehabilitation Phases and Areas at Commencement and Completion of MOP

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	69
			Ecosystem Establishment	0	2~~36~~5
			Ecosystem Development	0	0
			Relinquished Lands	0	0
			Total	**0**	**3~~0~~34**
Total				**1494**	**~~170~~12035**

[1] Excludes 5ha/yr of exploration related disturbance within future mining areas.

8 REHABILITATION MONITORING AND RESEARCH

8.1 REHABILITATION MONITORING

The inspection and monitoring of rehabilitation will be undertaken by MCCM personnel through regular inspections as well as through engaging suitably qualified specialists (as required).

Aspects of rehabilitation to be inspected will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of initial grass cover establishment;
- Success of tree and shrub plantings;
- Adequacy of drainage controls;
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

The aim of the vegetation monitoring program at MCCM is to evaluate the success of revegetation of the Rehabilitation towards achieving the performance and completion criteria specified in Section 6. The Rehabilitation monitoring program will be consistent with the monitoring program implemented for the Biodiversity Offsets in the BMP. The experimental design for MCCM's Rehabilitation monitoring program will involve progressively establishing ~~three types of~~ vegetation monitoring sites (including three replicate plots per site to increase statistic robustness) aiming to sample revegetation management (treatment = action sites) compared to ~~no management (untreated/unmanaged = control sites) and~~ the development of revegetation towards the desired woodland final land use (remnant woodland vegetation = analogue/reference sites).

The number and location of the MCCM rehabilitation vegetation monitoring sites will be determined progressively during the Ecosystem Establishment phase of rehabilitation works (indicative monitoring locations shown in Figure 1). MCCM will engage qualified ecologists to undertake vegetation monitoring on an annual basis in spring. Fixed vegetation monitoring plots measuring 20 x 50 m will be established at each monitoring site and permanently marked with a star picket and within each plot a 20 x 20 m quadrat will also be established based on the BioBanking Assessment Methodology (BBAM) (OEH, 2014). The BBAM vegetation monitoring methodology includes monitoring vegetation structural parameters and flora species diversity consistent with the performance and completion criteria in Section 6.

Rehabilitation inspection and monitoring documentation will be collated into a central database by the site environmental officer, or alternate, upon receipt.

Annual Reviews will report on monitoring results including discussion on trends and management effectiveness.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance in terms of lease relinquishment. Maintenance will continue until such time as the performance and completion criteria are met.

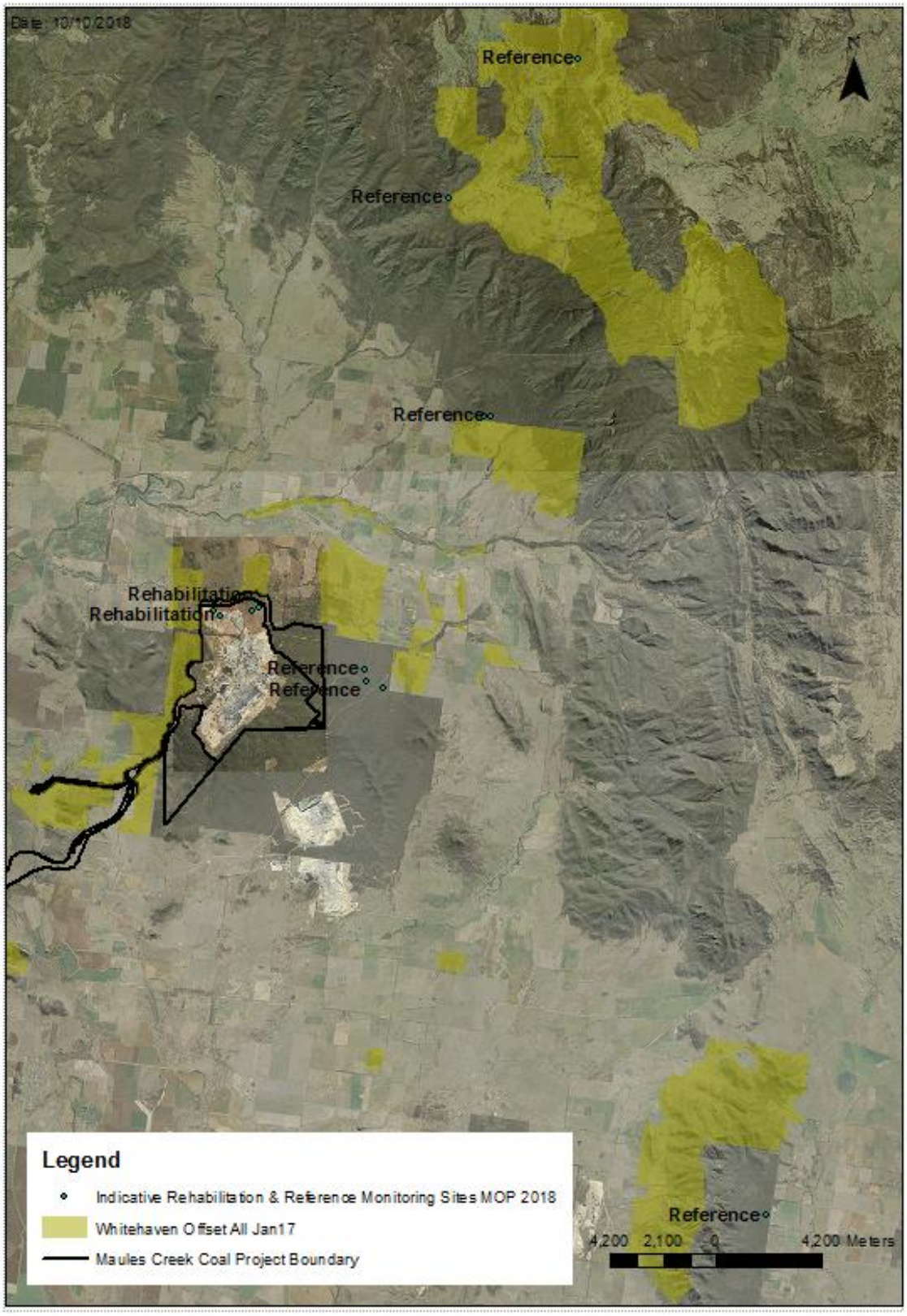


Figure 1 MCCM Indicative Rehabilitation & Reference Monitoring Sites

8.2 RESEARCH AND REHABILITATION TRIALS AND USE OF ANALOGUE SITES

MCCM has developed a Box-Gum Woodland Research Project Plan that describes how MCCM will invest $1,000,000 for research aimed at identifying effective methodologies for achieving rehabilitation and restoration of functioning White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland) Critically Endangered Ecological Community (CEEC) on mine rehabilitation. The Project Plan has been prepared in accordance with Condition 15 of the Maules Creek Coal Mine (MCCM) Environment Protection and Biodiversity Conservation (EPBC) Approval 2010/5566.

The Box-Gum Woodland Research Project Plan describes four research projects to be implemented between 2017 and 2021 which was developed by a Steering Committee comprised of preeminent restoration ecologists and researchers to address key gaps in the knowledge of restoration practice for Box-Gum Woodland CEEC on mining rehabilitation and are summarised in Table 19 below.

Table 19
Summary of Box Gum Woodland Rehabilitation Research Projects

Research Projects
1 – Structured Review of Rehabilitation of Grassy Box Woodland (COMPLETED)
2 – Soil Stockpile Management
3 – Overburden Regolith
4 – Box Gum Woodland Rehabilitation Establishment Systems
5 – Adaptive Research

Reference site/s representative of the MCCM rehabilitation final land uses will be selected from the various number of regionally based vegetation monitoring sites across Whitehaven Coal's Gunnedah Basin wide rehabilitation and biodiversity offset areas monitoring programs (Figure 1).

9 INTERVENTION AND ADAPTIVE MANAGEMENT

9.1 THREATS TO REHABILITATION

As described in Section 3.1, MCC has completed an overarching risk assessment to identify the potential threats to the success of rehabilitation at the MCCM. A full copy of this risk assessment is provided in Appendix C. To maximise the overall success of the rehabilitation program, a monitoring, inspection and corrective action regime will be implemented as described in Section 8.

Outcomes of the annual rehabilitation inspections will be recorded and any mitigation actions that are identified as part of the inspection will be entered into the MCC document control recording system for implementation. Where necessary, rehabilitation procedures will be reviewed and revised in order to improve rehabilitation standards.

In the event that the monitoring and rehabilitation research programs identify that rehabilitation results are sub-optimal and/or improvements can be made, further investigation to establish a cause and appropriate remediation strategy(s) will be undertaken. Aspects that may be considered as part of the investigation may include, but are not necessarily limited to the following:

- nutrient availability;
- pH, salinity and metal toxicity;
- shallow root depth;
- other soil limitations;
- plant diseases;
- insect attack;
- lack of nitrogen-fixing legumes;
- lack of organisms involved in litter breakdown (e.g. fungal fruiting bodies) and nutrient cycling (e.g. puff balls);
- predation;
- evidence of drought effects or storm damage;
- poor soil preparation; and
- weed competition and/or competition with other species in the seed/tube stock mix.

The composition and structure of revegetated areas will also be compared with the target vegetation community characteristics at the analogue monitoring sites (Section 8). In cases where the performance is sub-optimal, additional management measures will be implemented (e.g. replanting, causing disturbance through grazing and/or fire).

9.2 TRIGGER ACTION RESPONSE PLAN

A trigger action response plan (TARP) for rehabilitation at the MCCM has been developed (Table 20) and will be implemented where required.

Table 20
TARP for the Maules Creek Coal Mine

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
Landform stability	Slope gradient	1	Trigger	<70% of the rehabilitation area has slopes within the limits stipulated in the MOP.	<55% of the rehabilitation area has slopes within the limits stipulated in the MOP.
			Response	Undertake re-grading and revegetation of the area.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area.
	Erosion control	2	Trigger	Minor gully or tunnel erosion present and/or minor rilling (rilling up to 300 mm in depth or width).	Slumping and/or significant gully or tunnel erosion present and/or significant rilling, which is compromising landform.
			Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.	Engage suitably qualified person(s) to assist with the management of erosion and sedimentation at the site and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable.
	Water management Structures	3	Trigger	Water management structures (sediment dams, channels, contour banks) minor erosion and/or scouring as determined by monitoring.	Water management structures fail or display significant scouring / erosion as determined by monitoring.
			Response	An inspection of the site will be undertaken by a suitably trained person. Identify remedial actions such as amelioration, re-vegetation or alternative scour protection	Engage a suitably qualified person to develop a site specific remediation plan and review water management structure design criteria. Provide for physical works on the basis of design review.

Table 20 (Continued)
TARP for the Maules Creek Coal Mine

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
Biodiversity (native vegetation areas)	Native Species Richness	4	Trigger	~~Less than 50% of species sown recorded.~~ Less than the relevant mean target criteria for the "Time Since Initial Revegetation" (i.e. BVT 226 Year 1 = 1 or BVT 316 Year 5 = 6) in Table 16	~~Less than 25% of species sown recorded.~~ Less than the relevant minimum target criteria for the "Time Since Initial Revegetation" (i.e. BVT 226 Year 3 = 2 or BVT 316 Year 2 = 2) in Table 16.
			Response	~~Undertake a field survey to identify which species not present in revegetation areas.~~ ~~Re-seed or maintenance planting of revegetation areas with unsatisfactory species richness.~~ Review methods used by revegetation contractor; seed or seedling quality, soil quality or weather conditions since time of revegetation to determine if the cause of delayed native species richness.	Engage a suitably qualified person to investigate causes for revegetation failure and recommend remedial actions. Undertake a field survey to identify which species not present in revegetation areas. Re-seed or maintenance planting of revegetation areas with unsatisfactory species richness. Implement appropriate management actions including revising rehabilitation procedures if required.
	Native Groundcover (Grasses)	5	Trigger	~~Less than 50% of groundcover species sown recorded.~~ Less than the relevant mean target criteria for the "Time Since Initial Revegetation" (i.e. BVT 226 Year 1 = 2% or BVT 316 Year 5 = 8%) in Table 16.	~~Less than 25% of groundcover species sown recorded.~~ Less than the relevant minimum target criteria for the "Time Since Initial Revegetation" (i.e. BVT 226 Year 3 = 5% or BVT 316 Year 2 = 2%) in Table 16.

			Response	~~Undertake a field survey to identify likely causes of unsatisfactory germination rates.~~ ~~Re-seed areas with unsatisfactory cover.~~ ~~Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare.~~ Review methods used by revegetation contractor; seed or seedling quality, soil quality or weather conditions since time of revegetation to determine if the cause of delayed native groundcover (grasses).	Engage a suitably qualified person to investigate causes for germination failure and recommend remedial actions. Undertake a field survey to identify likely causes of unsatisfactory germination rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare. Implement appropriate management actions including revising rehabilitation procedures if required.
	Exotic Plant Cover (Weeds)	6	Trigger	Increasing ~~number~~ richness and cover of exotic species and/or occurrence of newly identified exotic species.	More than 10% of domain area and/or significant weed invasions.
			Response	Engage weed management contractor to remove / spray introduced weed species.	Engage weed management contractor to remove introduced weed species. Investigate management measures to improve native plant establishment and weed suppression including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate.
	Pest Animal Control	7	Trigger	Site fauna monitoring shows an increase in pest animal species following control measures implemented across sites.	Significant pest animal occurrences of newly identified pest species identified through site inspections and monitoring.
			Response	Identify the location of pest animal issues and review the need for further control measures.	Review the issues and facilitate additional control measures as required.

