

SUNNYSIDE COAL MINE  
CLOSURE MINING OPERATIONS PLAN  
(6 NOVEMBER 2018 - 5 NOVEMBER 2025)

November 2018

<b>Sunnyside Coal Mine</b>	
<b>Closure Mining Operations Plan (MOP)</b>	
<b>Name of Mine</b>	Sunnyside Coal Mine
<b>Closure MOP Commencement Date</b>	6 November 2018
<b>Closure MOP Completion Date</b>	5 November 2025
<b>Mining Authorisations (Lease/Licence No.)</b>	Mining Lease (ML) 1624
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<b>Date</b>	January 9 <sup>th</sup> 2019
<b>Version</b>	

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## 1 INTRODUCTION

### 1.1 HISTORY OF OPERATIONS

The Sunnyside Coal Mine is a conventional open-cut coal mining operation, located within the Gunnedah Shire, approximately 15 kilometres (km) west of Gunnedah in northern New South Wales (NSW) (Plan 1A – Appendix A). The Sunnyside Coal Mine is located within Mining Lease (ML) 1624 which is issued to Namoi Mining Pty Ltd (NMPL).

The Sunnyside Coal Mine is owned by NMPL, a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven), which is a publicly listed company on the Australian Stock Exchange.

Project Approval for the Sunnyside Coal Mine was granted by the NSW Minister for Planning under Part 3A of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act) on 24 September 2008 (PA 06\_0308). PA 06\_0308 provided for the extraction of approximately 7 million tonnes (Mt) of run-of-mine (ROM) coal, with a maximum rate of 1 million tonnes per annum (Mtpa). The approval also allows for the crushing and screening of ROM coal at the Sunnyside Coal Mine, prior to transport to the Whitehaven Coal Handling and Preparation Plant (CHPP) near Gunnedah.

ML 1624 was issued by the Minister for Mineral Resources on 5 November 2008. In addition, Environment Protection Licence (EPL) 12957 was granted on 15 December 2008. Operations at the Sunnyside Coal Mine commenced in 2008.

Due to unfavourable economic conditions, Whitehaven discontinued mining operations at the Sunnyside Coal Mine on 29 November 2012 and the mine was placed in care and maintenance. Stockpiled ROM coal continued to be transported to the CHPP on a campaign basis until May 2013. While the Sunnyside Coal Mine was non-operational, activities at the mine site were limited to environmental monitoring, ongoing rehabilitation, and care and maintenance (including spontaneous combustion management).

On 3 November 2015, a modification (MOD1) was granted for a five-year extension to mining operations to 5 November 2020. A subsequent modification (MOD2) was granted on 13 January 2017 for an administrative change to Annual Review requirements in Schedule 5 Condition 5 of PA 06\_0308.

Following improvements in coal prices, mining recommenced in September 2017.

A third modification (MOD3) was lodged to the NSW Department of Planning and Environment (DP&E) in August 2018 which involved a modification to the post-mining backfilling strategy to create a final landform that includes a wholly free-draining final void depression (Whitehaven, 2018a). MOD 3 was granted in January 2019.

This Closure Mining Operations Plan (Closure MOP) has been prepared incorporating the final landform approved in PA 06\_0308 MOD3.

### 1.2 SCOPE OF THIS CLOSURE MOP

This Closure MOP has been prepared by Whitehaven in accordance with the requirements of ML 1624 and PA 06\_0308 (as modified and in consideration of MOD3) for the Sunnyside Coal Mine.

In particular, this Closure MOP includes the requirements of a Mine Closure Plan described in Schedule 3, Condition 31 of PA 06\_0308 (noting that in a letter dated 18 June 2018, the DP&E Resources Regulator extended the MOP period of the *Mining Operations Plan 1 July 2017 to November 2020 Sunnyside Coal Mine* to 16 January 2018 to allow for consideration of MOD3 in the Closure MOP).

This Closure MOP has also been prepared to satisfy Schedule 3, Condition 30 of PA 06\_0308 being the requirement for a Rehabilitation and Landscape Management Plan (see Section 1.5 for more details).

This Closure MOP has been prepared in consideration of:

- *ESG3: Mining Operations Plan Guidelines, September 2013* (NSW Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy [DTIRIS-DRE], 2013) (the MOP Guidelines).
- Contemporary examples of approved Closure MOPs.
- *Draft Whitehaven Coal Manual – Closure Planning* (Whitehaven, 2018b).
- *Draft Whitehaven Coal Environmental Standard – Closure* (Whitehaven, 2018c).
- *Whitehaven Sunnyside Coal Mine Asset Retention and Disposal Review* (Whitehaven, 2018d).
- *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000).
- *Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure* (Commonwealth of Australia, 2016).

This Closure MOP covers the period between 6 November 2018 and 5 November 2025 (herein referred to as the Closure MOP term).

At this stage, coal extraction at the Sunnyside Coal Mine is proposed to cease in approximately November 2019. Following cessation of mining, supplementary earthworks (including out-of-pit overburden rehandling into the open cut, and bulk soil placement and shaping) are expected to continue until approximately November 2020. Between November 2020 and 5 November 2025, activities at the Sunnyside Coal Mine will be focused around ongoing rehabilitation (including some minor soil earthworks). Appendix C includes an indicative timeline and asset register of rehabilitation and decommissioning activities to be undertaken during the Closure MOP term.

By the end of the Closure MOP term, it is expected that areas of the Sunnyside Coal Mine will be relinquished subject to the satisfaction of the NSW DP&E Resource Regulator. Any areas of the Sunnyside Coal Mine that have not been relinquished by this time (e.g. some woodland areas) would continue to be monitored, as required, until the Resource Regulator is satisfied that these remaining areas can be relinquished.

### 1.3 HISTORY OF SUNNYSIDE COAL MINE MOPS

Table 1 lists the previous MOPs for the Sunnyside Coal Mine.

**Table 1**  
**Sunnyside Coal Mine MOP History**

Document Title	Amendment	Status	Approved	Expiry
Mining Operations Plan 1 July 2017 to 5 November 2020 Sunnyside Coal Mine	Original MOP	Current	1 July 2017	5 November 2018
Care and Maintenance Mining Operations Plan 6 May 2016 – 5 November 2020 Sunnyside Coal Mine	Original MOP	Superseded	6 May 2016	3 November 2017
Mining Operations Plan for the Sunnyside Coal Mine, via Gunnedah	Amendment C	Superseded	November 2015	5 May 2015
	Amendment B	Superseded	November 2014	5 November 2015
	Amendment A	Superseded	August 2014	December 2014
	Original MOP	Superseded	September 2008	September 2015

## 1.4 CURRENT CONSENTS, AUTHORISATIONS AND LICENCES

The Sunnyside Coal Mine is a State Significant Development (SSD) in accordance with Clause 8 and Schedule 1 (Item 5) of NSW *State Environmental Planning Policy (State and Regional Development) 2011*, therefore it is considered to be a Level 1 Mine as specified in the MOP Guidelines.

The Sunnyside Coal Mine's consents, authorisations and licenses are listed in Table 2. The Mining Lease and Project Approval areas are shown on the Closure MOP Plans (Appendix A).

**Table 2**  
**Sunnyside Coal Mine Consents, Authorisations and Licences**

Instrument	Relevant Authority	Date of Issue	Expiry Date	Comments
ML 1624	Division of Resources and Geoscience (DRG)	5 November 2008	5 November 2029	-
PA 06_0308	DP&E	24 September 2008	Mining operations until 5 November 2015	-
PA 06_0308 MOD1	DP&E	3 November 2015	Mining operations until 5 November 2020	To extend expiry of PA 06_0308 and address revised final landform.
PA 06_0308 MOD2	DP&E	13 January 2017	Mining operations until 5 November 2020	Administrative modification to Annual Review requirements in Schedule 5 Condition 5
PA 06_0308 MOD3	DP&E	January 2019	N/A	Modification to the approved post-mining backfilling strategy to create a final landform that is wholly free-draining and would no longer include a final void.
EPL 12957	NSW Environment Protection Authority (EPA)	15 November 2008	N/A	Includes two licensed surface water discharge points.
Water Licences WAL 29537 90BL254855 90BL254856 90BL254857 90BL254858 90BL254859 90BL110883 90BL104367 90BL102845	NSW Department of Industry – Water (DI Water)	Various	Various	Water Access Licence and groundwater monitoring bores.

## 1.5 MOP/REHABILITATION AND LANDSCAPE MANAGEMENT PLAN REQUIREMENTS

Table 3 summarises the relevant conditions of PA 06\_0308 (as modified) and ML 1624 with regard to the preparation of the Closure MOP, and shows where each condition has been addressed within this document.

Detailed objectives and regulatory requirements relating to rehabilitation and post-mining land use are outlined in Section 4.

PA 06\_0308 also contains conditions relevant to the preparation of a Rehabilitation and Landscape Management Plan (Schedule 3, Condition 30 of PA 06\_0308). On 28 February 2017, the NSW Department of Industry – Division of Resources and Energy (DRE) (now Resource Regulator) and DP&E agreed to the consolidation of the Rehabilitation and Landscape Management Plan into the 2017 MOP. This was confirmed in a letter on 24 April 2017. This Closure MOP has also been prepared in

consideration of these requirements (including the outcomes of consultation with OEH, DPI Water and local council for previous MOPs and MOD3).

**Table 3**  
**MOP/Rehabilitation and Landscape Management Plan Requirements**

Condition	Requirement	Section Addressed
PA 06_0308 Schedule 3 Condition 30	The Proponent shall prepare and implement a detailed Rehabilitation and Landscape Management Plan for the site to the satisfaction of the Secretary and DRG. This plan must:	
	a) be prepared in consultation with OEH, DPI Water and Council by suitably qualified expert(s) whose appointment(s) have been approved by the Secretary; and	Previous MOPs, and consultation undertaken for MOD3
	b) be submitted to the Secretary and DRG for approval by 1 March 2009;	N/A
	c) include:	
	• the rehabilitation objectives for the site;	Section 4.3
	• description of how the rehabilitation of the site would be integrated with the landscape of the surrounding area;	Section 4.2
	• detailed performance and completion criteria for the rehabilitation of the site;	Section 6
	• a detailed description of the measures that would be implemented to achieve the performance and completion criteria for each site, including the procedures to be implemented for:	
	- protection and enhancement of koala habitat;	Section 3.2.8
	- progressively rehabilitating the areas disturbed by mining operations;	Section 2.3.9
- restoration of agricultural land suitability;	Sections 4.2.2 and 7.2.4	
- revegetating the site;	Sections 4.2 and 7.2.4	
- protecting and/or enhancing areas in the vicinity of the disturbance area;	Sections 3.2.8 and 4.2.1	
- conserving and re-using any topsoil;	Section 3.2.7	
- controlling weeds and feral pests;	Sections 3.2.9 and 3.2.10	
- controlling access; and	Section 3.2.14	
- bushfire management.	Section 3.2.11	
- managing impacts to water quality and flows	Section 3.2.1	
• a program to monitor the performance of the rehabilitation against the stated objectives, performance and completion criteria;	Section 8	
• a description of the potential risks to successful rehabilitation, and a description of the contingency measures that would be implemented to minimise these risks; and	Sections 3 and 9	
• details of who is responsible for monitoring, reviewing and implementing the plan.	Section 13.2	

OEH = NSW Office of Environment and Heritage.

DPI Water = NSW Department of Primary Industries – Water (now DI Water).

**Table 3 (Continued)**  
**MOP/Rehabilitation and Landscape Management Plan Requirements**

Condition	Requirement	Section Addressed
PA 06_0308 Schedule 3 Condition 31	<p>At least two years prior to the cessation of mining operations on the site the Proponent shall prepare and implement a Mine Closure Plan to the satisfaction of the NSW Resource Regulator. This plan must be prepared as a component of the Mining operations Plan required under the conditions of the mining lease and must:</p> <ul style="list-style-type: none"> <li>a) define the objectives and criteria for mine closure;</li> <li>b) investigate options for the future use of the site;</li> <li>c) provide a detailed methodology for decommissioning the site's storage dams;</li> <li>d) investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local and regional employment levels;</li> <li>e) describe the measures that would be implemented to minimise or manage the on-going environmental effects of the project; and</li> <li>f) describe how the performance of these measures would be monitored over time</li> <li>g) include a program of geotechnical assessment and appropriate mitigation actions of all constructed areas of the final landform (including emplacement areas, high walls and end walls) to demonstrate the stability of the final landform into perpetuity; and</li> <li>h) be prepared in accordance with relevant guidelines.</li> </ul>	<p>Sections 4.3 and 6 Section 4.2 Section 7.2.1 Section 10 Sections 5, 6, 7 and 9 Section 8 Section 3.2.6</p>
ML 1624 Condition 3	<p>Mining Operations Plan (MOP)</p> <ul style="list-style-type: none"> <li>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 of the Department of Primary Industries.</li> <li>b) The MOP must: <ul style="list-style-type: none"> <li>i) identify areas that will be disturbed by mining operations;</li> <li>ii) detail the staging of specific mining operations;</li> <li>iii) identify how the mine will be managed to allow mine closure;</li> <li>iv) identify how mining operations will be carried out on site in order to prevent and or minimise harm to the environment;</li> <li>v) reflect the conditions of approval under: <ul style="list-style-type: none"> <li>- the Environmental Planning and Assessment Act 1979;</li> <li>- the Protection of the Environment Operations Act 1997;</li> <li>- and any other approvals relevant to the development including the conditions of this lease; and</li> </ul> </li> <li>vi) have regard to any relevant guidelines adopted by the Director-General.</li> </ul> </li> <li>c) The titleholder may apply to the Director-General to amend an approved MOP at any time.</li> <li>d) It is not a breach of this condition if: <ul style="list-style-type: none"> <li>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</li> <li>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.</li> </ul> </li> <li>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.</li> </ul>	<p>This Closure MOP</p> <p>Section 2.3 Section 2.3 Sections 5, 7 and 9 Section 3 Sections 1.4 and 4.1 Sections 1.4 and 7.1</p> <p>Noted</p> <p>Noted</p> <p>Noted</p>

## 1.6 CURRENT LAND OWNERSHIP AND LAND USE

The Sunnyside Coal Mine is located on the “Sunnyside” property which is owned by NMPL. The “Werona” and “Lilydale” properties, located to the north-west and east of the Sunnyside Coal Mine respectively, are also owned by NMPL. The “Plain View” property, located to the north-east of the Sunnyside Coal Mine is privately owned, however the property is related to the mine’s operations through leasing of the section of the property on which the coal transport route is located. The Sunnyside Coal Mine is located on Lot 12 DP755503 and Lot 1 DP393755 which are within the Parish of Gill in the Gunnedah Shire. These parcels are held in freehold title by NMPL. The subject land is zoned RU1 (Primary Production) under the *Gunnedah Local Environment Plan 2012*. The location of the Sunnyside Coal Mine is shown on Plan 1A.

Pre-mining land use is shown on Plan 1B. Prior to mining, the Sunnyside Coal Mine had predominantly been cleared for agricultural cultivation and grazing and was vegetated with open grassland. Land use immediately surrounding the Sunnyside Coal Mine is also predominantly cropping and pastoral land use. A rocky escarpment with remnant vegetation and regrowth is located immediately south of the Sunnyside Coal Mine. This southern area is considered a valuable area of local habitat given the historical landscape clearing within the region and is proposed to be managed as Koala habitat.

## 1.7 STAKEHOLDER CONSULTATION

Whitehaven and/or its representatives consulted with the following government agencies during the preparation of the 2008 MOP and associated environmental management and monitoring plans:

- Department of Primary Industries - Mineral Resources (now Resource Regulator).
- Department of Environment and Climate Change (now EPA).
- Department of Water and Energy (now DI Water).

Whitehaven also consulted with the now DP&E Resource Regulator during preparation of MOP Amendments A, B and C, the Care and Maintenance MOP, and the 2017 MOP (i.e. following recommencement of mining).

Whitehaven consulted with the DP&E Resources Regulator regarding this Closure MOP (and the related MOD3) in April 2018 and October 2018.

Consultation regarding the rehabilitation of the Sunnyside Coal Mine was primarily undertaken during the preparation of the Sunnyside Coal Project Environmental Assessment (EA) (Olsen Environmental Consulting Pty Limited [Olsen Environmental] and R.W. Corkery & Co. Pty Ltd [R.W. Corkery], 2008).

Further consultation has occurred with relevant stakeholders during preparation of the Sunnyside Coal Mine Modification Environmental Assessment (Whitehaven, 2015) and the Sunnyside Coal Mine Final Landform Modification (Whitehaven, 2018a).

A Community Consultative Committee (CCC) was established and meetings are convened in accordance with the requirements of PA 06\_0308 (Schedule 5 Condition 9). Meeting minutes are available on the Whitehaven website.

Progress of rehabilitation and closure activities are reported annually in *Annual Reviews* which are available on the Whitehaven website.

The approved Closure MOP will be presented to OEHL, Gunnedah Shire Council and the Sunnyside CCC during the 2019 reporting period.

## 2 PROPOSED MINING AND CLOSURE ACTIVITIES

### 2.1 PROJECT DESCRIPTION

Activities proposed during the Closure MOP term include:

- Coal extraction until approximately November 2019.
- Processing and rehandling of coal.
- Supplementary earthwork activities until approximately November 2020, including:
  - handling of all carbonaceous material into the open cut and capping with at least 5 metres (m) of inert material;
  - rehandling of overburden material from the northern out-of-pit waste emplacement and partial backfilling of the open cut to create a free-draining final depression; and
  - bulk soil earthworks including placing and shaping of subsoil and topsoil to allow rehabilitation.
- Ongoing rehabilitation and minor soil earthworks (e.g. regrading of topsoil cover).
- Decommissioning of relevant infrastructure.

Appendix C provides an indicative timeline and asset register of these activities.

### 2.2 ASSET REGISTER

Primary domains have been defined in accordance with the requirements of the MOP Guidelines and represent the set of discrete areas that have a particular operational or functional purpose. All areas previously disturbed by mining, or proposed to be subject to the activities described in the sections below, have been assigned to an appropriate primary domain. The relevant primary domains at the Sunnyside Coal Mine are defined in Section 5.1.

The asset register (Table 4) provides a summary of the key features of each primary domain at Closure MOP commencement. The areas for each primary domain represent the footprint for each domain depicted on Plan 2, provided in Appendix A.

**Table 4**  
**Asset Register**

Domain	Area (ha)	Major Assets
Domain 1: Infrastructure	22	Infrastructure areas, buildings, sealed access road and haul route to the Coocooboonah Lane intersection at the ML boundary, unsealed access roads, hardstand, helipad, amenity bund, maintenance areas.
Domain 3: Water management areas	5.4	Sediment dams, clean water storage dams, pipelines and pumps
Domain 4: Overburden emplacement areas	8.7	Overburden emplacements.
Domain 5: Stockpiled material	5.9	Stockpiled soil.
Domain 6: Void (Open cut void)	33.1	Void footprint.
Domain 7: Rehabilitation areas	31.2	Footprint of existing rehabilitation areas.
Domain 8: Undisturbed areas	124.9	Footprint of undisturbed areas within the mining lease.

ha = hectare.

## **2.3 ACTIVITIES OVER THE CLOSURE MOP TERM**

### **2.3.1 Exploration**

No exploration activities are expected to be undertaken during the Closure MOP term.

### **2.3.2 Construction**

No construction activities are expected to be undertaken during the Closure MOP term.

### **2.3.3 Mining Operations Associated with Coal Extraction**

Plan 3A shows the intended progression of open cut mine development from the beginning of the Closure MOP term to when coal extraction is expected to cease (approximately November 2019).

ROM coal is transported from the Sunnyside Coal Mine by trucks along public roads on the approved coal haulage route to the Whitehaven CHPP.

### **2.3.4 Overburden Emplacement and Supplementary Earthworks**

Production wastes comprise overburden (including interburden) from the development of the open cut.

The Sunnyside Coal Mine involves the transport and emplacement of this overburden material into out-of-pit and in-pit emplacement areas during coal extraction. Plans 3A and 3B show the location of these emplacement areas.

Following cessation of coal extraction, overburden material from the out-of-pit emplacement would be rehandled and used to partially backfill the open cut to create a free-draining final depression as part of the supplementary earthworks. The supplementary earthworks would also involve bulk soil activities (e.g. placing and shaping of subsoil and topsoil from stockpiles to the final depression) to allow for rehabilitation.

As part of the supplementary earthworks, all carbonaceous material (including from the infrastructure area) would be transferred into the open cut and capped with at least 2 m of inert overburden, subsoil and topsoil.

Material from the amenity bund north of the infrastructure area (to be decommissioned during the supplementary earthworks period) would be transferred to the open cut.

Overburden emplacement and supplementary earthworks are expected to cease by approximately November 2020.

### **2.3.5 Processing Residues and Tailings**

No processing residues or tailings will be produced during the Closure MOP term. No processing residues or tailings exist at the Sunnyside Coal Mine.

### 2.3.6 Material Production Schedule

The material production schedule for the duration of the Closure MOP period is listed in Table 5.

**Table 5**  
**Material Production Schedule during the Closure MOP Term**

Material	Unit	(6 Nov 2018 – 5 Nov 2019)	(6 Nov 2019 – 5 Nov 2020)	(6 Nov 2020 – 5 Nov 2025)
Stripped soil	m <sup>3</sup>	0	50,000	0
Overburden	Mbcm	1.9	1.0	0
ROM Coal	Mt	0.45	0	0
Coarse/Fine Reject	Mt	0	0	0
Product Coal	Mt	0.45	0.15	0

Mbcm = Million bulk cubic metres.