Table 20 (Continued)
TARP for the Maules Creek Coal Mine

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
Water Quality	Water quality	8	Trigger	Water quality exceeds baseline values	Long term upward trend outside ANZECC quality guideline limits values
			Response	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Hydrologist (or similar specialist) to review sampling and climate data and review likely cause(s). If mine related, undertake assessment to identify sources of water quality degradation and recommend remedial actions Implement specialist recommendations
	Discharge water quality at licence discharge points	9	Trigger	Sediment basin discharge exceeds EPL criteria for pH, TSS and/or oil/grease	Long term upward trend outside ANZECC quality guideline limits
			Response	Re-sampling will be undertaken during the next discharge event to confirm results exceed limits, and investigate potential causes.	Review sediment basin maintenance and discharge procedures, and sediment basin capacity requirements. Undertake required corrective actions.
Soil/spoil Quality	Salinity	10	Trigger	Increasing trend in soil/water salinity levels	Presence of salt scalds
			Response	Undertake soil/spoil testing to verify EC and recommend further soil / spoil amelioration	Engage a specialist consultant suitably qualified person to develop a site specific management report to be implemented to remediate salinity scalds. Undertake works as required.
	Spoil surface layers chemical characteristics	11	Trigger	Increasing trend in soil dispersivity (EAT)	Soil are moderately to highly dispersive

			Response	Undertake testing to determine required amelioration and undertake amelioration as required.	Review material handling practices to confirm that non-dispersive spoil is selectively dumped at final RL where possible and /or dispersive spoils emplaced at surface are appropriately ameliorated. Ameliorate dispersive spoils (for example with coarse gypsum) to a depth of 300 mm. Re-vegetate if required.
	Soil biophysical and chemical characteristics	12	Trigger	Soil nitrogen, potassium and phosphorous levels are not in the range of analogue sites by Year 5	Soil physical, chemical and biological characteristics are not able to sustain the desired final land use.
			Response	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.
	Topsoil Depth	1~~0~~3	Trigger	Topsoil is not reinstated to, at least, the minimum depth specified for the proposed final land use.	Sufficient suitable topsoil cannot be identified for reinstatement at the minimum specified depth for the proposed final land use
			Response	Top dress with additional suitable topsoil resource. If additional suitable material is not immediately available stabilise the area with cover crop until additional suitable topsoil is sourced and re-emplaced.	Undertake a review of the topsoil balance to confirm sufficient material to meet minimum depth requirements. Investigate suitable topsoil resource substitutes and introduce if required.

10 REPORTING

The MCCM mining tenement conditions require the lease holder to lodge an Annual Environmental Management Review (AEMR). Amongst other things, the AEMR must report against compliance with the MOP, report on progress in respect of rehabilitation criteria, report on the extent of compliance with regulatory requirements, and have regard to any relevant guidelines adopted by the Director General.

In addition, Condition 4 of Schedule 5 of PA 10_0138 requires the preparation of an Annual Review, which outlines the environmental performance of the MCCM over the preceding 12 month period.

At the MCCM, the AEMR and Annual Review are combined into a single document. It discusses rehabilitation performance against the key objectives and completion criteria and any non-conformance issues. It also includes monitoring results, statutory requirements, and a description of rehabilitation activities and measures that will be implemented over the following year. Stakeholders are provided access to the AEMR/Annual Review via the Whitehaven website.

In addition to AEMR/Annual Review reporting MCCM will report to DRG and DP&E any identified mine planning/scheduling/mine progression issues, and/or rehabilitation performance issues identified in Sections 8 and 9, along with proposed mitigation action(s), that may result in material delays to mine rehabilitation and/or changes to mine progression. Reporting will be undertaken as soon as practicable after becoming aware of the issue.

11 PLANS

As required by the ESG3 MOP Guidelines, MCC has prepared the following plans which are presented on the following pages:

- Plan 1A – Pre-Mining Environment – Locality
- Plan 1B – Pre-Mining Environment – Natural Environment
- Plan 1C – Pre-Mining Environment – Built Environment
- Plan 2 – Mine Domains at commencement of MOP
- Plan 3A – Mining and Rehabilitation – 1 January 2019
- Plan 3B – Mining and Rehabilitation –1 January 2020
- Plan 3C – Mining and Rehabilitation –1 January 2021
- Plan 3D – Mining and Rehabilitation –1 January 2022
- Plan 3E – Mining and Rehabilitation –1 January 2023
- Plan 4 – Final Rehabilitation and Post Mining Land Use
- Plan 5 – Mining Operations Plan – Cross Sections

220 000 E

230 000 E

N

Parish of Deriah

Parish of Wallah

Parish of Billyena

Horsearm Creek

Nandewar Range

Parish of Byar

Mt Kaputar National Park

Middle Creek Road

Black Mountain Creek Road

Maules Creek Road

Timor Mountain Road

Browns Lane

Parish of Durrisdeer

Maules Creek Village

Maules Creek

Parish of Berrioye

Harparary Road

Ellerslie Road

Trantham Road

NAMOI RIVER

6 620 000 N

A346

Teston Lane

Back Creek Road

Back Creek

ML1719

Parish of Therribri

EL 8072

Therribri Road

Leard State Conservation Area

Parish of Baan Baa

Leard State Forest

ML 1701

KAMILAROI HIGHWAY

Werris Creek Moree Railway

Willow Tree Range

C368

A339

Parish of Bollol

Old Narrabri Road

Leard Forest Road

Parish of Leard

CL375

A355

EL7435

ML1685

6 610 000 N

County of Pottinger

County of Nandewar

Goonbri Creek

Bollol Creek

Dinaring Rock Road

MLA464

ML1579

ML1693

Goonbri Road

Parish of Wean

Barbers Lagoon

Boggabri - Manilla Road

Parish of Boggabri

Parish of Willala

Braymont Road

BOGGABRI

6 600 000 N

EL5967

Grantham Street West

Cox ck

Cors

NARRABRI SHIRE COUNCIL

Parish of Vickery

KAMILAROI HIGHWAY

NAMOI RIVER

GUNNNEDAH SHIRE COUNCIL

Vickery State Forest

Parish of Gulligal

LEGEND

- Exploration Licence Boundary
- Authorisation Boundary
- Coal Lease Boundary
- Mining Lease Boundary
- Adjoining Lease Boundary
- Project Boundary
- Project Disturbance Boundary
- Local Government Area
- County Boundary
- Parish Boundary
- Cadastral Boundary
- National Park/ State Conservation Area
- State Forest
- Rail line
- Drainage

0 2
Kilometres
GDA 1994 MGA Zone 56

MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE: 8-11-2017
PREPARED BY: Resource Strategies Pty Ltd

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indication of the proposed development.

Appropriate Responsible Officer

09/11/17
Date

MAULES CREEK COAL MINE

PLAN 1A
Pre-mining Environment
Locality

WHITEHAVEN COAL

WHC-15-35_MOP 2017_101A

LEGEND

- Exploration Licence Boundary
- Authorisation Boundary
- Coal Lease Boundary
- Mining Lease Boundary
- Project Boundary
- Project Disturbance Boundary
- State Forest
- State Conservation Area
- Existing Maules Creek Biodiversity Corridor
- Maules Creek Biodiversity Offset Area
- 1 in 100 Year Flood Level
- Drainage
- Rail line
- Fence
- Existing Overhead Powerline

LAND USE

- Forest Area
- Cropping
- Pastural

Source: NSW Dept of Industry (2015); Orthophoto (Sept 2011) Whitehaven

0 1

Kilometres
GDA 1994 MGA Zone 56

N

ML 1719

ML 1701

Leard CCA Zone 3
State Conservation Area

LEARD STATE FOREST

Whitehaven Dome

Maryvale Creek

VEGETATION COMMUNITIES

Red/Gum Ironbark Forests
- Narrow-leaved Ironbark - White Cypress Pine shrubby open forest
- Silver-leaved Ironbark Heathy Woodland
- Dwyer's Red Gum - Ironbark Woodland
- Dwyer's Red Gum Woodland

RF Elements
- Cliff and Scree Thickets (Rainforest Species)

Riparian Forests
- Melaleuca Riparian Forest
- White Box - Blakely's Red Gum - Melaleuca Riparian Forest (CEEC)

White Box - Yellow Box - Blakely's Red Gum Woodlands
- White Box - Narrow-leaved Ironbark - White Cypress Pine Grassy Open Forest (CEEC)
- Yellow Box - Blakely's Red Gum Grassy Woodland (CEEC)
- White Box - Narrow-leaved Ironbark - White Cypress Pine Shrubby Open Forest

Belah Assocations
- Pilliga Box - Poplar Box - White Cypress Pine Grassy Open Woodland
- White Box - Wilga - Belah Woodland (CEEC)
- Belah Woodland

Grassland
- Derived Native Grassland (Low Diversity - White Box Woodland)
- Derived Native Grassland (Low Diversity - with scattered Poplar Box trees)
- Derived Native Grassland (CEEC)
- Crop land on basalt soil (with scattered White Box)

Source: Cumberland Ecology (2011)

MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE: 8-11-2017
PREPARED BY: Resource Strategies Pty Ltd

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indication of the proposed development.

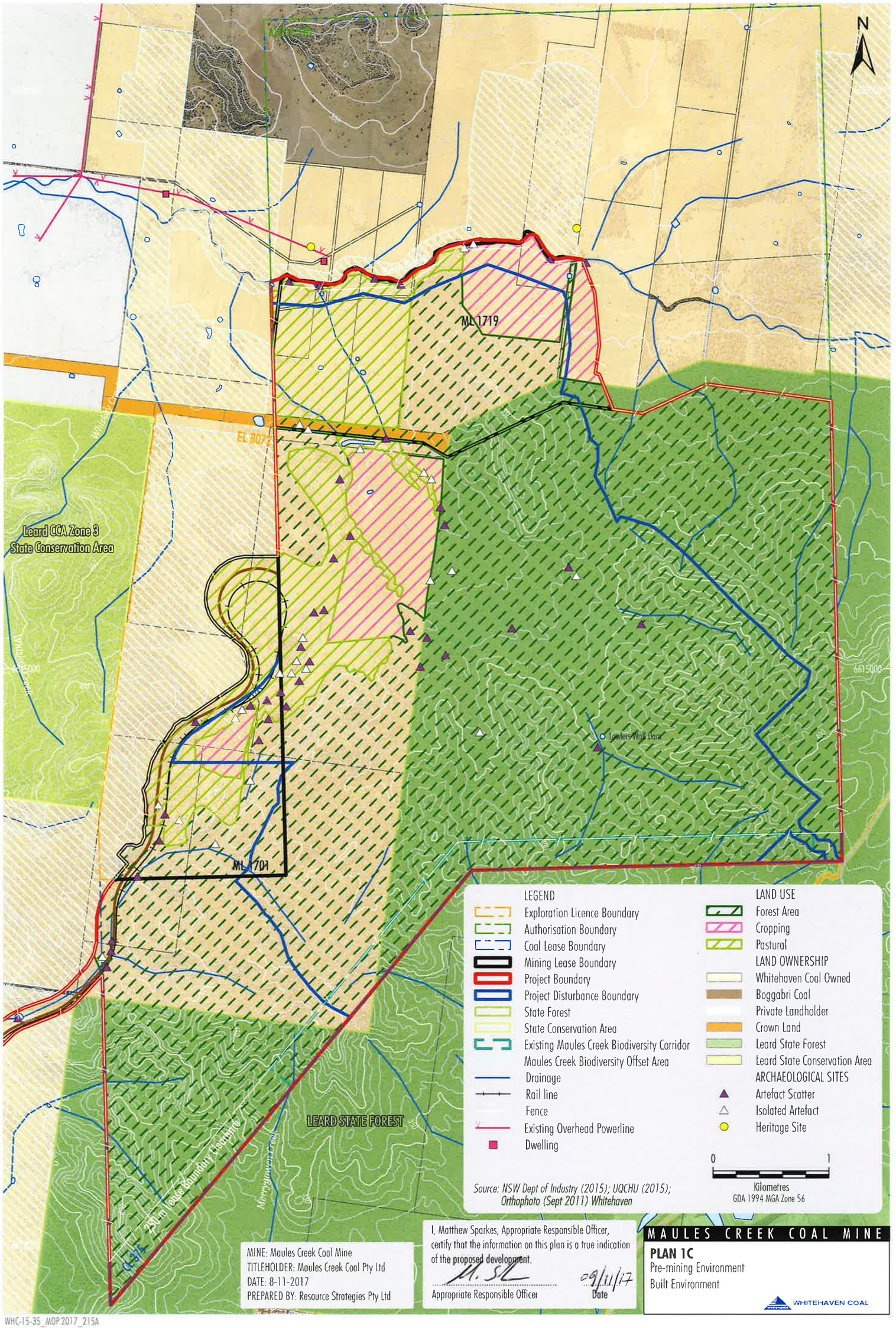
Appropriate Responsible Officer — Date: 09/11/17