### 2.3.7 Waste Management

Wastes produced at the Sunnyside Coal Mine comprise of:

- general domestic-type wastes from on-site buildings and routine maintenance consumables;
- oils and grease; and
- sewage.

Domestic-type wastes will be collected and disposed of by a licensed waste disposal contractor, with recyclable materials separated, where possible.

Waste oils from maintenance activities are pumped from equipment to bunded storage tanks or removed from site by a service truck.

Sewage is managed via onsite facilities serviced by licensed contractors.

### 2.3.8 Temporary Stabilisation

No temporary stabilisation is proposed during the Closure MOP term, however may be utilised if required.

### 2.3.9 Progressive Rehabilitation and Completion

Progressive rehabilitation would continue to be undertaken at the Sunnyside Coal Mine including topsoil and subsoil placement and shaping, and revegetation. Further details of rehabilitation activities to be undertaken during the Closure MOP term are provided in Section 7. An indicative timeline of rehabilitation is provided in Appendix C. Relinquishment of decommissioned rehabilitated areas is discussed in Section 7.4.

### 2.3.10 Decommissioning and Demolition Activities

Decommissioning of onsite infrastructure and water management dams would occur during the Closure MOP period. Further details of decommissioning activities to be undertaken during the Closure MOP term are provided in Section 7. An indicative timeline of decommissioning activities is provided in Appendix C. Relinquishment of decommissioned rehabilitated areas is discussed in Section 7.4.

### **3 ENVIRONMENTAL ISSUES MANAGEMENT**

#### **3.1 ENVIRONMENTAL RISK ASSESSMENT**

The Whitehaven Risk Register (Appendix B) was used to calculate the consequence and likelihood of an event at the Sunnyside Coal Mine during the Closure MOP term, to evaluate the subsequent risk level (risk rank). Risks are ranked as Low, Moderate, High or Critical. This system operates in accordance with AS/NZS ISO 31000/2009.

The Risk Register identifies eleven risks to rehabilitation during the Closure MOP term, one ranked as high risk, four as moderate risk, and the remaining six ranked as low risk.

#### **3.2 ENVIRONMENTAL RISK MANAGEMENT**

Operations at the Sunnyside Coal Mine are undertaken in accordance with an Environmental Management Strategy (EMS). The following management plans are required by PA 06\_0308:

- *Aboriginal Cultural Heritage Management Plan;*
- *Air Quality Management Plan;*
- *Blast Management Plan;*
- *Bushfire Management Plan;*
- *Energy Savings Action Plan;*
- *Environmental Management Strategy;*
- *Environmental Monitoring Program;*
- *Hydrocarbon Management Plan;*
- *Koala Management Plan;*
- *Noise Management Plan;*
- *Rehabilitation and Landscape Management Plan (this document);*
- *Pollution Incident Response Management Plan;*
- *Spontaneous Combustion Monitoring Plan;*
- *Waste Management Plan; and*
- *Water Management Plan.*

The current versions of the management plans are available on the Whitehaven website.

During the Closure MOP term, it is expected that a number of these management plans will become redundant or require revisions to reflect the cessation of coal extraction and supplementary earthworks (e.g. the Blast Management Plan and Noise Management Plan). Revision and removal of these plans would be undertaken in consultation with the relevant regulatory agencies.

The following sub-sections provide a description of the measures that will be used for rehabilitation-related aspects identified in the Risk Register requiring specific management.

### **3.2.1 Surface Water**

During mining operations, runoff from the waste emplacement is diverted to on-site sediment basins.

To minimise potential for dirty water discharges entering receiving waters, sediment dams are regularly inspected and maintained as required to retain the design capacity. Water quality monitoring is undertaken at each Licensed Discharge Point (as described in EPL 12957) during each overflow event (i.e. while discharging) and upstream and downstream of Sunnyside in Coocooboonah Creek to verify compliance with EPL water quality discharge limits.

Sediment basins will continue to be maintained until the rehabilitated catchment has met rehabilitation completion criteria and water quality monitoring at the Licensed Discharge Points satisfies the EPA's requirements to remove the Licensed Discharge Points for the catchment from EPL 12957. Decommissioning of sediment basins is described in Section 7.2.1.

As water from the final depression would only be released when runoff reaches suitable quality to be classified as "clean" water, no adverse water quality impacts to the downstream receiving environment are anticipated (GeoTerra, 2018).

### **3.2.2 Groundwater**

The final landform will incorporate partial backfilling of the open cut void to create a free-draining final depression. No pit lake is predicted for the final landform as it is free-draining and the groundwater table is below the minimum elevation of the final depression. Therefore, no outflow of groundwater is anticipated (GeoTerra, 2018).

Monitoring and management would continue in accordance with the Water Management Plan.

### **3.2.3 Erosion and Sedimentation**

Final landform drainage structures including contour banks, drains and rock lines structures have been, or will be, designed and constructed on rehabilitated landforms to manage run-off from rehabilitation areas at sub-erosive velocities.

All runoff from rehabilitation areas is to be directed to sediment basins and storage dams prior to discharge from site until runoff reaches suitable water quality (Section 3.2.1). Erosion is assessed as a component of the rehabilitation monitoring and inspection program and any significant erosion features are remediated as required.

Temporary erosion and sediment controls would be installed prior to topsoil respreading.

### **3.2.4 Acid Mine Drainage**

A material characterisation assessment was undertaken prior to the commencement of mining operations at the Sunnyside Coal Mine and reported in the Sunnyside Coal Project EA (Olsen Environmental and R.W. Corkery, 2008). Acid rock drainage laboratory analysis and batch leach tests were undertaken to determine the acid-forming potential of the overburden at the Sunnyside Coal Mine. Testing indicated that waste rock at the Sunnyside Coal Mine is not potentially acid-producing and that the leachate from the overburden would be moderately saline with a neutral to slightly alkaline pH.

Laboratory testing did identify a small volume coal seam located approximately 36 m below the surface which demonstrated some acid-producing potential. However, this coal seam is only 18 centimetres (cm) thick and represents approximately 1% of the total overburden volume. As such, its acid-producing potential will be dominated by the non-acid producing rock.

This small volume of potentially acid-producing material will be incorporated into either the in-pit or out-of-pit emplacement and will be capped with at least 2 m of non-acid forming material to reduce the potential for oxidisation.

On the basis of the above, acid mine drainage was ranked as a moderate risk to rehabilitation and closure.

### **3.2.5 Spontaneous Combustion**

The Hoskissons Coal Seam (the resource mined at the Sunnyside Coal Mine) has the potential for spontaneous combustion. Testing completed on representative core samples during the preparation of the EA classified the intrinsic spontaneous combustion propensity as high (Olsen Environmental and R.W. Corkery, 2008).

Spontaneous combustion has been evident at the Sunnyside Coal Mine with carbonaceous shale material in the spoil on the pit floor and adjacent spoil stockpiles indicating a potential to ignite. In response to this, NMPL submitted a comprehensive Spontaneous Combustion Monitoring Plan (SCMP) to the EPA in 2013. The SCMP detailed a capping program to ensure that areas exhibiting spontaneous combustion in the void were capped with a minimum of 5 m of inert material. The minimum 5 m of inert material is considered sufficient to minimise the risk of the cap being compromised by water ingress, erosion and root penetration and is sufficient to reduce oxygen dispersion required to sustain combustion.

During care and maintenance of the Sunnyside Coal Mine, spontaneous combustion of stockpiled carbonaceous material within the open cut was identified. Management of the material with the propensity for spontaneous combustion was subsequently conducted in accordance with an SCMP, which was submitted to the EPA and implemented via a Pollution Reduction Program on EPL 12957 (version dated 17 December 2013).

The major earthworks described in the SCMP began in December 2013 and were completed in April 2014. Following the completion of earthworks, and throughout the care and maintenance phase, weekly on-site spontaneous combustion inspections were undertaken. As reported in the Annual Reviews, no visible signs of spontaneous combustion were observed; however, a slight sulphur odour has been detected on some occasions in close proximity to the affected area.

In addition, in 2016, infrared imaging was captured utilising a drone, and minor earthworks found areas of heating within the pit. It is likely that heating will continue in the material underground until the material becomes oxygen-depleted (i.e. via further earthworks in-pit).

As such, Whitehaven will continue to conduct regular monitoring of the affected area as required.

General management of spontaneous combustion will continue through the Closure MOP term and will consist of:

- earthworks to ensure that no coal seams remain exposed in the final landform highwall or endwall (i.e. due to partial backfilling of the open cut);
- selective handling of carbonaceous material;
- minimising the length of time coal is held in stockpiles;
- routine shift inspections of coal stockpiles and emplacement areas for signs of spontaneous combustion;
- infrared imaging of potential spontaneous combustion areas will be undertaken, as required;
- reporting spontaneous combustion incidents; and

- training in spontaneous combustion management.

### 3.2.6 Geotechnical Stability and Slope Management

Material removed from the top of the waste emplacement would be used to partially backfill the open cut (i.e. to improve geotechnical stability of the final landform highwall), which would result in a free-draining final depression with a minimum elevation of approximately 330 m Australian Height Datum (AHD).

Rehabilitated slopes would be verified by survey to be generally less than 10 degrees for out-of-pit and in-pit overburden emplacement, 47 degrees for the retained portions of the highwall, and 15 degrees for the endwall in the final depression.

To ensure the ongoing stability of slopes retained in the final landform, geotechnical assessment and survey of all key areas will be undertaken during the MOP term to assess the stability of the landform and to verify that it has been constructed in accordance with the final landform shown in Plan 4.

Survey or remote sensing of the rehabilitated landforms will be undertaken to identify any evidence of slumping or weathering that could compromise stability of the highwall or endwall.

### 3.2.7 Soil Type(s) and Suitability

Soil resources at the Sunnyside Coal Mine were assessed in the Soils and Land Capability Assessment by Geoff Cunningham Natural Resource Consultants Pty Ltd (GCNRC) in 2008. GCNRC (2008) identified and classified soils to be stripped ahead of disturbance for the Sunnyside Coal Mine operations.

Soil resources identified to be salvaged for rehabilitation were predominantly representative of three discrete soil mapping units (SMUs), being:

- SMU 1 - Soils of the Upper Slopes - to 145 cm deep over weathered rock; upper slope location; surface condition loose to firm; moderate to large amounts of surface stone present, rounded/angular to 15 cm;
- SMU 2 - Soils of the Mid- and Lower Slopes - to 260 cm+ deep; mid- and lower slope location; surface condition loose, firm or hard setting; surface stone absent or some surface stone present, rounded or angular, 1-15 cm (usually < 10 cm); and
- SMU 3 - Soils of the Drainage Depression Deep - to 260 cm+ deep; surface condition self-mulching and cracking; surface stone absent.

Table 6 presents an inventory of the overall available soil volumes for rehabilitation and closure of the Sunnyside Coal Mine.

**Table 6**  
**Inventory of Soil Volumes (stockpiled and spread to date)**

Soil	Quantities (m <sup>3</sup> )	
	At the start of the Closure MOP	At the end of the Closure MOP
Cumulative soil volume stripped	0	150,000
Cumulative soil volume used for rehabilitation purposes	0	527,500
Cumulative soil stockpile volume	377,500	0

Appendix D presents 2012 and July 2018 soil quality test results of topsoil and subsoil stockpiles located at Sunnyside Coal Mine. Collectively the soil test results indicate the following:-

- Metals analysed (Boron, copper, Iron, Manganese and Zinc) were low and below contamination guidelines,
- Levels of iron were high ranging between 13,000 and 31,000 mg/kg,
- pH is high between 8 and 9.4,
- Electrical conductivity, exchangeable calcium and exchangeable sodium are slightly evaluated,
- Nutrient levels are good with around 400mg/kg of total nitrogen, and total phosphorus around 300mg/kg,
- There is very low organic matter in the soils mostly below 1%.

An assessment of the test results (refer Appendix D) recommends an application of 1.5t/ha of gypsum, and consideration of addition of organic matter at a rate of 10-20m<sup>3</sup> per hectare, to the soil. Addition of organic matter will be dependent upon the performance of revegetation (refer Tables 15 and 25).

Investigations undertaken to date have identified that some historic stockpiles include both topsoil and subsoil and as such no fully quantified inventory is currently available that splits the volume of topsoil and subsoil stockpiles. During the Closure MOP term, Whitehaven will undertake a continued program of classification of existing stockpiles to inform a detailed soil inventory and determine the volume split of topsoil and subsoil available for rehabilitation (i.e. to confirm that adequate topsoil and subsoil is available to complete rehabilitation activities at the Sunnyside Coal Mine). Contingency measures to be implemented should a deficiency in soil volume be identified are described in Table 25.

Ongoing soil stockpile management measures include:

- Implementation of a weed control program in the event that unacceptable weed generation is observed; and
- avoiding the operation of machinery on the soil stockpiles to prevent compaction and maintain soil aggregation.

Topsoil and subsoil will be respread following establishment of the final landform. Topsoil will be respread to a nominal depth of 150 millimetres (mm) and subsoil to a depth of 400 mm. When the soil is re-spread it will be ripped along the contour to prevent soil erosion, rock raked, and seeded with the desired rehabilitation vegetation species.

### **3.2.8 Flora and Fauna**

The Sunnyside Coal Mine is located in an area which had previously (prior to mining) been extensively cleared for agriculture. Subsequently no major areas of native vegetation have, or will be, cleared within the footprint of the operation. Notwithstanding this, Whitehaven has incorporated flora and fauna management aspects including:

- ongoing implementation of the *Koala Management Plan* (including establishment of corridors and supplementary plantings); and
- control of priority weeds.

These management aspects would continue as required over the Closure MOP term.

### **3.2.9 Weed Management**

Under the NSW *Biosecurity Act, 2015*, Whitehaven has a statutory responsibility to prevent the spread of priority weeds on all Whitehaven-owned land on and surrounding the Sunnyside Coal Mine. Weed

species presence and abundance is assessed in the rehabilitation monitoring program on both rehabilitation areas and analogue sites.

Pre-mining assessments identified 34 weed species in the area of the Sunnyside Coal Mine, including four declared noxious weeds, being:

- Prickly Pear - *Opuntia stricta var. stricta*;
- Johnson Grass - *Sorghum halepense*;
- Patterson's Curse - *Echium plantagineum*; and
- Galvanised Burr - *Sclerolaena birchii*.

These priority weeds will be targeted for identification and treatment. Several environmental weeds of note are also present, including Paddy's Lucerne (*Sida rhombifolia*) and Horehound (*Marrubium vulgare*). These species have the potential to impact on areas of remnant vegetation and revegetation and will also be a key focus for control.

Weed management practices to be adopted during the Closure MOP term include:

- ongoing visual assessments and weed monitoring as part of the rehabilitation monitoring program;
- application of herbicides where required to control weed infestations;
- recording and controlling any occurrences of priority weeds;
- restriction of grazing and vehicular traffic to minimise spread of weeds; and
- liaison with the North West Local Land Services (LLS).

Following closure of the Sunnyside Coal Mine, it is expected that ongoing weed management requirements would be generally consistent with the requirements at surrounding agricultural properties.

### **3.2.10 Pest Animal Control**

Feral animals have not been a significant issue over the life of the mine and are not considered to present a significant risk to rehabilitation. Controls in place to minimise the impact and potential for feral animal infestation include:

- ongoing visual observations of feral animal activity including inspections for all the nominated vertebrate pests will be conducted in conjunction with the biodiversity and post-mining rehabilitation monitoring program; and
- liaison with North West LLS, and participation with the existing Whitehaven Biodiversity pest control programs as required by observation/monitoring. Pest control actions may include 1080 poison baiting for the declared Rabbits and Wild Dogs as well as other nuisance species such as European Red Foxes and Feral Pigs.

Following closure of the Sunnyside Coal Mine, it is expected that ongoing pest management requirements would be generally consistent with the requirements at surrounding agricultural properties.

### **3.2.11 Bushfire**

Fire prevention will continue to be undertaken and liaison with the Rural Fire Service (RFS) undertaken.

Following closure of the Sunnyside Coal Mine, it is expected that ongoing bushfire management requirements would be generally consistent with the requirements at surrounding agricultural properties.

### **3.2.12 Contaminated Land**

A contaminated land assessment will be undertaken for any infrastructure areas decommissioned during the Closure MOP term (including ROM coal handling and stockpiling facilities, workshops, fuel storage and chemical storage facilities).

Any potential contamination will be remediated accordingly (see Section 7.2.1 for further details).

### **3.2.13 Mine Subsidence**

The Sunnyside Coal Mine is located to the north of the now closed Gunnedah No. 5 Coal Mine subsidence district. Subsequently, no specific management controls or monitoring programs are necessary. For the open cut area, a barrier pillar of 40 m has been maintained as an offset from the old underground workings.

### **3.2.14 Public Safety and Controlling Access**

Actions to be undertaken to prevent unauthorised access to the Sunnyside Coal Mine include:

- signage at the entry of the Sunnyside Coal Mine (intersection with the Coochooboonah Lane realignment) indicating that authorised personnel only are permitted on-site;
- the entry point to the Sunnyside Coal Mine has a gate which is locked when the mine is not in operation;
- signage on boundary fencing indicating that the Sunnyside Coal Mine is an active mine (when the mine is in operation) and indicating that unauthorised access is not permitted;
- all persons are required to sign in at the site office;
- inductions for all persons; and
- visitors and personnel not inducted are required to be accompanied by an inducted person.

Public safety measures following closure of the Sunnyside Coal Mine would be developed during the Closure MOP term in consultation with relevant stakeholders. Notwithstanding, the Sunnyside Coal Mine final landform (including its proposed future land uses) has been designed to be safe, stable and non-polluting. It is expected that relevant signage, fencing and bunding for safety would be retained, subject to consultation with future landowner(s) and stakeholders.

### **3.2.15 Visual**

Ongoing rehabilitation of the out-of-pit emplacement (which has already progressed significantly at the beginning of the Closure MOP period) would continue to improve visual amenity of the Sunnyside Coal Mine over time. Furthermore, rehandling of overburden during the supplementary earthworks would reduce the height of the out-of-pit emplacement in turn reducing visual impact of the Sunnyside Coal Mine.

The final landform highwall and endwall are located below the surrounding ground level and therefore would generally only be visible at elevated viewpoints in the vicinity of the Sunnyside Coal Mine.

The established northern amenity bund wall screening the coal processing area would be removed during the supplementary earthworks, however the coal processing area would also subsequently be decommissioned (i.e. following closure, views of the Sunnyside Coal Mine from the north would be of the established woodland rehabilitation on the out-of-pit emplacement).

## 4 POST-MINING LAND USE

### 4.1 REGULATORY REQUIREMENTS

The regulatory and approval requirements relating to post-mining land use, rehabilitation and closure are summarised in Table 7.

**Table 7**  
**Regulatory Requirements Relating to Post-Mining Land Use, Rehabilitation and Closure**

Condition	Requirement	Status
<b>ML 1624</b>		
2	The proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.	In progress.
7	Disturbed land must be rehabilitated to a sustainable/agreed end land use to the satisfaction of the Director-General.	In progress.
18	Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, condition unless otherwise authorised by a relevant approval, and in accordance with an accepted MOP. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.	In progress.
22	Access tracks must be kept to a minimum and be positioned so that they do not cause any unnecessary damage to the land. Temporary access tracks must be ripped, topsoiled and revegetated as soon as possible after they are no longer required for mining operations. The design and construction of access tracks must be in accordance with specifications fixed by the Department of Environment and Climate Change.	In progress.
31	The lease holder must make every reasonable attempt, and be able to demonstrate their attempts, to enter into a cooperation agreement with the holder(s) of any overlapping petroleum title(s). The cooperation agreement should address but not be limited to issues such as: <ul style="list-style-type: none"> <li>• access arrangements;</li> <li>• operational interaction procedures;</li> <li>• dispute resolution;</li> <li>• information exchange;</li> <li>• well location;</li> <li>• timing of drilling;</li> <li>• potential resource extraction conflicts; and</li> <li>• rehabilitation issues.</li> </ul>	N/A.
<b>PA 06_0308 (as modified)</b>		
Schedule 2 Condition 1	The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.	In progress.
Schedule 2 Condition 5	Mining operations may take place on the site until 5 November 2020. Note: Under this Approval, the Proponent is required to rehabilitate the site to the satisfaction of the Secretary and DRG. Consequently this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been rehabilitated to a satisfactory standard.	In progress.
Schedule 2 Condition 13	The Proponent shall ensure that all demolition work is carried out in accordance with Australian Standard AS 2601-2001: The Demolition of Structures, or its latest version.	To commence at decommissioning.
Schedule 3 Condition 28	The Proponent shall implement the Koala habitat management and enhancement actions described in the EA (shown conceptually in Figure 6 in Appendix 4) in consultation with the OEH and to the satisfaction of the Secretary.	In progress.
Schedule 3 Condition 29	The Applicant must rehabilitate the site to the satisfaction of the Resource Regulator.	In progress.
Schedule 3 Condition 40	The Proponent shall minimise the visual impacts of the project to the satisfaction of the Secretary.	In progress.