MAULES CREEK COAL MINE

PLAN 1B
Pre-mining Environment
Natural Environment

WHITEHAVEN COAL

WHC-15-35_MOP 2017_214A



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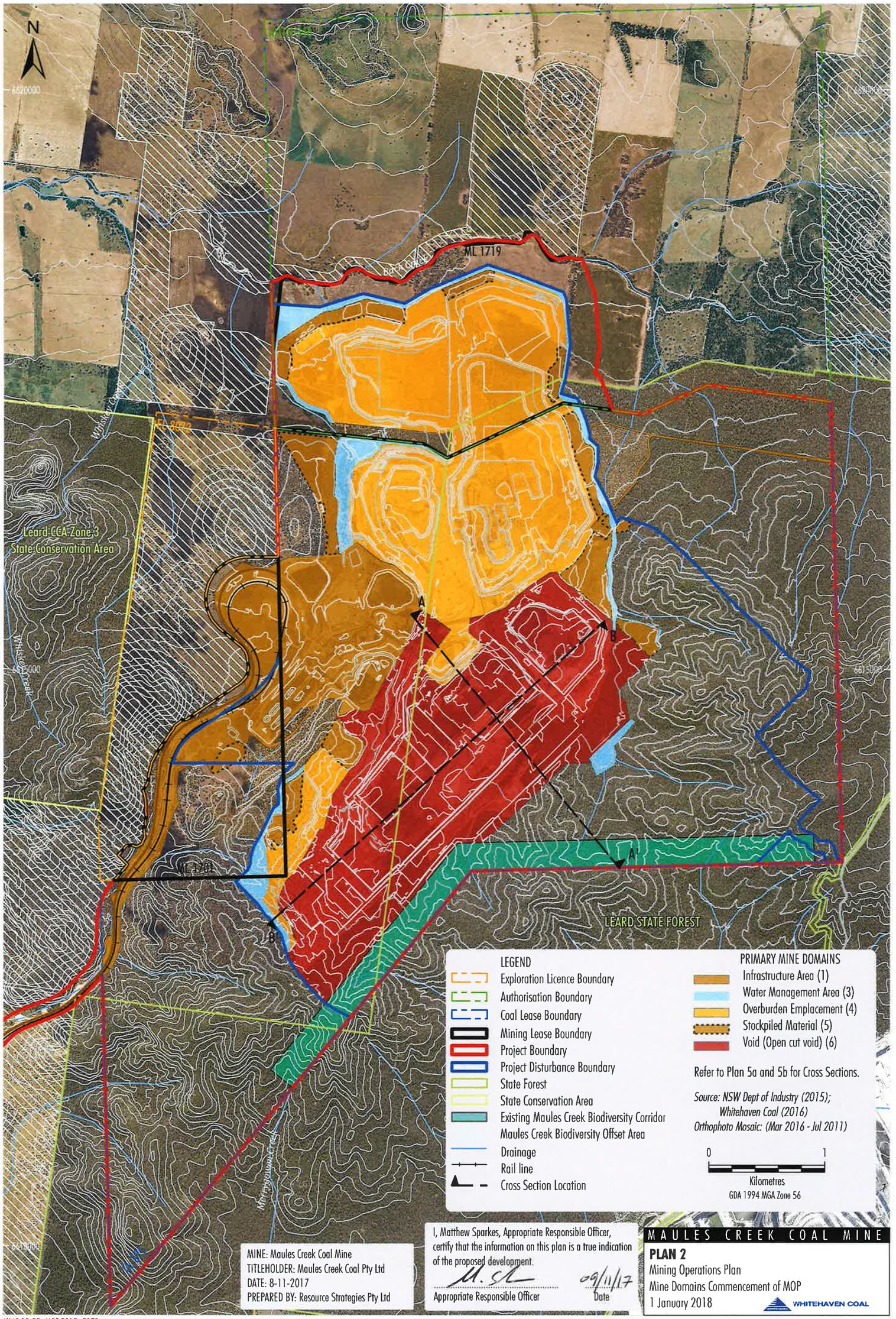

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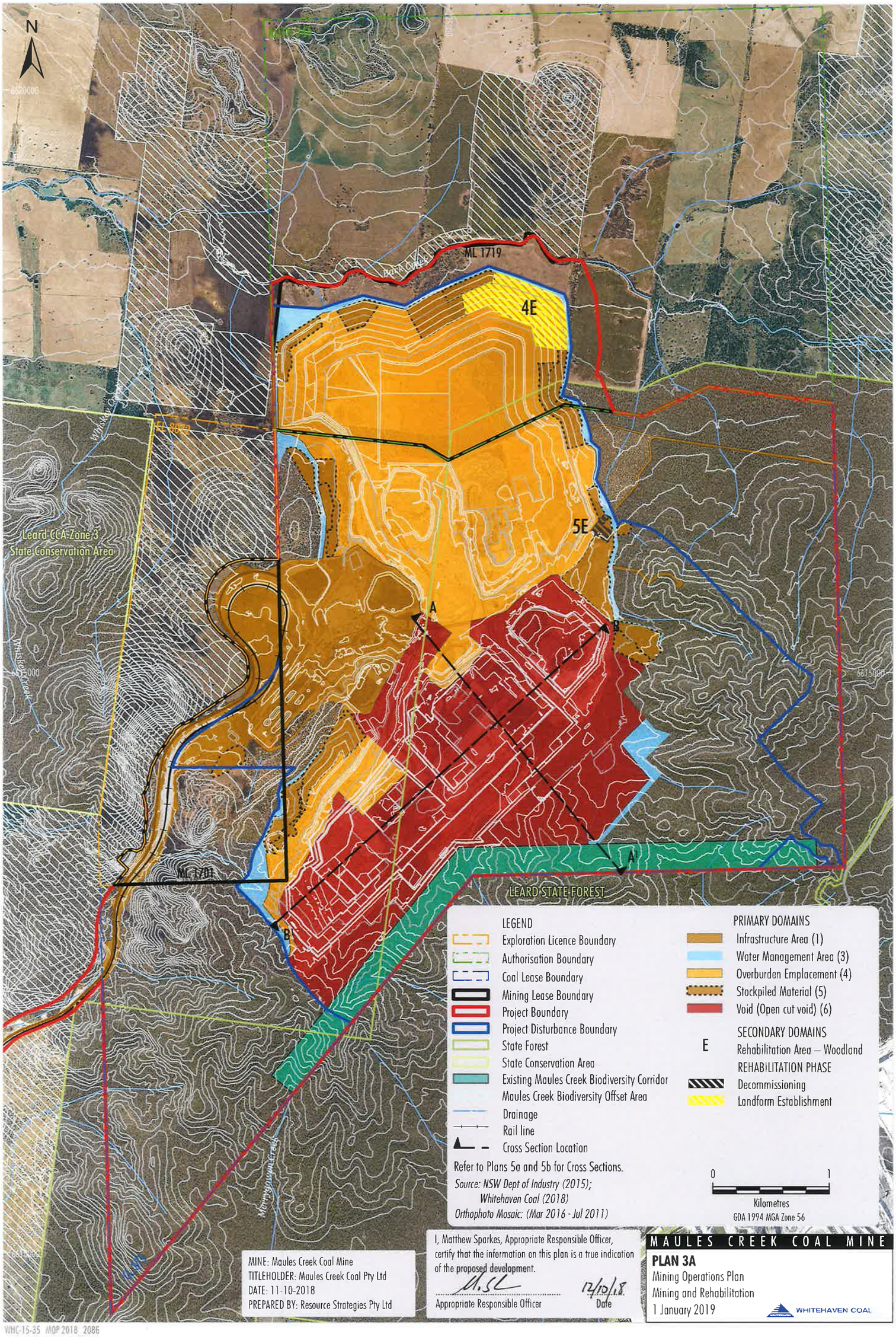

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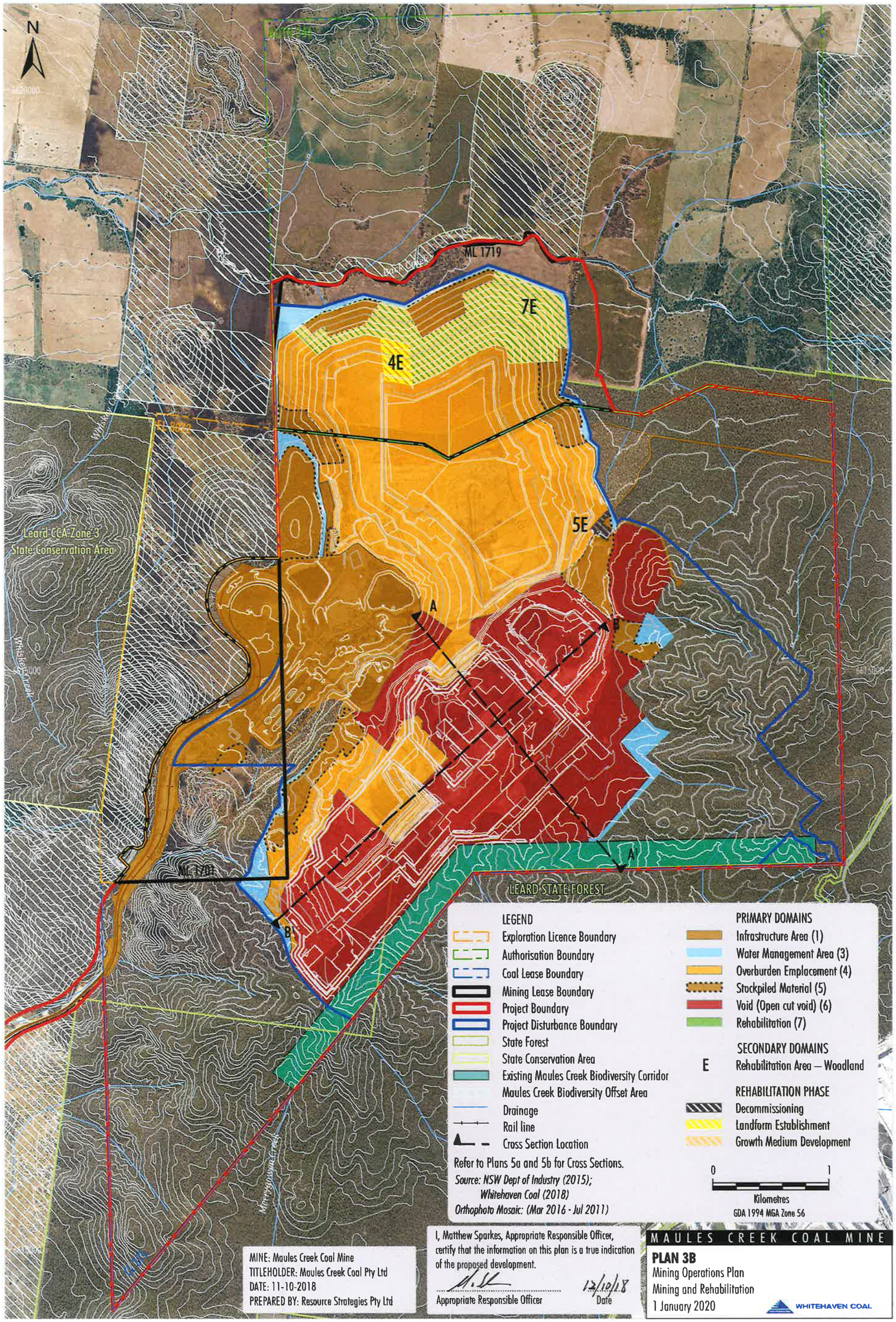
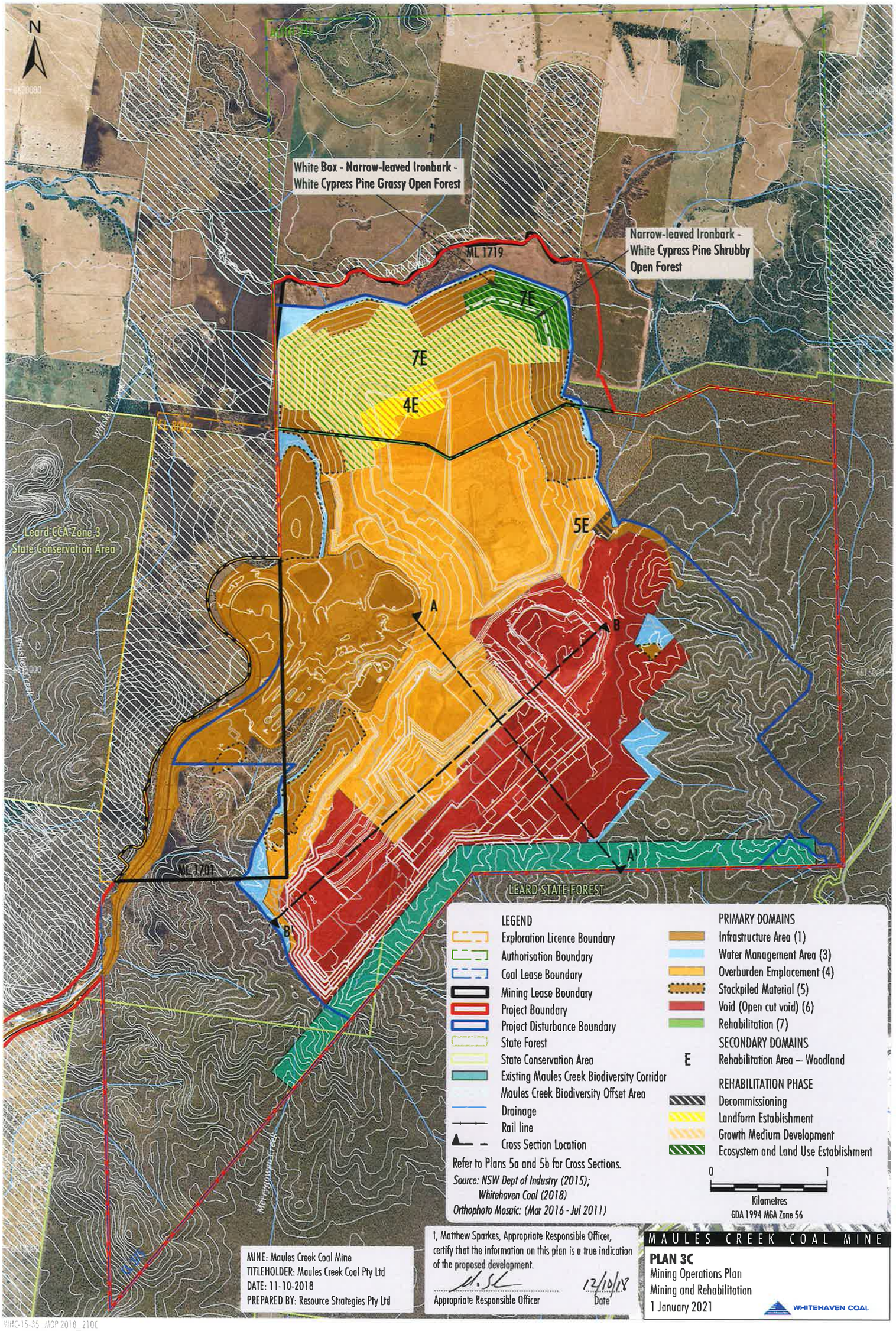