## **4.2 POST-MINING LAND USE GOALS AND FUTURE USE OF THE SITE**

The overall closure goal for the Sunnyside Coal Mine is to establish a stable and safe landform that is commensurate with the surrounding topography and which maximises the return to an appropriate agricultural land use comparable to the pre-mining land use, but is considerate of the fact that the landform is a backfilled mining area. The rehabilitation strategy also includes the enhancement of habitat value and ecosystem connectivity.

The conceptual final landform rehabilitation plan which details the proposed post-mining future land use(s) is provided on Plan 4.

### **4.2.1 Biodiversity Enhancement**

The post-mining landform will include approximately 30.5 hectares (ha) of land rehabilitated with woodland species to enhance biodiversity values of the area. The rehabilitation of disturbed areas with woodland species targets the enhancement of Koala habitat and movement corridors and includes the batters of the regraded out-of-pit waste emplacement.

The elevated areas (undisturbed by mining activities) on the southern end of the property will remain as Koala habitat. Additionally, approximately 17.6 ha of additional tree planting on areas undisturbed by mining activities along the eastern, northern and western boundaries of the property will enhance wildlife corridors.

It is expected that this area will continue to serve as a biodiversity enhancement area following closure of the Sunnyside Coal Mine, subject to consultation with future landowner/s and any other relevant stakeholders.

### **4.2.2 Pasture**

The post-mining landform (including areas of the out-of-pit emplacement and final depression) will include approximately 54 ha of land rehabilitated with a mix of native and exotic pasture species. Pasture rehabilitation areas will be created with a mix of land capability classes that is generally in accordance with the pre-mining environment to restore the potential for some productive grazing areas with characteristics similar to pasture areas in the general locality.

It is expected that this area will be used for grazing purposes following closure of the Sunnyside Coal Mine by future landowner/s. NMPL may alternatively elect to retain ownership of the land and lease the area for ongoing agricultural use.

### **4.2.3 Final Depression Highwall and Endwall**

Following cessation of mining the open cut would be partially backfilled, resulting in a minimum elevation of approximately 330 m AHD in the free-draining final depression. A portion of the open cut highwall to the south of the open cut (which would have a maximum elevation of approximately 372 m AHD) would be retained as part of the final landform.

To ensure the ongoing stability of slopes retained in the final landform, geotechnical assessment and survey of all key areas will be undertaken during the Closure MOP term to assess the stability of the landform and to verify that it has been constructed in accordance with the final landform shown in Plan 4. Survey or remote sensing of the rehabilitated landforms would be undertaken to identify any evidence of slumping or weathering that could compromise the stability of the highwall or endwall.

#### **4.2.4 Retained Infrastructure and Water Management**

Following mine closure, it is intended to retain some additional clean water dams and some access tracks (Plan 4). Decommissioning of infrastructure present at the commencement of the MOP term is described in Section 7.3 and an indicative timeline and asset register is provided in Appendix C.

It is expected that any retained water infrastructure would be used for ongoing agricultural purposes (e.g. stock watering) following closure of the Sunnyside Coal Mine.

### **4.3 REHABILITATION AND CLOSURE OBJECTIVES**

Key rehabilitation objectives to achieve the desired post-mining land use goals have been separated into short-term and long-term categories.

The short-term and majority of long-term rehabilitation objectives are expected to be completed during the MOP term; however, some long-term objectives (e.g. monitoring rehabilitation success) would be continued beyond mine closure as required.

#### **4.3.1 Short-term Rehabilitation and Closure Objectives**

Short-term rehabilitation and closure objectives at the Sunnyside Coal Mine include:

- to schedule operations including overburden/interburden emplacement and shaping and revegetation to achieve target final landform/landuse, and minimise visual exposure;
- to rehabilitate areas of disturbance no longer required for mining-related operations;
- to apply soil (topsoil/subsoil) to the final landform based on material availability and post-mining land use;
- to stabilise all earthworks, drainage lines and disturbed areas in order to minimise erosion and sedimentation; and
- to control vermin, feral animals and noxious weeds.

#### **4.3.2 Long-term Rehabilitation and Closure Objectives**

Long-term rehabilitation and closure objectives at the Sunnyside Coal Mine include:

- continuation and/or restoration of biodiversity and ecological integrity of areas affected by mining or agriculture within the mining lease;
- to establish a low maintenance, geotechnically stable final landform commensurate with agricultural and nature conservation land uses;
- to blend the created landforms to appear as a natural extension with the surrounding landforms;
- to provide habitat for fauna and corridors for fauna movement within the final landform;
- to enhance Koala habitat in accordance with the Koala Management Plan;
- to monitor rehabilitation success in terms of physical and biological parameters; and
- to achieve relinquishment status of rehabilitated and decommissioned areas.

## 5 REHABILITATION AND CLOSURE PLANNING AND MANAGEMENT

### 5.1 DOMAIN SELECTION

Primary and secondary domains have been defined in accordance with the methodology prescribed in the MOP Guidelines.

The primary domains represent the set of discrete areas that have a particular operational or functional purpose. All areas previously disturbed by mining, or proposed to be subject to the activities described in the sections below, have been assigned to an appropriate primary domain.

The relevant primary domains at the Sunnyside Coal Mine are defined in Table 8. The footprint of each primary domain at the commencement of the Closure MOP term is depicted on Plan 2.

**Table 8  
Primary Domains**

Primary Domains	Code	Description
Infrastructure	1	Footprint of areas disturbed for existing and decommissioned infrastructure including; amenity facilities, sealed and unsealed roads and carparks and maintenance areas.
Water management area	3	The network of clean water and dirty water dams and associated infrastructure used for operational and rehabilitation water management.
Overburden emplacement area	4	Footprint of out-of-pit overburden waste dumps.
Stockpiled material	5	Material stockpiled for future management, (e.g. soil resources).
Void (Open cut void)	6	Open cut footprint.
Rehabilitation area	7	Footprint of existing rehabilitation areas.
Undisturbed areas	8	Footprint of undisturbed areas within the mining lease.

Secondary domains have been selected to reflect the proposed post-mining and future land use described throughout Section 4 and have been selected in consideration of the MOP Guidelines.

Secondary domains are shown on Plans 2 to 4, and are described in Table 9.

**Table 9  
Secondary Domains**

Secondary Domains	Code	Description
Infrastructure	A	Infrastructure to be retained following relinquishment including some access tracks.
Water management areas	B	The network of dams and water management structures retained in the final landform. Dams will provide water resources for grazing areas and native fauna.
Rehabilitation areas - Pasture	D	Areas rehabilitated with native pasture species to a rural land capability of (at least) Class VI, sufficient to sustain a grazing land use.
Rehabilitation areas - Woodland	E	Areas rehabilitated with native vegetation species analogous to adjacent remnant vegetation communities in the areas surrounding the Sunnyside Coal Mine. Native vegetation areas will have characteristics similar to existing analogue sites to provide suitable habitat and movement corridors for native fauna.
Final Depression Highwall and Endwall	I	Final depression highwall constructed at approximately 47 degrees.
Conservation Area	J	Enrichment zones/New Vegetation - Areas undisturbed by mining activities (including remnant vegetation and pasture areas), preserved and enhanced with supplementary plantings to enhance biodiversity values such as movement corridors.

## 5.2 DOMAIN REHABILITATION AND CLOSURE OBJECTIVES

Rehabilitation and closure objectives for the domains identified in the sections above are described in Table 10.

**Table 10**  
**Domain Rehabilitation and Closure Objectives**

Domain	Code	Rehabilitation Objective
<b>Primary Domains</b>		
Infrastructure	1	<p>Infrastructure will be progressively decommissioned and removed from site when no longer required.</p> <p>Unless agreed with stakeholders, all infrastructure and services will be removed from site (except for some access tracks).</p> <p>All land contamination/hazardous/carbonaceous materials will be identified and appropriately removed or remediated.</p> <p>Infrastructure areas will be rehabilitated with a combination of native vegetation and pasture areas.</p>
Water management areas	3	<p>Downstream water users are not adversely affected by the mine's operation. Where practical clean water has been diverted around disturbance areas.</p> <p>Dirty water run-off (including rehabilitation areas) will be captured and treated prior to discharge in accordance with EPL discharge criteria.</p> <p>Sediment dams and associated structures (including diversion drains and banks) will be retained until the catchment is completely rehabilitated and run-off is considered 'clean water' run-off.</p> <p>Sediment dams will be progressively decommissioned when no longer required (dewatered and de-silted) and either rehabilitated or converted to clean water dams for retention in the final landform for future stock watering purposes.</p> <p>Some existing clean water dams will be retained in the final landform for agricultural purposes.</p>
Overburden emplacement areas	4	<p>Post-mining landforms will be geotechnically stable, safe and non-polluting.</p> <p>Overburden emplacement areas will be adequately drained with drainage structures designed and constructed with reference to <i>Managing Urban Stormwater, Soils and Construction manual</i> (Landcom, 2004) (Blue Book).</p> <p>Overburden emplacement areas will be shaped with slopes generally less than 10 degrees with a crest no greater than 345 m AHD.</p> <p>Overburden emplacement areas will be rehabilitated with a combination of native vegetation and pasture areas.</p>
Stockpile areas	5	<p>Soil stockpiles have been established and maintained.</p> <p>Soil stockpiles have been located in areas not proposed to be disturbed for mining to minimise the potential for stockpiles to require relocation.</p> <p>Following soil re-use, stockpile areas will be lightly ripped and revegetated with pasture or native vegetation communities according to the section of final landform in which the stockpile was located.</p>
Void (Open cut void)	6	<p>The open cut will be partially backfilled with overburden and shaped to a depth of between 336 m AHD (south-east limit of the open cut) and 330 m AHD (north-west limit of the open cut) to ensure geotechnical stability and encapsulation of carboniferous material.</p> <p>The final depression will be geotechnically stable, safe and non-polluting.</p> <p>Surface water will drain towards the north-west outlet of the final depression.</p>
Rehabilitation area	7	As per objectives for the appropriate secondary domain.
Undisturbed areas	8	As per objectives for the appropriate secondary domain

**Table 10 (continued)**  
**Domain Rehabilitation and Closure Objectives**

Domain	Code	Rehabilitation Objective
<b>Secondary Domains</b>		
Infrastructure	A	Retained infrastructure. Some access tracks will be retained in the final landform for use by post-mining landholders.
Water management areas	B	The final landform drainage will be designed and constructed to integrate with surrounding catchments. Some clean water dams will be retained (Plan 4). Final landform drainage will be designed and constructed to minimise erosion and enhance geomorphic stability. The final landform water management will not adversely impact downstream water users.
Rehabilitation areas - Pasture	D	Pasture areas with characteristics comparable with analogue sites will be established on selected areas disturbed by mining (e.g. former infrastructure areas, final depression) (Plan 4). Grazing rehabilitation areas will comply with (at least) a Rural Land Capability of Class VI. Management inputs required to sustain grazing will be in the range of analogue sites.
Rehabilitation areas - Woodland	E	Native vegetation with characteristics comparable with analogue sites will be established on selected areas disturbed by mining (e.g. overburden emplacement slopes) (Plan 4). Local provenance seed will be used for woodland rehabilitation areas. Woodland rehabilitation areas will contribute to habitat resources for local fauna (including the Koala) and provide linkages with adjacent native vegetation.
Final Depression Highwall and Endwall	I	Retained portion of the highwall (Plan 4) has a slope of approximately 47 degrees.
Conservation Area	J	Enrichment zones. Supplementary plantings will be undertaken to enhance the native vegetation diversity and density. Enrichment zones will be managed to control weeds, pest animal species, and exclude grazing stock.

### 5.3 REHABILITATION PHASES

Achievement of the agreed post-mining land use will be through a series of conceptual rehabilitation phases. These phases of rehabilitation are described in Table 11. The rehabilitation phase applicable to each domain at the end of the Closure MOP term is shown in Table 12.

**Table 11**  
**Rehabilitation Phases**

Phase	Description
Decommissioning	The process of removing plant and equipment from active services and rendering the area safe for humans, wildlife and stock.
Landform Establishment	The process of shaping sub-stratum material into a desired land surface profile. This includes earthworks activities such as cut and fill, encapsulation of potentially problematic material, rock raking, water storage and drainage construction.
Growth Medium Development	The process of establishing and enhancing the physical structure, chemical properties and biological properties of a soil stratum suitable for plant growth. This includes placing and spreading recovered subsoil and topsoil resources and applying ameliorants.
Ecosystem Establishment	The process of seeding, planting and transplanting plant species. Incorporates management actions such as weed and feral pest control to achieve species establishment and growth to juvenile communities, and habitat augmentation.
Ecosystem Sustainability	The process of applying management techniques to encourage planted vegetation to grow and develop towards a desired and sustainable post-mining land use outcome. Incorporates features including species reproduction, nutrient recycling and community structure.
Land Relinquishment	The completion criteria for rehabilitation are met and the land is determined to be suitable to be relinquished from the mining tenement.

**Table 12**  
**Summary of Rehabilitation Phases at the End of the Closure MOP Term**

Rehabilitation Phase \ Domain	Infrastructure – Rehabilitation Area Pasture (1D)	Infrastructure – Rehabilitation Area Woodland (1E)	Water Management Area – Retained Water Management Area (3B)	Water Management Area – Rehabilitation Area Pasture (3D)	Overburden Emplacement Area – Rehabilitation Area Pasture (4D)	Overburden Emplacement Area – Rehabilitation Area Woodland (4E)	Stockpiled Material – Rehabilitation Area Pasture (5D)	Stockpiled Material – Rehabilitation Area Woodland (5E)	Void (Open Cut Void) – Rehabilitation Area Pasture (6D)	Void (Open Cut Void) – Rehabilitation Area Woodland(6E)	Void (Open Cut Void) – Final Depression Highwall and Endwall (6I)	Rehabilitation Area – Rehabilitation Area Pasture (6D)	Rehabilitation Area – Rehabilitation Area Woodland(6E)
Active	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 1 Decommissioning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 2 Landform Establishment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 3 Growth Medium Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 4 Ecosystem and Land Use Establishment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 5 Ecosystem and Land Use Sustainability			✓								✓		
Phase 6 Relinquished Lands													

## **6 PERFORMANCE INDICATORS AND COMPLETION CRITERIA**

Tables 13 to 18 detail rehabilitation objectives, indicators and completion criteria for each rehabilitation phase for all domains.

**Table 13  
Decommissioning Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Domains</b>						
Public safety.	Site security.	Security measures (e.g. Mining Lease boundary fencing) have been implemented (where required) prior to commencing decommissioning and demolition works.	Closure MOP Section 3.2.14	No	No	Ongoing
<b>Domain 1 – Infrastructure</b>						
All infrastructure and services will be removed from site (except as previously described) prior to relinquishment.	Demolition of infrastructure.	All demolition work has been carried out in accordance with <i>AS2601-2001: The Demolition of Structures</i> or its latest version.	AS2601 - 2001	No	No	To commence
		All surface infrastructure that is not required for the post-mining land use has been demolished (or dismantled) and removed from the site.	Closure MOP Section 5.2	No	No	To commence
	Site services.	All site electricity and telecommunication services have been disconnected and removed.	Closure MOP Section 5.2	No	No	To commence
	Foundations and pavements.	All concrete footings, foundation pads and pavements have been removed.	Closure MOP Section 5.2	No	No	To commence
All hazardous and contaminated materials are appropriately removed or remediated in accordance with the recommendations of a contamination site assessment.	Carbonaceous material.	Any carbonaceous material has been removed from the footprint of the infrastructure areas and disposed of in the void, with at least 5 m cover (supported by records).	Closure MOP Section 5.2	No	Yes	To commence
	Hazardous materials.	Site investigation records indicate that infrastructure areas are free of any hazardous materials.	Closure MOP Section 5.2	No	No	To commence
	Contaminated soils.	Records indicate that contaminated soils have been identified and remediated or removed in accordance with legislation.	Closure MOP Section 5.2 EPA 1998 NEPC 1999	No	No	To commence
<b>Domain 3 – Water Management Areas</b>						
Mine water dams and sediment dams are desilted and decontaminated prior to conversion to clean water dams or backfilling and regrading into in the final landform.	Dam sediments.	Sediment accumulated in mine water and sediment dams is removed and emplaced in the final depression with adequate inert cover, supported by records.	Closure MOP Section 5.2	No	No	To commence

**Table 14**  
**Landform Establishment Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Domains</b>						
Post-mining landforms will be geotechnically stable, safe and non-polluting landforms that blend with the surrounding topography and that are suited to the nominated post-mining land uses.	Slopes.	Rehabilitated slopes are verified by survey to be generally less than 10 degrees (overburden emplacement) and approximately 47 degrees (highwall in the final depression).	Closure MOP Section 5.2	No	Yes	Commenced
	Stability.	Survey or remote sensing of the rehabilitated landforms shows an absence of slumping that could compromise stability.	Closure MOP Section 8.1	No	Yes	Ongoing
	Discharge water quality.	Dirty water is captured and discharged in accordance with the EPL (supported by records).	EPL 12957	No	Yes	Ongoing
	Visual.	The regraded landform blends with the surrounding topography.	Closure MOP Section 4.3	No	No	Ongoing
<b>Domain 3 – Water Management Areas</b>						
Safe, stable, adequately drained post-mining landforms consistent with the surrounding landscape and downstream water users are not adversely affected.	Final landform drainage.	The design for all erosion and sediment control structures will be consistent with Blue Book requirements.	Closure MOP Section 5.2	No	Yes	Ongoing
	Geomorphic stability.	Visual assessment by a specialist certifying that drainage structures are stable with no active gully heads, tunnel erosion or bank failure that are likely to compromise the long-term stability of the structure.	Closure MOP Section 5.2	No	Yes	Ongoing
	EPL discharge criteria.	All discharge water quality criteria complies with EPL12957.	EPL 12957	No	Yes	Ongoing
<b>Domain 4 – Overburden Emplacement Areas</b>						
Create a landform that blends with the adjoining landscape.	Landform compatibility.	Landforms are surveyed and demonstrated to be constructed in accordance with the final landforms shown in MOP Plan 4.	Closure MOP Plan 4	No	No	Ongoing
	Maximum height.	Survey verifies that overburden emplacement areas are no higher than 345 m AHD.	Closure MOP Section 5.2	No	No	Ongoing
	Slopes.	Slopes on the final landform designed and constructed to minimise erosion and are assessed to be stable.  The final batter slopes for the Overburden Emplacement Area generally less than 10 degrees.	Closure MOP Section 3.2.3 and 5.2	No	Yes	Ongoing

**Table 14 (continued)**  
**Landform Establishment Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>Domain 6 - Void (Open Cut Void)</b>						
Post-mining landforms will be geotechnical stable, safe, and non-polluting.	Design.	The void design and implementation is as per nominated criteria in the MOP and assessed by a suitably qualified and experienced geotechnical engineer to validate the landform is stable and does not pose an unacceptable safety risk.  The final depression is backfilled to between 336 m AHD and 330 m AHD verified by survey.	Closure MOP Sections 4.2.2, 4.2.3 and 5.2	No	No	Ongoing
	Stability.	There is no evidence of settlement or slumping in the landform that would cause a safety issue.	Closure MOP Sections 4.2.2, 4.2.3 and 5.2	No	Yes	To commence
	Highwall	The highwall of the final depression has been constructed at approximately 47 degrees.	Closure MOP Sections 4.2.2, 4.2.3 and 5.2	No	Yes	To commence
	Slopes.	Final depression slopes have been constructed to generally less than 10 degrees.	Closure MOP Sections 4.2.2, 4.2.3 and 5.2	No	Yes	To commence
	Drainage.	The final depression is a non-permanent water source, receiving only localised surface runoff with incident rainfall draining to the north-west outlet.	Closure MOP Sections 4.2.2, 4.2.3 and 5.2	No	Yes	To commence
	Carbonaceous materials.	All coal and carbonaceous material is capped with a minimum of 5 m of inert overburden, subsoil and topsoil (supported by records).	Closure MOP Section 5.2	No	Yes	Ongoing
	Erosion.	There is no evidence of slumping or uncontrolled erosion that could compromise stability prior to commencement of growth medium development phase.	Closure MOP Section 5.2	No	Yes	Ongoing
		Active erosion is assessed to be not compromising landform stability prior to commencement of growth medium development phase.	Closure MOP Section 5.2	No	Yes	Ongoing
	Spontaneous combustion.	There is no evidence of spontaneous combustion prior to commencement of growth medium development phase.	Closure MOP Section 3.2.1.3	No	Yes	Ongoing

**Table 15**  
**Growth Medium Development Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Domains</b>						
Topsoil and subsoil resources are salvaged and maintained for use in rehabilitation.	Topsoil depth.	Rehabilitation records verify that rehabilitation areas topsoiled with a nominal depth of 150 mm, where available.	Closure MOP Section 3.2.7 and GCNRC 2008	No	No	Commenced
	Subsoil depth.	Rehabilitation records verify that rehabilitation areas include subsoil with a nominal depth of 400 mm where available.	Closure MOP Section 3.2.7 and GCNRC 2008	No	No	Commenced
Erosion is minimised.	Temporary Erosion and Sediment Control (ESC).	Temporary ESCs are installed prior to topsoil re-spreading.	Closure MOP Section 3.2.3	No	No	Ongoing
		Topsoiled rehabilitation areas are sown with a non-persistent cover crop at the recommended sowing rate per hectare.	Closure MOP Section 7.2.4	No	No	Ongoing
Subsoils and topsoils will be characterised prior to re-spreading	Soil parameters.	Rehabilitation monitoring verifies soil characteristics such as pH, Electrical Conductivity, Exchangeable sodium percentage, nitrogen and phosphorous are generally in the range of analogue sites or do not appear to be limiting plant performance.	This Closure MOP	No	Yes	Ongoing
Soils are ameliorated where determined necessary	Ameliorant application.	Soil ameliorants (e.g. gypsum, mulch, biosolids, composts) are applied where necessary (supported by records).	Closure MOP Section 5.2	No	Yes	Ongoing