WMC-15-35_MOP 2018_209C



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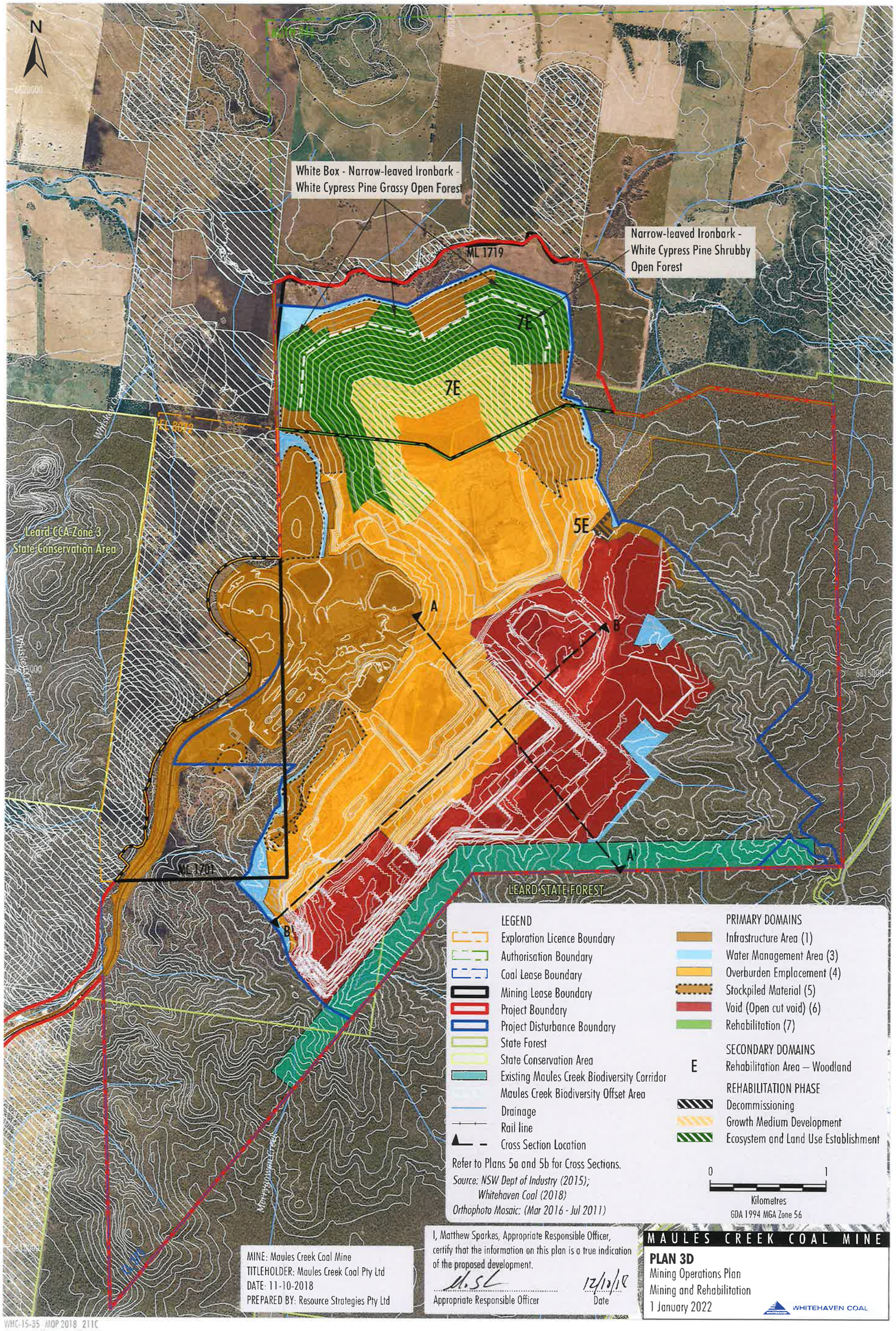
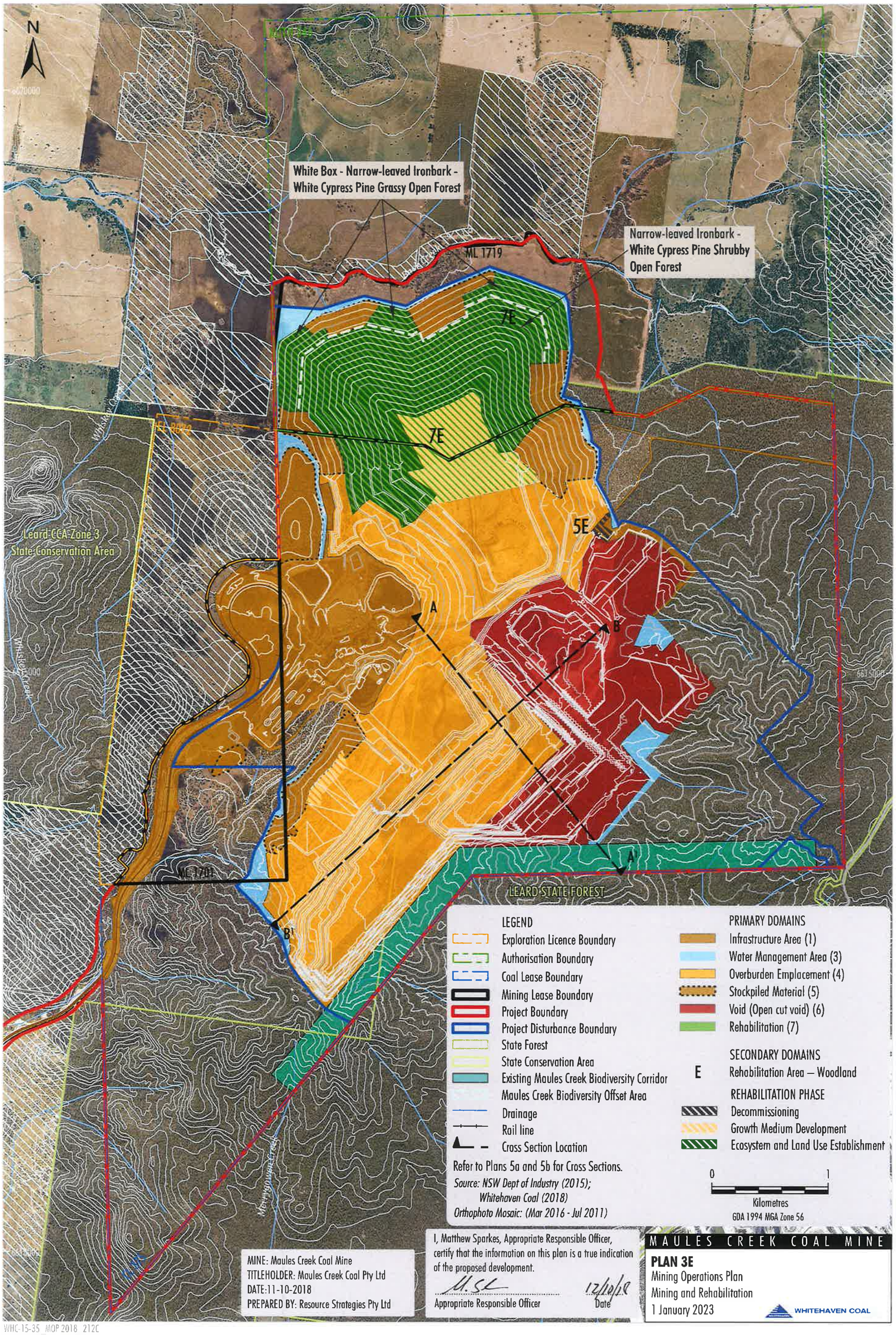


WHC-15-35_MOP 2018_211C



MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE:11-10-2018
PREPARED BY: Resource Strategies Pty Ltd

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indication of the proposed development.

Appropriate Responsible Officer — Date: 12/10/18

MAULES CREEK COAL MINE

PLAN 3E
Mining Operations Plan
Mining and Rehabilitation
1 January 2023

WHITEHAVEN COAL

LEGEND

- Exploration Licence Boundary
- Authorisation Boundary
- Coal Lease Boundary
- Mining Lease Boundary
- Project Boundary
- Project Disturbance Boundary
- State Forest
- State Conservation Area
- Existing Maules Creek Biodiversity Corridor
- Maules Creek Biodiversity Offset Area
- 1 in 100 Year Flood Level
- Drainage
- Rail line
- Fence
- Cross Section Location

SECONDARY DOMAINS
POST MINING LANDUSE (December 2034)

- Rehabilitation Area - Woodland
- Final Void
- Water Management Area

AUTH 341
ML 1719
ML 1701
Leard CCA Zone 3
State Conservation Area
LEARD STATE FOREST
Whistler Creek
Whistler Creek
Maryvale Creek
230 m Leard Boundary Clearance
465000
685000
685500

LAND CAPABILITY

I — Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation.

II — Structural soil conservation works such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotation.

III — Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture.

IV — Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class IV.

VI — Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. May include some isolated structural works.

VII — Land best protected by trees. Very important habitat areas for protecting biodiversity. Timber production or honey is possible.

Refer to Plan 5 for Cross Sections.

Source: NSW Dept of Industry (2015); Orthophoto (Sept 2015) Whitehaven

0 — 1
Kilometres
GDA 1994 MGA Zone 56

MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE: 8-11-2017
PREPARED BY: Resource Strategies Pty Ltd

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indication of the proposed development.

Appropriate Responsible Officer — Date 9/11/17

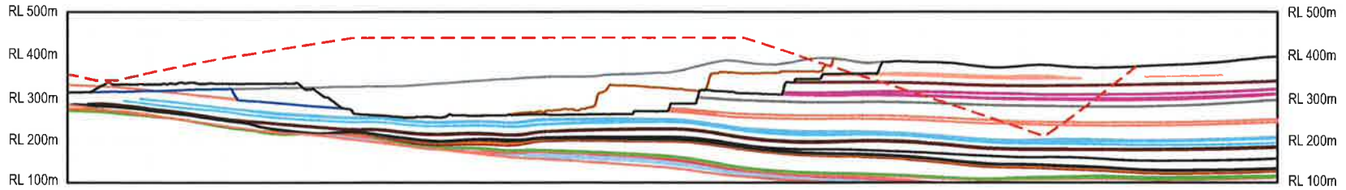
MAULES CREEK COAL MINE

PLAN 4

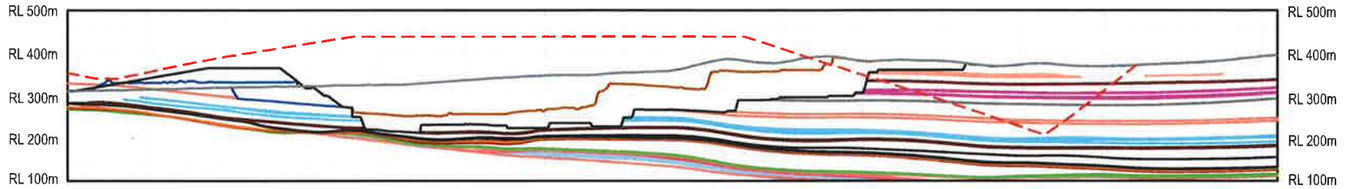
Final Rehabilitation and Post-mining Land Use

WHITEHAVEN COAL

WHC-15-35_MOP 2017_216A



CROSS SECTION A-A' 1st Jan 2019 LANDFORM



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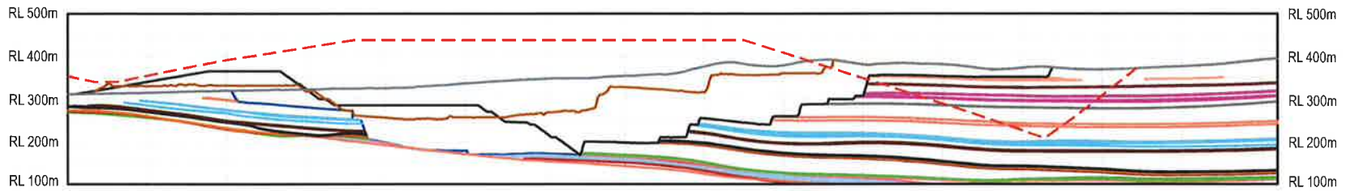

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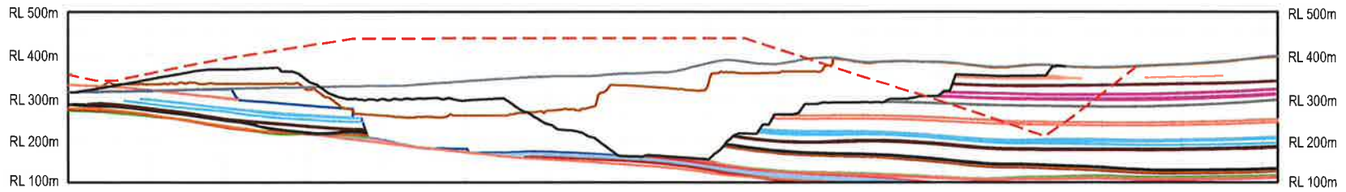

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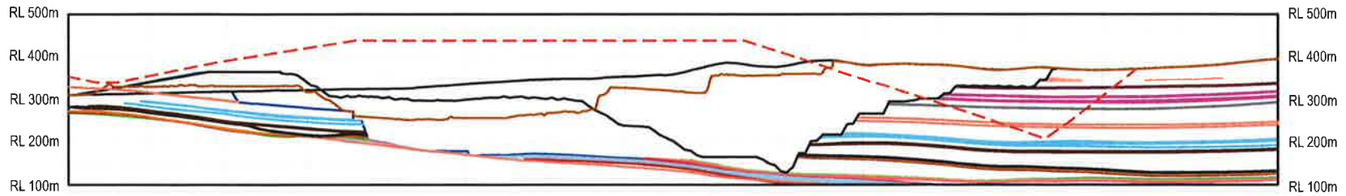


CROSS SECTION A-A' 1st Jan 2023 LANDFORM

LEGEND

- Natural Surface
- Existing Surface
- Mine Stage Landform
- Final Surface Landform
- Herndale Seam
- Onavale Seam
- Teston Seam
- Thornfield Seam
- Braymont Seam
- Jeralong Seam
- Merriown Seam
- Velyama Seam
- Nagero Seam
- Upper Northern Seam
- Lower Northern Seam
- Therribri Seam
- Flixton Seam
- Tarrawonga Seam
- Templemore Seam

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indicationof the proposed development.