**Table 16**  
**Ecosystem Establishment Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Domains</b>						
Weeds and feral animals do not present a risk to rehabilitation.	Weed presence.	Monitoring verifies there are no significant weed infestations and weeds do not comprise a significant (> 50%) proportion of the species in any stratum.	Closure MOP Section 3.2.9, 8.1.2 and 8.1.3	No	Yes	Ongoing
		Monitoring records indicate that noxious weeds are controlled in accordance with legislation and the MOP.	This Closure MOP, Noxious Weeds Act 1993	No	Yes	Ongoing
	Feral animal density.	Monitoring records indicate that feral and pest animal species are controlled in accordance with relevant legislation and the MOP.	Closure MOP Section 3.2.10 Game and Feral Animal Control Act 2002, Local Land Services Act 2013 , Biosecurity Act 2015	No	Yes	Ongoing
Grazing stock is excluded from rehabilitation areas and enrichment zones prior to relinquishment.	Stock exclusion fencing.	Rehabilitation areas and enrichment zones are fenced to exclude grazing stock (until stable and grazing will not impact upon its establishment).	Closure MOP Section 5.2	Yes	No	Ongoing
Bushfire risks are managed to minimise the risk to rehabilitation.	Bushfire.	Bushfire mitigation actions, including monitoring and managing fuel loads, maintaining fire-breaks, firefighting equipment and access, storage and handling of hydrocarbons, welding procedures and no smoking signage are implemented in accordance with the Bushfire Management Plan.	Closure MOP Section 3.2.11	Yes	No	Ongoing
Erosion does not present a safety hazard or compromise the post-mining land capability.	Erosion Control.	Visual monitoring indicates there is no significant erosion that compromises land capability or the intended final land use.	This Closure MOP	No	Yes	Ongoing
		Monitoring verifies there are no active gully or tunnel erosion features, or rills >300 mm deep or wide.	This Closure MOP	No	Yes	Ongoing

**Table 16 (continued)**  
**Ecosystem Establishment Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>Domain D - Rehabilitation Areas Pasture</b>						
Re-establishing 44 ha of agricultural land over the areas disturbed by the mine.  Pasture areas will be capable of sustaining grazing with land capability that reflects the pre-mining environment.	Area of pasture rehabilitation.	At least 44 ha of rehabilitated pasture areas have been sown with a mixture of pasture species including fast growing, short-lived species and perennial grasses and legumes.	Closure MOP Sections 4.2.2 and 5.2	No	Yes	Ongoing
	Species selection.	Rehabilitation areas comprise a mixture of grasses representative of regionally occurring vegetation where possible. Grasses sown will be selected from those listed in Table 21.	Closure	No	Yes	Ongoing
	Vegetation establishment.	Rehabilitation monitoring records verify that ground cover (vegetation, leaf litter, and mulch) is at least 85%. The first monitoring program will be completed within 12 months of rehabilitation undertaken in accordance with this MOP to quantify pasture crop establishment.	This Closure MOP	No	Yes	Ongoing
		No bare surfaces >20 m <sup>2</sup> in area or >10 m in length down slope as indicated by rehabilitation monitoring at Year 5 following establishment.	This Closure MOP	No	No	Ongoing
	Vegetation health.	Rehabilitation monitoring shows that pasture health is comparable to analogue sites.	This Closure MOP	No	No	Ongoing

**Table 16 (continued)**  
**Ecosystem Establishment Phase**

Domain Objective	Indicator	Completion Criteria								Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
		Time since Initial Revegetation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7				
<b>Domain E – Rehabilitation Areas Woodland</b>													
Woodland rehabilitation of approximately 26 ha revegetation for White Box grassy woodland (BVT 226 and PCT 1383) as consulted with OEH September 2018	Native Species Richness	Mean Target	1	2	3	4	5	5	6	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	1	1	2	3	3	4	5		No	Yes	Not commenced
	Native Overstorey Cover	Mean Target	1%	3%	4%	5%	6%	8%	9%		No	Yes	Not commenced
		Minimum Target	0%	0%	0%	0%	0%	0%	0%		No	Yes	Not commenced
	Native Mid-storey Cover	Mean Target	0%	1%	1%	1%	1%	2%	2%		No	Yes	Not commenced
		Minimum Target	0%	0%	0%	0%	0%	0%	0%		No	Yes	Not commenced
	Native Groundcover (Grasses)	Mean Target	2%	4%	6%	8%	10%	12%	14%		No	Yes	Not commenced
		Minimum Target	2%	3%	5%	6%	8%	9%	11%		No	Yes	Not commenced

**Table 17**  
**Ecosystem Sustainability Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Domains</b>						
Weeds are controlled.	Weed presence.	Rehabilitation monitoring verifies there are no significant weed infestations and that weed presence is comparable to analogue sites and does not present a risk to rehabilitation.	Closure MOP Section 3.2.9, 8.1.2 and 8.1.3	No	Yes	Ongoing
		Monitoring records indicate that noxious weeds are controlled in accordance with relevant legislation and the MOP.	This Closure MOP, Biosecurity Act 2015	No	Yes	Ongoing
Feral animal pests are controlled.	Feral animal density.	Monitoring records indicate that feral and pest animal species are controlled in accordance with relevant legislation and the MOP.	Closure MOP Section 3.2.10 and 5.2, Game and Feral Animal Control Act 2002, Local Land Services Act 2013 , Biosecurity Act 2015	No	Yes	Ongoing
Management measures will be implemented to minimise bushfire risks in rehabilitation areas.	Bushfire risk management.	Bushfire mitigation actions including managing fuel loads, maintaining fire-breaks and firefighting access are implemented where necessary.	Closure MOP Section 3.2.11	No	No	Ongoing
Erosion does not present a safety hazard or compromise the post-mining land capability.	Erosion and Sediment Control.	There is an absence of rilling (> 300 mm deep) within each domain.	SCPEA Section 4B.4.6	No	Yes	Ongoing
		Risk assessment determines that no significant erosion is present that constitutes a safety hazard or compromises the capability of the supporting the post-mining land use.	Closure MOP Section 3.2.3	No	Yes	Ongoing

**Table 17 (continued)**  
**Ecosystem Sustainability Phase**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer).	Soil quality.	Soil testing indicates that topsoil soil characteristics (pH, EC [electrical conductivity], ESP) generally meet the following criteria: <ul style="list-style-type: none"> <li>pH – between 4.5 and 8.5, or is comparable to relevant analogue sites;</li> <li>EC - &lt; 1 dS/m, or is comparable to relevant analogue sites; and</li> <li>ESP – that is comparable to the analogue sites.</li> </ul> Where soil testing results indicate values outside the above criteria, rehabilitation monitoring at the relevant area verifies that the soil quality is not inhibiting plant growth.	SCPEA Sections 4B.10.3 and 4B.10.5, this MOP	No	Yes	Ongoing
	Surface cover.	Rehabilitation monitoring records verify that ground cover (vegetation, leaf litter, and mulch) is greater than 85 %.	Closure MOP Sections 8.1.2 and 8.1.3	No	Yes	Ongoing
<b>Domain B - Water Management Areas</b>						
Final landform drainage will integrate with surrounding catchments, achieve long-term geomorphic stability and minimise erosion.	Discharge water quality.	Discharge water quality meets EPL requirements.	EPL12957	Yes	Yes	Ongoing
	Geomorphic stability.	Water management structures are assessed to be stable.	Closure MOP Section 5.2	No	Yes	To commence
<b>Domain D – Rehabilitation Areas - Pasture</b>						
Pasture areas will be capable of sustaining grazing with land capability that reflects the pre-mining environment.	Species composition.	Rehabilitation monitoring verifies that species in pasture rehabilitation areas comprise a mixture of grasses representative of pasture vegetation as listed in Table 21.	SCPEA Closure MOP Sections 5.2 and 8.1.2	No	Yes	Ongoing
	Regeneration.	Established species survive and/or regenerate after disturbance.	This Closure MOP	No	No	Ongoing
		Species are capable of setting viable seed, flowering or otherwise reproducing.	This Closure MOP	No	No	Ongoing
	Vegetation health.	Rehabilitation monitoring verifies that vegetation health is comparable to reference sites.	This Closure MOP	No	No	Ongoing
Land capability.	Pasture areas are assessed to have a Rural Land Class VI or better (capable of sustaining grazing), consistent with the final landform.	Closure MOP Sections 5.2 and 8.1.2	No	No	Ongoing	

**Table 17 (continued)**  
**Ecosystem Sustainability Phase**

Domain Objective	Indicator	Completion Criteria				Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
Domain E – Rehabilitation Areas - Woodland		Methodology	Benchmark	BVT NA 226	Local Analogue				
Woodland rehabilitation revegetation for White Box grassy woodland (BVT 226 and PCT 1383) as consulted with OEH September 2018 to restore woodland habitat suitable for Koala	Native Species Richness	Measured following BBAM methodology will target between the Benchmark and Analogue Site values and is to be inclusive of feed tree species from known Koala habitat at the Sunnyside Coal Mine and the Koala Management Plan (KMA 2007) i.e. Eucalyptus melliodora (Yellow Box), E. albens (White Box), E. populnea (Bimble Box) and E. dealbata (Tumbledown Gum).	Mean Target	23	15	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	18	Not Available				
	Native Overstorey Cover	Measured following the BBAM methodology will target between the Benchmark and Analogue Site values suitable of known koala habitat at the Sunnyside Coal Mine	Mean Target	25%	7%		No	Yes	Not commenced
			Minimum Target	6%	Not Available				
	Native Mid-storey Cover	Measured following BBAM methodology will target between the Benchmark and Analogue Site values	Mean Target	5%	5.5%		No	Yes	Not commenced
			Minimum Target	0%	Not Available				
	Native Groundcover (Grasses)	Measured following BBAM methodology will target between the Benchmark and Analogue Site values	Mean Target	40%	38%		No	Yes	Not commenced
			Minimum Target	30%	Not Applicable				

**Table 18**  
**Relinquishment**

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of Closure MOP
<b>All Secondary Domains</b>						
Site will be restored to a landform capable of sustaining the post-mining land uses.	Completion criteria.	All relevant completion criteria for the land proposed for relinquished (Phases 1 to 5) are acknowledged to be met by the Resource Regulator (or contemporary equivalent).	This Closure MOP	No	No	Not commenced
	Access tracks.	Access tracks not required in the final landform are decommissioned and rehabilitated.	Closure MOP Sections 4.2.4 and 5.2	No	No	Not commenced
	Monitoring points.	Any ancillary disturbance or equipment associated with surface water and rehabilitation monitoring points is removed and/or rehabilitated.	Closure MOP Section 5.2	No	No	Not commenced
	Groundwater bores.	Groundwater monitoring bores located within the ML that are not to be retained post-mining are decommissioned and sealed in accordance with guidelines.	Closure MOP Section 5.2	No	No	Not commenced
	Land ownership.	Land ownership and/or lease arrangements are finalised (if applicable).	Closure MOP Sections 4.2.4 and 5.2	No	No	Not commenced
<b>Domain A – Infrastructure</b>						
Land associated with existing access tracks will be retained for post-mining use.	Statutory responsibility.	Statutory responsibility for retained infrastructure, and associated licences is transferred (if required) and excised from ML 1624.	Closure MOP Sections 4.2.4 and 5.2	No	No	Not commenced
<b>Domain B – Water Management Area</b>						
Downstream water users are not impacted by mining at the Sunnyside Coal Mine	Water quality.	Water quality achieves criteria and EPL12957 is surrendered.	EPL12957	No	Yes	Ongoing

## 7 REHABILITATION AND CLOSURE IMPLEMENTATION

### 7.1 STATUS AT MOP COMMENCEMENT

Table 19 describes the status of each domain at the commencement of this Closure MOP period. This information is also presented graphically in Plan 2.