M. Sk
Appropriate Responsible Officer

09/11/17
Date

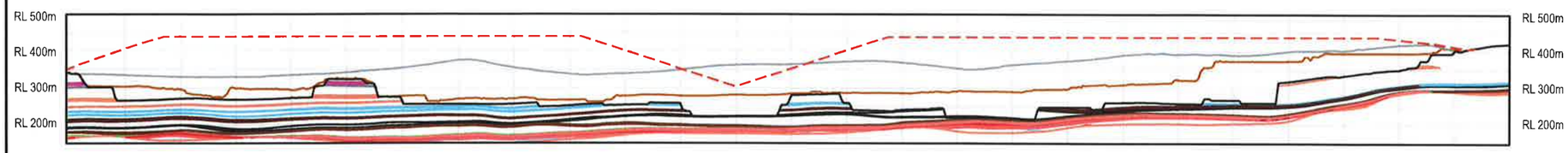
MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE: 8-11-2017
PREPARED BY: Resource Strategies Pty Ltd

MAULES CREEK COAL MINE

PLAN 5a
Mining Operations Plan
Cross Sections

WHITEHAVEN COAL

WHC-15-35_MOP 2017_001A



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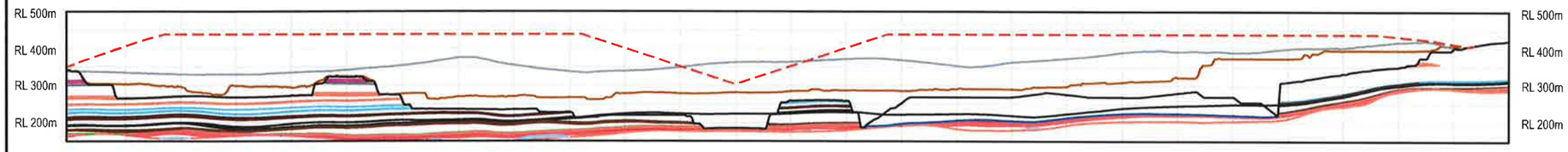

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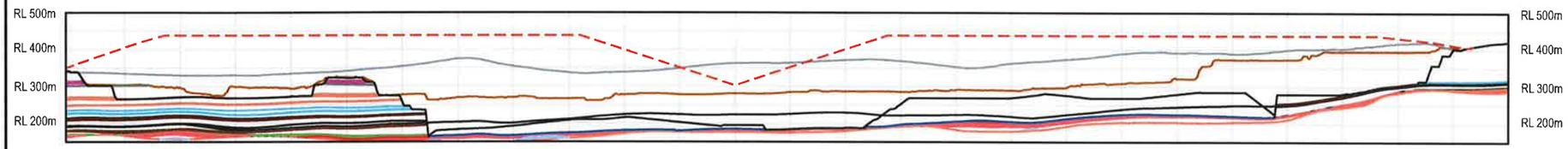

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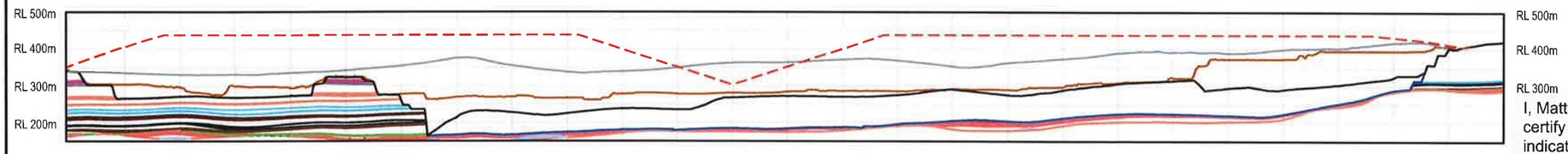

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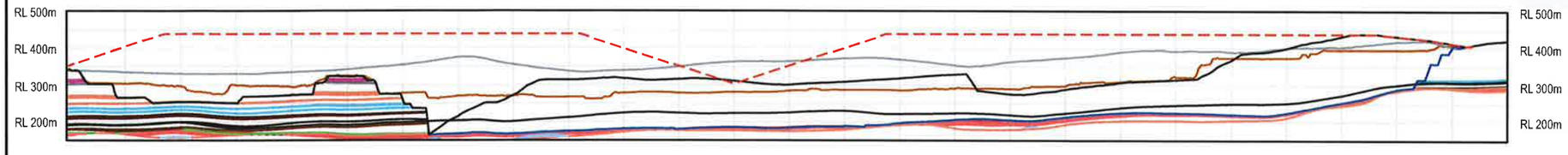

CROSS SECTION B-B' 1st Jan 2023 LANDFORM

LEGEND

- Natural Surface
- Existing Surface
- Mine Stage Landform
- Final Surface Landform
- Herndale Seam
- Onavale Seam
- Teston Seam
- Thornfield Seam
- Braymont Seam
- Jeralong Seam
- Merriown Seam
- Velyama Seam
- Nagero Seam
- Upper Northern Seam
- Lower Northern Seam
- Therribri Seam
- Flixton Seam
- Tarrawonga Seam
- Templemore Seam

I, Matthew Sparkes, Appropriate Responsible Officer, certify that the information on this plan is a true indicationof the proposed development.

Appropriate Responsible Officer

09/11/17
Date

MINE: Maules Creek Coal Mine
TITLEHOLDER: Maules Creek Coal Pty Ltd
DATE: 8-11-2017
PREPARED BY: Resource Strategies Pty Ltd

MAULES CREEK COAL MINE

PLAN 5b
Mining Operations Plan
Cross Sections

WHITEHAVEN COAL

WHC-15-35_MOP 2017_002A

12 REVIEW AND IMPLEMENTATION OF THE MOP

12.1 REVIEW OF THE MOP

This MOP will be updated and submitted to DRG for approval should any changes to the mining schedule be required or should any additional disturbance be required within the Mining Leases beyond the disturbance boundary provided in this MOP.

12.2 IMPLEMENTATION

MCC will assign and communicate the responsibilities for achieving closure and rehabilitation objectives. General roles and responsibilities for the implementation of this MOP are presented in Table 21.

Table 21
Roles and Responsibilities

Role	Responsibility
General Manager	• Provide required resources and support to implement the MOP.
Mine Manager – Maules Creek	• Authorise this MOP and future amendments • Maintain accountability for the overall environmental performance, including the procedures and outcomes of this MOP. • Respond to any unplanned events that may potentially result in negative environmental impacts. • Ensure reportable incidents are investigated and reported to the Environmental Department. Ensure inspections are undertaken in accordance with this MOP and the environmental management plans. • Check that persons conducting the inspection are appropriately trained and understand their obligations and the specific requirements of this MOP. • Specific responsibilities outlined in this MOP and the various environmental management plans.
Environment Superintendent and Officer – Maules Creek	• Monitor the overall environmental performance, including the procedures and outcomes of this MOP are implemented • Ensure inductions and training relevant to the requirements within this MOP are implemented. • Act as the interface for environmental matters between Government agencies. • Respond to any unplanned events that may potentially result in negative environmental impacts • Notify the relevant Government agencies of any incidents or non-compliances. • Specific responsibilities outlined in this MOP and the various environmental management plans. • Inform the relevant managers of unexpected or serious environmental impact issues. • Review this MOP if any significant changes to mine plans or operations occur. • Collation of rehabilitation inspection and monitoring documents into a central database.
External Relations Superintendent – Maules Creek	• Act as the interface for community matters between private industry, contractors, community groups and the wider community. • Respond to any unplanned events that may potentially result in negative community impacts
All personnel	• Adhere to the requirements of this MOP. • Report any events that may potentially result in negative environmental impacts immediately to their supervisor. • Specific responsibilities outlined in this MOP and the various environmental management plans.

13 REFERENCES

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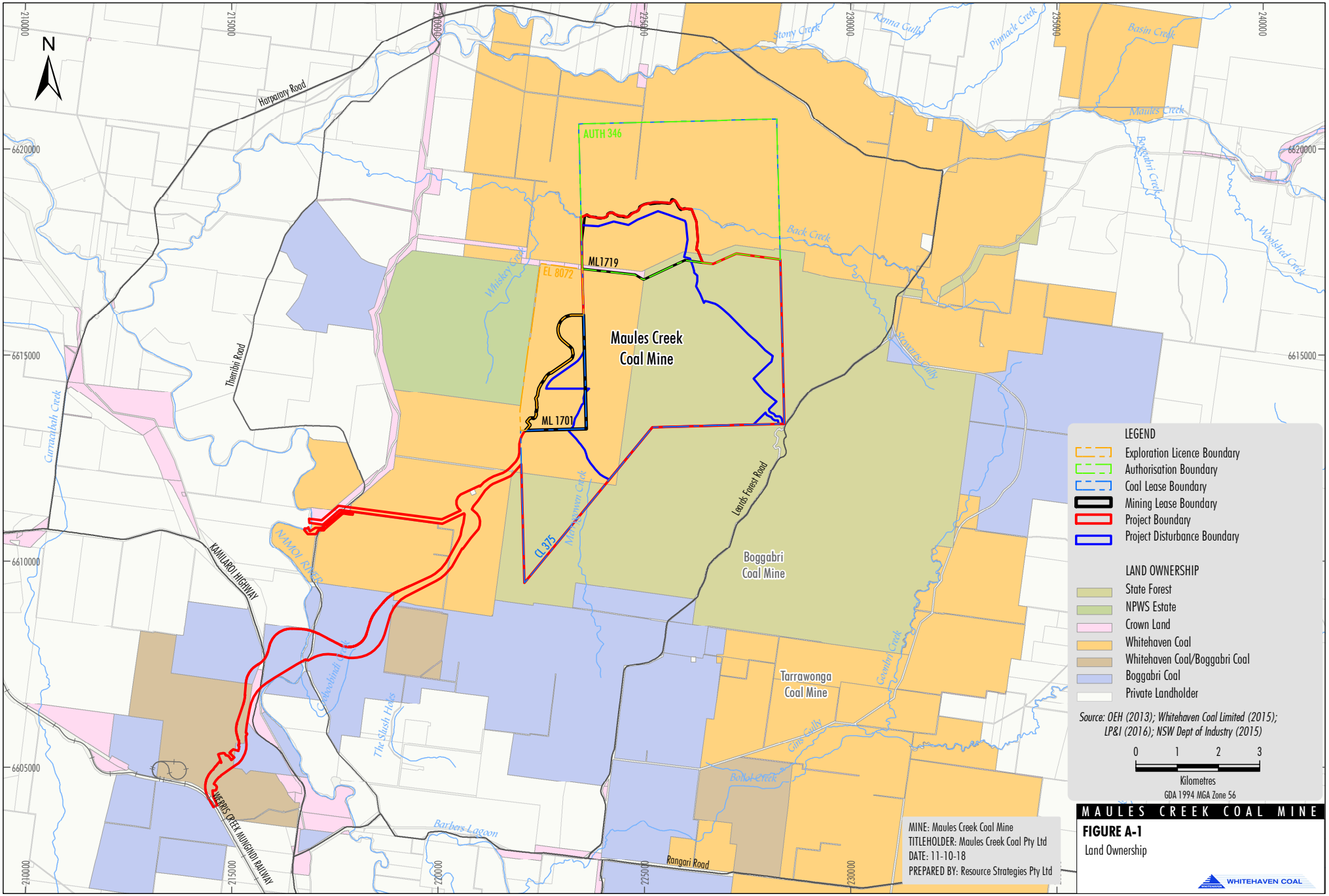
APPENDIX A

LAND OWNERSHIP



WHC-15-35_MOP 2018_202A

APPENDIX B

LIST OF MAULES CREEK ENVIRONMENTAL MANAGEMENT PLANS

- Noise Management Plan.
- Blast Management Plan.
- Air Quality and Greenhouse Gas Management Plan.
- Water Management Plan.
- Biodiversity Offset Strategy.
- Box-Gum woodland EEC Implementation Plan.
- Threatened Fauna Implementation Plan.
- Biodiversity Management Plan.
- Aboriginal Archaeology and Cultural Heritage Management Plan.
- Historic Heritage Management Plan.
- Traffic Management Plan.
- Mining Operations Plan (including the Rehabilitation Management Plan).
- Social Impact Management Plan.
- Environmental Management Strategy.
- Mine Site Rehabilitation Plan
- Pollution Incident Response Management Plan