**Table 19**  
**Status at Closure MOP Commencement**

Code	Domain	Status at Closure MOP Commencement
<b>Primary Domains</b>		
1	Infrastructure	This domain is currently active and subject to ongoing operations.
3	Water management area	This domain is currently active and subject to ongoing operations.
4	Overburden emplacement area	This domain is currently active and subject to ongoing operations.
5	Stockpile areas	This domain is currently active and subject to future operations. Remaining soil stockpiles are temporarily stabilised and will be retained for future rehabilitation of infrastructure areas.
6	Void (Open cut void)	This domain is currently active and subject to ongoing operations.
7	Rehabilitation areas	This domain is currently active and is subject to future disturbance, ongoing maintenance and land management activities.
8	Undisturbed areas	This domain is undisturbed and is subject to ongoing maintenance and land management activities.
<b>Secondary Domains</b>		
A	Infrastructure	This domain is currently active and subject to ongoing operations.
B	Water management area	This domain is currently active and subject to ongoing operations.
D	Rehabilitation area - Pasture	This domain is currently active and subject to ongoing operations
E	Rehabilitation area - Woodland	Approximately 17.8 ha of woodland rehabilitation has been established at the commencement of the Closure MOP term, consisting of the out-of-pit dump batters. This domain is subject to future disturbance, ongoing maintenance and land management activities.
I	Final Depression Highwall and Endwall	This domain is currently active (active mining area) and subject to future operations. Current void yet to be rehabilitated.
J	Conservation Area	Enrichment zone/New vegetation. These areas currently remain undisturbed and scheduled for further habitat/corridor enhancement planting.

### 7.2 PROPOSED REHABILITATION ACTIVITIES DURING THE CLOSURE MOP TERM

Rehabilitation and maintenance of rehabilitation in completed areas will be undertaken throughout the Closure MOP term. Table 20 summarises the forecast total disturbance and rehabilitation areas at the Sunnyside Coal Mine over the Closure MOP term.

**Table 20**  
**Disturbance and Rehabilitation Progression during the term of the Closure MOP**

Year	Total Disturbance Area (ha)	Total Rehabilitation Area (ha)	Cumulative Rehabilitation (ha)	Comments
Start of Closure MOP (November 2018)	105.7	17.8	17.8	See Plan 2.
Year 1 (November 2019)	105.7	0	17.8	See Plan 3A.
Year 2 (November 2020)	24.3	81.4	99.2	See Plan 3B.
End of Closure MOP (November 2025)	24.3	0	99.2	See Plan 4.

The methodology for rehabilitation activities is described in the subsections below. An indicative timeline of rehabilitation and decommissioning activities is provided in Appendix C.

### 7.2.1 Decommissioning Phase

The Decommissioning Phase encompasses all works required to prepare land for rehabilitation including removal of built infrastructure, foundation and hardstand materials, services, equipment and materials including wastes and contamination. An indicative timeline and asset register of decommissioning activities is provided in Appendix C.

The methodology for the decommissioning activities are described in the subsections below.

#### ***Termination of Services and Demolition Works***

Activities over the Closure MOP term would include:

- Disconnection and termination of services (e.g. water and electricity).
- Demolition and removal of site office and facilities (including the weighbridge).
- Demolition and removal of coal handling infrastructure (e.g. ROM pad).
- Removal of other concrete pads and footings, if required.
- Removal of access roads (i.e. connection to the Coochoonah Lane Re-alignment) and carpark, if required.
- Removal or repurposing of Koala fence (i.e. development of a fence to exclude stock from the highwall).
- Grouting and capping of exploration boreholes.
- Removal of internal access roads.
- Removal of the amenity bund.

All demolition work could be carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*.

### ***Contaminated Materials***

The soil under and around the site office, facilities and coal handling infrastructure will be tested for contamination and remediated as required. Contaminated soils materials will be excavated and moved to a bunded area on-site for bio-remediation prior to being disposed of either off-site at a licensed facility, or onsite within void backfill, once they meet the solid waste classification. The relatively small potential volume of treated material has not been relied upon for achieving the site rehabilitation material balance.

Prior to lease relinquishment Whitehaven will verify that there are no contaminants or hazardous materials present at any infrastructure to be retained.

### ***Water Management Structures***

At the end of the Closure MOP term some clean water dams are proposed to be retained as shown on Plan 4. For the clean water dams to be retained following mine closure, minor earthworks may be required to ensure the dams are safe and stable in the long-term.

Once runoff from the final depression reaches suitable quality, runoff from the final depression would be allowed to drain towards Coocooboonah Creek via integration with the existing clean water management system. As a result, some sediment dams/water dams would not be required later in the Closure MOP term and would be decommissioned.

The procedure for decommissioning of sediment/water dams would include:

- dewatering of the dam;
- de-silting of the dam (if required);
- assessment of any contaminants and subsequent treatment and/or removal as required (e.g. in accordance with the procedure for contaminated materials above);
- material assessment of the dam walls, with selective handling of unsuitable soil, topsoil and subsoil;
- infilling of the dam to pre-mining landform with a level of compaction (including allowance for settlement) or regrading of the dam embankments; and
- ripping and seeding for post-mining and future land use.

### **7.2.2 Landform Establishment**

Landform establishment is the process of shaping the final landform to a safe, stable and free-draining landform that is appropriate for the desired final land use and consistent with the surrounding landscape. The final landform for the Sunnyside Coal Mine is shown on Plan 4.

During the MOP term, landform establishment will involve the progressive earthworks during remaining coal extraction periods (i.e. filling behind advancing open cut operations) as well as supplementary earthworks, which would involve reshaping of the out-of-pit and in-pit overburden emplacement areas and final depression to achieve the final landform shown on Plan 4.

Upon cessation of coal extraction, Whitehaven would rehandle waste rock from the out-of-pit waste emplacement, reducing its existing elevation by approximately 7 m (to approximately 345 m AHD). Material would be rehandled using fleet items currently approved for mining operations (e.g. dozers, excavators and haul trucks or scrapers).

The rehandle of the out of pit emplacement would include selective handling of vegetation, topsoil, and subsoil to minimise biota loss. Existing trees would be temporarily stockpiled before replacement on the rehabilitated landform.

Material removed from the top of the waste emplacement would be used to partially backfill the open cut (i.e. to improve geotechnical stability of the open cut highwall), which would result in a free-draining final depression with a minimum elevation of approximately 330 m AHD.

The highwall in the south-western portion of the open cut (which has a maximum elevation of approximately 372 m AHD) would remain, however, the height of the existing highwall would be reduced following the partial backfill of the final depression.

Rehabilitated slopes will be verified by survey to be generally less than 10 degrees (overburden emplacement) and an average of 47 degrees (retained highwall in the final depression).

All coal and carbonaceous material within the final depression will be capped with a minimum of 5 m of inert overburden, subsoil and topsoil (supported by approximate records).

Water management and erosion control structures will be installed as required and will be consistent with Blue Book (Landcom, 2004) requirements.

Landform establishment works are expected to be completed prior to approximately November 2020 (i.e. when the supplementary earthworks are completed).

### **7.2.3 Growth Media Development**

In the context of this Closure MOP, growth media development encompasses activities to reinstate soils with the initial physical, chemical and biological characteristics required to establish the desired vegetation community.

Where resources allow, stockpiled topsoil and subsoil will be re-spread onto areas requiring rehabilitation. The subsoil layer will be spread on an even but roughened surface that has been ripped along the line of the contour to break any compacted and/or smooth surfaces. Ripping will also assist the keying of subsoil into the overburden, which will, in turn, assist in the prevention of land slip and can help vegetation penetrate deep into the soil profile, encourage ingress of water and minimise erosion.

Growth media development is expected to be completed prior to approximately November 2020 (i.e. when the supplementary earthworks are completed).

### **7.2.4 Ecosystem and Land Use Establishment**

In the context of this Closure MOP, ecosystem and land use establishment includes activities to establish the desired floristic composition (species diversity and density) and habitat features.

### **Domain D – Rehabilitation Area Pasture**

Following the re-creation of the final landform a pasture mix will be sown by conventional agricultural methods ie preparation of surface to form seed bed, broadcast seeding and scarification. This will help with the stabilisation of the landform and to return the land to agricultural productivity. The pasture species will be appropriate for the season and will include but not be limited to the annual and perennial grass species and legumes as identified in Table 21.

**Table 21**  
**Recommended Pasture Species Seed Mix**

Pasture Species	Rate (kg/ha)	Fertiliser
<b>Warm Season Grasses</b>		
Bombatsi Panic	1 – 2	250 kg/ha Di-Ammonium Phosphate (DAP)
Green Panic 1	2 – 4	
Purple Pigeon Grass	1 – 2	
<b>Annual Legumes</b>		
Subterranean Legume	4 - 5	-
<b>Cool Season Legumes</b>		
Barrel (Sephi) medic	2 – 4	-
Snail (sava) medic	3 – 5	-
Woolly Pod Vetch	4 – 6	-
Serradella (Elgara)	1 – 2	-
Lucerne	0.5	-
<b>Cool Season Grasses</b>		
Phalaris (Sirolan or Holdfast)	1 - 2	-
Wallaby Grass	0.3 - 1	-

#### Domain E – Rehabilitation