APPENDIX C

RISK ASSESSMENT

Risk Assessment of Rehabilitation-Related Aspects

Environmental Factor	Hazard (Stressor)	Source of Hazard	Event	Potential Impacts	Likelihood	Consequence	Inherent Risk	Proposed controls	Likelihood	Consequence	Residual Risk
Landforms and Closure	Clearing and earthworks Physical presence	Open cut (Including final void) and OEA	• Landform instability • Landform incompatibility • Alteration of natural landform function	Design failure results in landform instability	5	4	High	• Controls outlined in the MSRP and the MOP, specifically: – progressive mine planning; – regular review and revision of mine plans and rehabilitation performance; and – progressive rehabilitation. • Development of Final Void and Mine Closure Plan in accordance with Condition 74 Schedule 3 of PA 10_0138.	2	4	Medium
				Significantly impacts on visual amenity	2	4	Medium	• Controls outlined in the MSRP and the MOP, specifically: – progressive rehabilitation; and – low impact colour infrastructure.	2	1	Low
				Significant change in surface water flow	5	4	High	• Controls outlined in the MSRP, MOP and Water Management Plan, specifically: – Stockpiled materials would be selected and drainage designed to minimise erosion. • Appropriately engineered surface water diversions. • Development of Final Void and Mine Closure Plan in accordance with Condition 74 Schedule 3 of PA 10_0138.	2	4	Medium
Surface Water	Clearing and rehabilitation earthworks Liquid and solid waste disposal Hazardous substances	Overburden emplacement area Open cut Mine infrastructure area	• Misdirection of surface water flows • Erosion • Sedimentation • Contamination of surface water flows	Sedimentation of watercourses	4	2	Medium	• The open cut would be bunded to separate clean and dirty run-off. • Sediment control measures would be designed and implemented as required. • Containment bunds. • Controls outlined in the MOP. • Controls outlined in the Water Management Plan.	4	2	Low

Risk Assessment of Rehabilitation-Related Aspects (Continued)

Environmental Factor	Hazard (Stressor)	Source of Hazard	Event	Potential Impacts	Likelihood	Consequence	Inherent Risk	Proposed controls	Likelihood	Consequence	Residual Risk
Surface Water (Cont.)				Significant reduction in water quality	3	2	Medium	• Spill procedures/kits. • Water quality monitoring and maintenance of hydraulic control structures. • Controls outlined in the Water Management Plan, specifically: – Controlled wastes would be properly handled. – On-site solid waste disposal would be minimised and properly managed. – Hazardous substances would be stored in properly bunded facilities. – Manage drainage and water flows so as to protect water quality and direction of water flow including drainage diversions.	3	2	Medium
Groundwater				Significant impact on existing supply bores	2	2	Low	• Monitoring to verify predicted groundwater model drawdown. • Monitor abstraction of groundwater volume and levels and quality of groundwater bores. • Identification of at-risk bores and implementation of mitigation measures (if required).	2	2	Low
				Significant impact on surface water (incl. Back Creek, Namoi River)	2	2	Low	• Monitoring to verify predicted low risk of impact.	2	2	Low
				Significant reduction in groundwater quality	3	2	Medium	• Promote awareness of management procedures for contaminants used on-site. • Store contaminants in appropriately bunded facilities, ensure spills are thoroughly cleaned up. • Appropriate disposal. • Spill procedures/kits. • Monitoring and maintenance strategy.	2	2	Low

Risk Assessment of Rehabilitation-Related Aspects (Continued)

Environmental Factor	Hazard (Stressor)	Source of Hazard	Event	Potential Impacts	Likelihood	Consequence	Inherent Risk	Proposed controls	Likelihood	Consequence	Residual Risk
Groundwater (Cont.)				Long-term significant groundwater contamination (salinity) arising from pit lake	3	2	Medium	• Monitoring to verify predicted groundwater behaviour. • Implementation of mitigation measures (e.g. backfill if required).	2	2	Low
Flora and Vegetation	Climatic conditions Fire Dust Weed Invasion Inappropriate soil substrate	Overburden storage area Backfilled sections of the open cut	• Failure of revegetation through poor climatic conditions, pests, inappropriate selection of plant species • Accumulation of dust in rehabilitation areas (from nearby operational areas) • Weed invasion/spread into rehabilitation areas • Failure of vegetation due to poor soil conditions	Vegetation communities that develop in rehabilitation areas are inconsistent with surrounding areas and the pre-mining vegetation.	4	4	High	• Soil Management Protocol. • Implement the MOP and MSRP. • Conduct progressive rehabilitation. • Implement the rehabilitation monitoring program. • Implement the BMP. •	2	4	Medium

Risk Assessment of Rehabilitation-Related Aspects (Continued)

Environmental Factor	Hazard (Stressor)	Source of Hazard	Event	Potential Impacts	Likelihood	Consequence	Inherent Risk	Proposed controls	Likelihood	Consequence	Residual Risk
Fauna	Clearing and rehabilitation earthworks Lighting Noise Physical presence Physical interaction	Overburden storage area Backfilled sections of the open cut	• Failure of fauna habitat in rehabilitation areas due to climatic conditions, pests, inappropriate selection of plant species • Artificial lighting • Noise associated with mining activities adjacent to rehabilitation areas • Increase in feral animal habitat	Fauna habitat in rehabilitation areas is not suitable or insufficiently developed. Feral animals become established in rehabilitation areas.	4	2	Medium	• Implement the MOP and MSRP. • Conduct progressive rehabilitation. • Implement the rehabilitation monitoring program. • Implement the BMP. • .	2	2	Low
Soil Resources	Clearing and earthworks Hazardous substances	Rehabilitation areas Project wide	• Inadequate salvage of topsoil • Compaction of soil • Inadequate management of PAF material • Lack of stockpile coordination • Soil mixed up with waste dumps or buried under waste dumps	Loss of soil resources that significantly impacts rehabilitation	3	2	Medium	• MSRP and MOP • Soil Management Protocol and Land Disturbance Protocol. • Mine planning measures to identify PAF material and avoid or appropriately manage.	2	2	Low

Risk Assessment of Rehabilitation-Related Aspects (Continued)

Environmental Factor	Hazard (Stressor)	Source of Hazard	Event	Potential Impacts	Likelihood	Consequence	Inherent Risk	Proposed controls	Likelihood	Consequence	Residual Risk
Soil Resources (Cont.)				Significant contamination of soil resources	2	2	Low	• Bunded fuel/chemical storage. • Appropriate disposal. • Spill procedures/kits.	2	2	Low
				Reduction in viability of seeds, nutrients, organic matter and micro-organisms	2	2	Medium	• Stockpile management as per measures outlined in Soil Management Protocol.	2	2	Low
				Changes to the natural soil evolution/forming process caused by stripping and reusing soil from disturbed areas in rehabilitation	2	2	Low	• Stockpile management as per measures outlined in Soil Management Protocol.	2	2	Low

APPENDIX D

SOIL HANDLING AND MANAGEMENT PLAN

SOIL MANAGEMENT PROTOCOL

Edition	Rev.	Comments	Author	Authorised By	Date
1	A	Preparation of SMP	Landloch Pty Ltd		12/04/2013
	B	Revised SMP	Landloch Pty Ltd		18/04/13
	C	Update SMP	Landloch Pty Ltd		25/10/13
	D	Revised SMP	G. Gray		26/10/15

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

The Maules Creek Coal Mine (Project) is located on the northwest slopes and plains of NSW, approximately 18 km north-east of Boggabri within an existing mining precinct centred within and around the Leard State Forest. The Leard State Forest has historically been predominantly utilised for forestry, recreation and more recently, mining related activities.

The Project is operated by Maules Creek Coal (MCC), a joint venture between Aston Coal 2 Pty Limited (Whitehaven Coal Limited (Whitehaven)), ITOCHU Corporation and J-Power Corporation Pty Limited.

In 2010, Aston Coal 2 Pty Limited (a wholly owned subsidiary of Whitehaven) submitted a Project Application to the Department of Planning and Infrastructure (DP&I), for a new project approval under Part 3A of the EP&A Act to enable the construction and operation of an open cut coal mine, with a current mine life of at least 21 years.

The project application was determined by the NSW Planning Assessment Commission (PAC), under delegation by the Minister for Planning and Infrastructure. Project approval was received in October 2012.

Schedule 3, Condition 39(a) of the Project Approval requires the preparation of a Soil Management Protocol (SMP). The SMP will also address Schedule 3, Condition 39(b) and (c) as stated in Table 1-1.

Table 1-1 Project Approval 10_0138 Requirements

Applicable Condition	Requirement	SMP reference or other MCC Document
Schedule 3 Condition 39	The Proponent shall: (a) develop a detailed soil management protocol that identifies procedures for • Comprehensive soil surveys prior to soil stripping; • Assessment of top-soil and sub-soil suitability for mine rehabilitation; and • Annual soil balances to manage soil handling including direct respreading and stockpiling; (b) maximise the salvage of suitable top-soils and sub-soils and biodiversity habitat components such a bush rocks, tree hollows and fallen timber for rehabilitation of disturbed areas within the site and for enhancement of biodiversity offset areas; (c) ensure that coal reject or any potentially acid forming interburden materials must not be emplaced at elevations within the pit shell or out of pit emplacement areas where they may promote acid or sulphate species generation and migration beyond the pit shell or out of pit emplacement areas; (e) ensure that no water can drain from an out of pit emplacement area to any watercourse or to any land beyond the lease boundary; and	2.2 2.2 2.3 Whole SMP and Biodiversity Management Plan 2.8 and Materials Safety Management Plan Water Management Plan

Applicable Condition	Requirement	SMP reference or other MCC Document
	(d) ensure that any coal barrier between the final void and any future surrounding mining operations minimises exchange of any contained groundwaters in the pit shell.	Water Management Plan

Federal approval was granted in February 2013 by the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC), under the Environment Protection and Biodiversity Conservation Act 1999.

Condition 26(b) and Conditions 27(c) and (d) from Approval EPBC 2010/5566 outline soil management requirements for the Project, as shown in Table 1-2.

Table 1-2 EPBC Approval Requirements

Applicable Condition	Requirement	SMP reference or other MCC Document
Condition 26	The person taking the action must: b. not replace top soil and sub soil layers at a depth less than the minimum depths determined through pre-stripping soil surveys as described in condition 27(c).	
Condition 27	The *mine site rehabilitation plan* must include, at a minimum, the following information: c. detailed soil depth surveys and analysis to inform the effective placement and restoration of soils underlying the proposed rehabilitation sites; including mapping of soils across the disturbance sites and soil sampling at no less than one sample point per 20 ha of each soil type identified. Sampling must identify; type, depth, water holding capacity, structure and physio-chemical properties of each of the soil and subsoil layers; d. processes and methodology for the removal, storage and re-layering of the top soil and sub layers underlying the disturbed sites being prepared for rehabilitation. These processes and methodologies must ensure the replacement of top soil and sub soil layers: • meet the minimum depth requirements determined from sampling outcomes as identified in condition 27(c); and • replicate other existing soil parameters including, but not limited to, soil type, water holding capacity, structure and physio-chemical properties.	2.2, 2.6, 2.8 2.4, 2.5, 2.6, 2.7, 2.8, 2.9

This SMP has been prepared in accordance with the relevant project approval conditions and provides MCC with a protocol for managing soils requiring relocation as part of approved Project activities. This SMP is a sub plan of the Maules Creek Coal Mining Operations Plan (MOP).

1.2 Objectives of this SMP

The objectives of the SMP are to:

- Provide employees and contractors of MCC with a protocol to manage the clearing and stockpiling of soils as part of mining activities;
- Minimise disturbance to soils within mining areas;
- Ensure that soil health is monitored and maintained in accordance with this protocol and industry best practice;
- Maximise the salvage of suitable top-soils and sub-soils for use in rehabilitation;
- Ensure remaining vegetation is suitably mulched for inclusion on the rehabilitated areas;
- Maintain topsoil and seed viability;
- Address relevant commitments made within the Environmental Assessment: and
- To ensure compliance with the requirements of the Project Approval and EPBC Approval.

2.0 SOIL MANAGEMENT PROTOCOL

This SMP has been developed to ensure that all objectives with respect to soil management are achieved in the approved mine disturbance area.

The following sections provide details on key aspects of topsoil, subsoil, spoil management and soil balance for disturbance areas.

Topsoil stripping plans will be required for each area prior to soil disturbance. As part of this process, a Land Disturbance Protocol is currently in place, to ensure that clearing activities are managed appropriately.

2.1 Soil Profile

Nine soil types were identified within the Project site in the EIS Appendix P. Additional soil testing was conducted to confirm soil types, features and constraints. Detailed soil survey work conducted prior to disturbance will further refine the soil types and their constraints.

The soils types currently identified and their expected constraints and limitations are described in Table 2-1.

The soil attributes in Table 2-1 are defined as:

- Rocky: stony, gravelly and rocky soils. Although not advantageous for a growing medium, the coarse fragments will be beneficial in limiting erosion risk.
- Low Fertility: Loss of organic matter on stripping will be rapid.
- Erosive: A soil with a high potential for erosion if not managed correctly, particularly if placed on rehabilitated areas with gradients greater than its *insitu* environment. This is defined largely by the particle size distribution of the soil and clay mineralogy.
- Sodic/Hardsetting: Soil with an Exchangeable Sodium Percentage (ESP) >6 and appreciable clay content and/or hardsetting characteristics. This is closely linked to erosive attributes.

- Low Water Holding Capacity: A soil with low water holding capacity, particularly in the topsoil. This is closely related to the soil's clay content and type.

Other soil constraints to plant growth, such as salinity, are not used as an indicator as they are not of concern for these soil types.

Table 2-1 Project Soil Constraints

Soil Group	Soil Description	Soil Classification[1]	Rocky	Low Fertility	Erosive	Sodic/ Hardsetting	Low Water Holding Capacity
1	Shallow Gravelly Brown Sandy Loam	Leached Brown Lithic Tenosol	X	X			X
2	Gravelly Fine Brown Sandy Loam	Leached Yellow Kandosol	X	X			X
3a	Gravelly Red Duplex Sandy Clay Loams over Rhyolite	Red Chromosol	X	X		X	X
3b	Self-mulching Brown & Grey Clays over Andesite	Brown and Grey Vertosol		X[2]		X	
4a	Shallow Bleached Redish Brown Sandy Loams	Red & Brown Lithic Tenosol		X	X	X	X
4b	Brown & Grey Duplex Sandy Loams	Brown & Grey Chromosol		X	X	X	
4c	Self-mulching Black Clays over Andesite	Black & Grey Vertosol		X[2]	X	X	
5	Sodic Duplex and Gradational Brown Loams	Sodic Brown Sodosol & Dermosol		X	X	X	
6	Brown Clays and Red Brown Earths	Self-mulching Brown Vertosol		X[2]	X	X	

[1] Australian Soils Classification (Isbell, 1996), [2] - Fertility varies, can be high in some soil types. Soil testing will clarify fertiliser requirements.

Appendix A shows specific soil data for each identified soil type, including recommended stripping depths and indicative soil ameliorant and fertiliser rates. Additional detailed soil survey work conducted prior to stripping will further refine these recommendations.

2.2 Topsoil and Subsoil Testing Procedure

Prior to stripping, topsoil and subsoil will be sampled to:

- identify the soil resource prior to stripping;
- produce a soil map for all proposed disturbed areas;
- assist with the preparation of a soil balance or inventory to assist with rehabilitation planning; and
- determine if the soil requires amelioration to ensure the soils' physical and characteristics are within recommended ranges, as shown in Table 2-2.

Soil sampling will determine if the soil requires amelioration to ensure the soils physical and chemical characteristics are suitable for revegetation purposes. Levels for soil nutrients will be established on the basis of site data and reviewed following annual sampling and analysis.

Soil exchangeable sodium levels and potential for clay dispersion will be assessed, with data on exchangeable cations being used to calculate gypsum requirements (if any) to reduce Exchangeable Sodium Percentage to <4%. (Presence of dispersive clays will significantly increase erosion risk, and also reduce vegetation establishment and growth.)

Removal of vegetation will effectively reduce ecosystem nutrient stores. Some elements such as Nitrogen will be eventually replaced by growth of leguminous species (particularly Acacias), but elements (generally Phosphorous) that are in extremely low levels may well become limiting to ecosystem recovery. Consequently, it would be most straightforward to adopt an application of fertiliser to address any losses of nutrient due to removal of the standing biomass and nutrient cycling, and to assist in rapid regeneration of the natural vegetation. However, where soils are stockpiled for periods longer than 3 months, nutrient requirements are likely to be higher, and should be determined on the basis of specific sampling and analysis.

Soil sampling prior to stripping is essential to determine whether the soils require amelioration, and also to provide guidance on maximum depths of stripping (for situations where topsoil may be in short supply). As well, the sampling data will provide useful baseline information on the ranges of specific soil properties relevant to ecosystem recovery.

Additional soil sampling will also be undertaken if soils have been stockpiled for periods of longer than 3 months as soil fertility will be significantly reduced compared to direct returned soils.

The soil parameters to be measured are listed in Table 2-2. Subsoils will not be assessed for fertility, as fertility for subsoils is typically low and plant nutrition is primarily obtained from the topsoils.

Table 2-2 Physical and Chemical Soil Parameters (Rayment GE *et al*, 2011).

Soil Analyses	Abbreviation	Units	Methodology
Topsoil			
pH	pH	-	Field and Lab 1:5 soil:water
Electrical Conductivity	$E.C_{1:5}$	dS/m	Field and Lab 1:5 soil:water
Exchangeable Cations	Ex (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Al^{3+})	meq/100g	NH_4Cl
Dispersion Potential	EAT	Value 1-8	Emerson Index
Total Nitrogen	Total N	mg/kg	Kjeldahl
Total Phosphorous	Total P	mg/kg	Nitric/Perchloric
Available Phosphorous	Av P	mg/kg	Colwell
Available Potassium	Av P	mg/kg	Colwell
Available Sulfur	Av S	mg/kg	KCl-40
Texture	-	-	Field hand texture[b]
Effective Cation Exchange Capacity	*ECEC*	meq/100g	NH_4Cl
Exchangeable Sodium Percentage	*ESP*	%	NH_4Cl
Bulk density	*BD*	g/cm^3	
Organic Carbon	*OC*	%	LECO
Water Holding Capacity	*WHC*	mm/cm^3	
Subsoil			
pH	pH	-	Field and Lab 1:5 soil:water
Electrical Conductivity	$E.C_{1:5}$	dS/m	Field and Lab 1:5 soil:water
Exchangeable Cations	Ex (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+})	meq/100g	NH_4Cl
Effective Cation Exchange Capacity	*ECEC*	meq/100g	NH_4Cl
Exchangeable Sodium Percentage	*ESP*	%	NH_4Cl
Dispersion Potential	EAT	Value 1-8	Emerson Index
Water Holding Capacity	*WHC*	mm/cm^3	
Bulk density	*BD*	g/cm^3	
Texture	-	-	Field hand texture[b]

[b] (McDonald, 1998)

Additional assessment of topsoil for the presence of weeds will be undertaken as part of soil sampling. Soil testing will assist in coordinating the storage or direct application of topsoil to rehabilitation areas. The suitability of the topsoil and subsoil for reuse or disposal by burial will be assessed after receipt of soil sampling results. Any soils deemed unsuitable for use in rehabilitation will be disposed of subsurface.

Soil sampling will be undertaken at a minimum sampling frequency of approximately one sample per 20 hectares of each soil type and will include an assessment of the soil profile (topsoil and subsoil). This will include key soil survey assessment criteria, as per McDonald, 1998, which include but is not limited to type, depth, structure and chemical characteristics. Sampling will be performed from pits using a backhoe (or similar) to create suitable pits where needed, or a suitable soil sampling coring device.

The soil sampling survey will be used to develop a 1: 10 000 scaled soil map as outlined in Guidelines for Surveying Soil and Land Resources, 2nd Edition (McKenzie et al. 2008). The soil map will be used in conjunction with the Soil Handling and Management Plan.

2.3 Soil Balance

Soil testing will determine the available topsoil and subsoil volumes for each stripping area, assist with soil balance preparation and rehabilitation resource planning.

Table 2-3 shows the volume of harvestable topsoil and subsoil within the mine disturbance area (excluding the construction footprint which will require minimal stripping), based on the stripping depths recommended in Appendix A. Excluding the final void in the mine disturbance area, 1,570ha will require rehabilitation requiring 3,140,000m^3 of growing medium to be spread at a depth of 0.2m. The topsoil resource required for rehabilitation is deficient and 864,350m^3 of subsoil will be required for rehabilitation. The subsoil will be subject to the same testing that is outlined in Table 2-2 to identify soil ameliorant rates required.

Table 2-3 Indicative topsoil and subsoil balance

Resource	Volume (m^3)
Topsoil required for rehabilitation	3,140,000
Topsoil	2,275,650
Deficit	864,350
Subsoil	996,300

Topsoil stored for long durations is likely to undergo structural degradation and death of seeds and micro-organism. Significant topsoil degradation typically occurs after a period of approximately 3 months. It is therefore preferential to use freshly stripped topsoil instead of stockpiled topsoil for rehabilitation purposes.

Soil Handling and Management Plan (Appendix B) will include:

- Location and volume of topsoil removed and where it has been placed, either directly onto an area for rehabilitation or stockpiled;
- Update of topsoil stockpiles register and map; and
- Ameliorates applied to removed topsoil.

2.4 Clearing and Grubbing

During the clearing and grubbing process the mixing of topsoil and subsoil will be minimised.

A record will be kept of the nature and quantities of salvaged bush rocks, timber etc. This is to ensure that the salvage of these items is maximised, in accordance with protocols outlined in the Biodiversity Management Plan (BMP).

The vegetation remaining, will either be stored for biodiversity purposes or will be mulched and respread over the stripped area following application of soil ameliorants (if applicable) and stockpiled in accordance with measures outlined in Section 2.7.

2.5 Soil and Spoil Amelioration

Site soils and mine spoils have generally poor fertility, low organic carbon, are sodic and dispersive. The soil testing as discussed previously will be undertaken to determine amelioration requirements and rates.

If gypsum is required it is preferable to mix it in with the topsoil as part of the stripping operation (ameliorates applied to topsoil surface prior to stripping), irrespective if the topsoil is to be placed in storage or directly applied to a rehabilitation area.

Application of ameliorants as part of the topsoil stripping process is cost effective, and gives the ameliorants additional time to react and modify the soil to assist in the maintenance of soil conditions suitable as a stable growing medium.

Soil testing of the stockpiles prior to spreading will identify if any further gypsum is required for amelioration.

Soil sampling will determine the application rates of ameliorates as discussed in section 2.2. Indicative rates are shown in Appendix A.

Additional applications of ameliorates may be required to ensure an optimum growing medium. It is generally not possible to correct soil deficiencies by a single application of fertiliser. It is possible, however, to slowly build up a bank of available elements in the soil from which vegetation is able to draw and which is replenished by the eventual death and decay of the plants. ie. the nutrients are continually recycled through the soil and the vegetation. Since many of the available nutrients are held in the organic soil fraction, this recycling condition cannot be achieved until adequate levels of organic matter have accumulated in the soil (Hannan 1995).

Fertiliser is not expected to be required annually, however, by not applying fertiliser in the initial stages it can impede the rapid development of vegetation which is required for erosion control and key component to the soil biology development for nutrient cycling. The soil, particularly if stockpiled for long periods of time, will have lost large amounts of its natural nutrient store. It is expected that an initial application is required prior to seeding and possibly (most likely) a second application the following season. The requirement to apply a rate of fertiliser application will be determined following soil sampling undertaken as part of the annual rehabilitation monitoring to ensure that application rates are suitable for the rehabilitation stage.

2.6 Soil Stripping

The surface 0.15 m of *insitu* soil is biologically active and contains almost all of the nutrients, seeds, and beneficial organisms. The biologically active layer is likely to be shallower than 0.15 m. However, stripping soil in layers thinner than 0.15 m is generally not possible with available machinery. All soils below the topsoil are defined as subsoils. Recommended soil stripping depths are outlined in Appendix A.

The Shallow Gravelly Brown Sandy Loam soil type dominates the mine disturbance area. This soil type will be suitable for re-use in rehabilitation areas that will not have a high agricultural land use following amelioration. High stone content topsoil is suitable for re-use for low land capability classes VI and VII, such as waste landform rehabilitation.

2.6.1 Planning and Permitting

A Soil Handling and Management Plan will be developed for each area that is to be stripped. Appendix B shows the details required to be collected for this plan. As part of the development of the Soil Handling and Management Plan, the Land Disturbance Protocol Form must be completed. All staff and contractors are required to obtain the relevant approval prior to clearing activities.

2.6.2 Stripping Methods

Earthmoving plant operators will be supervised to ensure that stripping operations are conducted in accordance with the stripping plan and in situ soil conditions. This will ensure that all suitable soil resources are salvaged and that the quality of the stripped soil is not reduced through contamination with unsuitable soils.

The process of soil stripping will also involve the continual evaluation of soil throughout the depths of the profile as areas and layers are exposed. Management of soils and stripping depths during this process is dynamic and generally require soil observations to be made on site on the day topsoil stripping is occurring. This enhances decision making and operational modifications can be adopted to best utilise the soil resources available.

The process outlined below for stripping topsoil should be followed:

- The area to be stripped of topsoil will be clearly demarcated and surveyed;
- Topsoil will be in a slightly moist condition during stripping;
- Topsoil will not be stripped during excessively wet or dry conditions;
- Where practical, stripped material will be placed directly onto reshaped overburden and spread immediately (if mining sequences, equipment scheduling and weather conditions permit) to avoid the requirement for stockpiling and costs with double handling;
- As part of the planning process, sufficient area for stockpiling, placement or burial of topsoil will have been identified and these areas will be accessible;
- As part of the planning process, temporary drainage, sediment control and structures to prevent erosion will be developed for each area if required;
- Soil collection by open bowl scrapers or loading into rear dump trucks by front-end loaders are the preferred less aggressive soil handling systems.

Over-stripping can result in the stored seeds being buried too deep, which will reduce germination. It will be important to monitor topsoil stripping closely to ensure that over stripping does not occur. Recommended stripping depths for each soil is shown in Appendix A.

Topsoil stripped from each vegetation community will ideally used in areas identified for rehabilitation for the corresponding vegetation community however this may not always be possible. Where topsoil cannot be used for rehabilitation immediately it will be stockpiled with consideration to vegetation community type.

2.7 Soil Stockpiling

The topsoil seed bank is an important reserve of indigenous plant seeds and soil microflora, which will assist with the preservation of local genetic material and the reestablishment of a similar range and mix of species of the original vegetation in the rehabilitation area.

The Soil Handling and Management Plan will indentify where the stripped soil will be placed, based on its suitability for reuse and the soil balance. Suitability will be determined following soil testing. Soil stockpile locations, vegetation community volumes and date of soil stripping will be recorded in the Soil Handling and Management Plan and GIS database as outlined in Appendix B.

Where possible, topsoils will be directly placed onto prepared rehabilitation areas. This will help to ensure the health and viability of stripped soils.

Where stockpiling is unavoidable, the following process for soil stockpiling will be followed to minimise degradation of stored soil and encourage nutrient stores:

- Where possible, stockpiles will be located in areas away from drainage lines. Drainage will be diverted around stockpiles to prevent erosion;
- Sediment controls will be installed downstream from stockpiles to prevent contamination of clean water;
- Stockpiles will be limited to a maximum height of 4m;
- Initial stockpiled material (stockpiles created in first 5-10 years) will be stored for use when all other topsoil material has been utilised (refer to section 2.3);
- More erodible materials will be placed on flatter areas to minimise the potential for erosion;
- The surface of soil stockpiles shall be contour scarified in order to promote infiltration and minimise erosion until vegetation is established;
- Stockpiles intended to be used within 5 years will be seeded with grass cover crops to protect the stockpile from raindrop splash erosion, aerate the soil to reduce anaerobic conditions, enhance organic carbon levels and suppress weeds;
- Stockpiles intended to be in placefor greater than 5 years will be seeded with cover crops, grass, tree or shrub species to protect the stockpile from raindrop splash erosion, aerate the soil to reduce anaerobic conditions, enhance organic carbon levels, suppress weeds and to create a via seed resource;
- Material will be stripped from the top layer of the stockpile to take advantage of the benefits of the cover crops.; and
- Following removal of the top layer of stockpiled material, the stockpile will be contour scarified and seeded with the appropriate cover crop.

2.8 Characterisation

Characterisation of subsoil and spoil for erosion (primarily dispersion) and agronomic (pH, EC, CEC, and metals) parameters will be undertaken. Sampling will determine if the subsoil and spoil is suitable for rehabilitation use or if it requires amelioration or selective handling and placement. Characterisation of spoil for use as structural fill will also be undertaken, however this is not covered by this protocol.

Unsuitable subsoil and spoil parameters are detailed in Table 2-4.

Table 2-4 Unsuitable Subsoil and Spoil Parameters

Parameter	Unsuitable Range
pH	<5.0 or >8.5
Exchangeable sodium percentage	>6% if clay content >10%
Electrical conductivity (1:5 suspension)	>1.0dS/m

If not able to be ameliorated, unsuitable spoil and subsoil, including Potentially Acid Forming (PAF) material, will be capped with a minimum of 5.0m of suitable spoil (compacted depth) or, more appropriately, capped to a depth greater than the minimum rooting depth of the vegetation. Capping spoil will need to be ameliorated and contour ripped prior to the placement of the ameliorated topsoil. The Soil Handling and Management Plan will identify where unsuitable spoil and subsoil has been placed.

2.9 Soil Respreading

Prior to re-spreading of stockpiled soil, an assessment of weed infestation will be undertaken to determine if addiotnal weed control measures are required prior to reuse of the topsoil .

The following will be considered during soil respreading:

- Topsoil requirements for rehabilitation areas will be balanced against stored stockpile inventories, vegetation communities and proposed respreading depths;
- During the removal of soils from the stockpiles, care will be taken to minimise structural degradation of the soils;
- Material will be spread in even layers at an appropriate thickness. Soil sampling will determine the optimal topsoil depth in support of available resources and to meet the rehabilitation goals of the area being rehabilitated;
- All topsoils are to be lightly ripped (maximum tyne width 1m) prior to seeding. This is to be conducted on the contour and care taken not to bring unsuitable spoil material to the surface; and
- Fertiliser application should be conducted prior to seeding while the surface is being lightly scarified to create an optimal seed bed.

Further detail on rehabilitation methods are discussed in the MOP.

3.0 MONITORING

The soil management process will be monitored through each step to ensure that the health of the soil is maintained and the rehabilitation and biodiversity objectives can be achieved.

The Soil Handling and Management Plan (Appendix B) sets out the requirements for each step of the soil management process.

Soil parameters in rehabilitated areas will be monitored during the annual rehabilitation monitoring program. A suite of soil parameters will be used at key stages of the rehabilitation to track its stability and sustainability. Rehabilitation monitoring will allow for adaptive management by reviewing substandard performance from a rehabilitation area and evaluate the probability of an event occurring; evaluating the consequence; and using a risk-based approach to determine trigger levels (both upper and lower) where response or action is required.

4.0 RESPONSIBILITY

The responsibility for overall soil management at the Project belongs to the Environment department. However, all staff and contractors have a responsibility to follow the processes and procedures for managing soils, as outlined in this protocol and the MOP. All staff and contractors must ensure that they have the necessary permits and approvals in place, including a topsoil management plan, prior to undertaking works which will disturb soils.

5.0 REPORTING

Soil stripping and placement for each stripping area will be documented in the Soil Handling and Management Plan which will be prepared following soil and subsoil testing and updated following stripping activities to confirm the location of either stockpiled material or the direct placement of material.

Soil stockpiling and rehabilitation will be assessed and reported annually as part of the Annual Review (AR)/Annual Environmental Management Report (AEMR). Results of the assessments will be incorporated into future reviews of this SMP and the MOP.

6.0 REFERENCES

Hansen Bailey (2013) Draft Materials Safety Management Plan, prepared for Maules Creek Coal

Hansen Bailey (2011) Maules Creek Project Environmental Assessment, prepared for Aston Coal 2 Pty Ltd

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McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1998) Australian Soil and Land Survey Field Handbook. 2nd edition, Inkata Press, Melbourne.

McKenzie N.J., Gundy M.J., Webster R., and Ringrose-Voase A.J. 2008, *Guidelines for surveying soil and land resources. 2nd edition, Volume 2 Australian Soil and Land Survey Handbook Series*, CSIRO Publishing.

Rayment, G.E., and Lyons, D.J., 2011, *Soil Chemical Methods - Australasia,* CSIRO Publishing, Collingwood.

7.0 TERMS AND ABBREVIATIONS

The terms and abbreviations used within this report are listed in Table 7-1.

Table 7-1 Terms and Abbreviations

Term/Abbreviation	Meaning
Acid soil	Soil with a pH of less than 6.5 (Rayment and Lyons 2011)
CEC	Cation Exchange Capacity
Dispersion potential	The dispersion potential of subsoil is an indicative rating based on factors including ESP, Ca:Mg ratios, salinity, particle size, Emerson Class numbers and clay mineralogy where available.
EA	Environmental Assessment
EC	Electrical Conductivity
EP&A Act	*Environmental Planning and Assessment Act* 1979
ESP	Concentration of exchangeable sodium cations expressed as a percentage of the cation exchange capacity.
Fertility	Soil fertility (the capacity of the soil to support plant growth in a given climatic regime) is a function of the physical, chemical and biological characteristics of the soil. Indices used include Organic Carbon, Cation Exchange Capacity (CEC), Available Macro and Mirco Nutrients
MCC	Maules Creek Coal Pty Ltd
Microbes	A general term for microorganisms such as bacteria, fungi and protozoa that cannot be seen with the naked eye.
MOP	Mining Operations Plan
OC	Organic Carbon
PA	Project Approval
PAC	Planning Assessment Commission
PAF	Potential Acid Forming
RMP	Rehabilitation Management Plan
Sodicity	The proportion of exchange sites in a soil or soil layer occupied by sodium ions, expressed as the exchangeable sodium percentage (ESP). Soil with an ESP exceeding 6 is referred to as being sodic and tends to be dispersive
Soil structure	Soil structure refers to the distinctness, size and shape of natural soil aggregates and voids.

Soil type	A general term used to describe the features of particular soils in terms of fertility, colour, texture and parent material.
Subsoil	Subsoil is a commonly used term used to identify soil material below the topsoil (A horizons) and is usually comprised of B horizons
the Project	Maules Creek Coal Mine Project
Topsoil	Topsoil is a commonly used term to identify soil horizons designated as A horizon(s) and is described as the mineral horizon at or near the soil surface with some accumulation of humified organic matter, usually darker in colour than underlying horizons with maximum biologic activity for any given soil profile; for the purposes of this report, topsoil is defined as that proportion of the soil profile that is suitable for stockpiling and rehabilitation.
Whitehaven	Whitehaven Coal Limited

APPENDIX A

BASE SOIL BALANCE

Soil Type	Soil Description	Stripping Depth (m)		Mine Disturbance Area (ha)[c]	Volume (m^3) [b]		Gypsum (t/ha)		Fertiliser [a] (kg/ha)
		TS	SS		TS	SS	TS	SS	TS
1	Shallow Gravelly Brown Sandy Loam	0 - 0.1	NR	865	778,500	0	-	-	150
2	Gravelly Fine Brown Sandy Loam	0 - 0.15	NR	198	267,300	0	-	-	150
3a	Gravelly Red Duplex Sandy Clay Loams over Rhyolite	0 - 0.15	0.15 – 0.6	175	236,250	787,500	2	3	100
3b	Self-mulching Brown & Grey Clays over Andesite	0 - 0.15	0.15 – 0.6	17	22,950	76,500	2	3	100
4a	Shallow Bleached Reddish Brown Sandy Loams	0 - 0.15	NR	393	530,550	0	-	-	100
4b	Brown & Grey Duplex Sandy Loams	0 - 0.15	NR	241	325,350	0	2	-	100
4c	Self-mulching Black Clays over Andesite	0 - 0.15	0.1 – 0.4	49	66,150	132,300	2	3	50

Soil Type	Soil Description	Stripping Depth (m)		Mine Disturbance Area (ha)[c]	Volume (m^3) [b]		Gypsum (t/ha)		Fertiliser [a] (kg/ha)
		TS	SS		TS	SS	TS	SS	TS
5	Sodic Duplex and Gradational Brown Loams	0 - 0.15	NR	36	48,600		2	-	100
6	Brown Clays and Red Brown Earths	0 - 0.15	NR	0	0	0	2	-	100
Total				1,974	2,275,650	996,300			

[a] Pasture Starter (N(6.7):P(13.5):K(0):S(7.9):Ca(9.1)), [b] including a 10% handling loss, [c] Source: EIS Appendix P, TS: Topsoil, SS: Subsoil, NR: Not Recommended

APPENDIX B

SOIL HANDLING AND MANAGEMENT PLAN

Soil Handling and Management Plan

Stage	Soil handling and management tasks
Topsoil/Subsoil Testing	Date: _____ Survey Area: _____ha Was soil testing completed: + Yes + No If yes, attached results. Testing Location(s) (attach plan with coordinates GDA 94): _____ Does the soil meet suitable material criteria (Table 2-2 of SMP): + Yes + No If no, this material must be stored separately or ameliorated. Vegetation Community type: _____ Average Topsoil Depth: _____mm Average Subsoil Depth: _____mm Topsoil Volume Resource: _____m^3 Subsoil Volume Resource: _____m^3 Form completed by: _____ Comments:
Pegging, Clearing and Grubbing, Soil Amelioration and Mulch Application	Date: _____ Survey Area: _____ha Stripping Location (attach plan with coordinates GDA 94): _____ Has the area been pegged in accordance with the design requirements: + Yes + No If no, provide justification for not doing so. Has the mixing of topsoil and subsoil been minimised during grubbing: + Yes + No If no, provide justification for not doing so. Has soil ameliorants been applied based on soil testing results: + Yes + No If no, attach evidence for no application. If yes, what were the products, rates and depth incorporated: _____ Has mulch been spread over the proposed stripping are: + Yes + No Form completed by: _____ Comments:

Stage	Soil handling and management tasks
Topsoil/Subsoil Stripping	Date: _____ Strip Area: _____ha Is the area to be cleared weed infested: + Yes + No If yes, this material must be stored separately Average Topsoil Depth: _____mm Average Subsoil Depth: _____mm Topsoil Volume Recovered: _____m^3 Subsoil Volume Recovered: _____m^3 Strip Method: + Dozer + Grader + Loader + Shovel + Scraper Destination (attach plan with coordinates GDA 94): _____ Form completed by: _____ Comments:
Topsoil Stockpile Destination	Date Placed: _____ Stockpile ID: _____ Stockpile Location: _____ Approved Stockpile Location: + Yes + No Total Volume: Topsoil_____m^3 Subsoil_____m^3 Stockpile Constructed as per the Soil Management Protocol: + Yes + No If no, provide justification for not doing so Appropriate erosion and sediment control actions implemented: + Yes + No If no, provide justification for not doing so Stockpile on Site GIS Layer: + Yes + No Site GIS Layer Updated: + Yes + No Stockpile Signed (Topsoil, Subsoil, ID): + Yes + No Stockpile Seeded: + Yes + No Seeding Details (eg. species, rate etc.): _____ Form completed by: _____ Comments:

Stage	Soil handling and management tasks
Topsoil Rehandle (ie. stockpile relocation)	Date: _____ Reason for Rehandle: _____ Initial Location (attach plan with coordinates GDA 94): _____ Stockpile ID: _____ Final Location (attach plan with coordinates GDA 94): _____ Stockpile ID: _____ Rehandle Volume: Topsoil: _____m^3 Subsoil: _____m^3 Is this unsuitable material: + Yes + No If yes, this material must be stored separately Note: Please also complete the Stockpile Destination section above if relocating a stockpile. Form completed by: _____ Comments:
Rehabilitation	Date: _____ Topsoil Application Area: _____ha Application Area Location (attach plan with coordinates GDA 94): _____ Topsoil Application Depth: _____ mm Subsoil Application Depth: _____ mm Topsoil Volume Used: _____ m^3 Subsoil Volume Used: _____ m^3 Topsoil/Subsoil Source Location (attach plan with coordinates GDA 94): _____ Source Stockpile ID: _____ GIS Layer / Register Updated: + Yes + No Form completed by: _____ Comments: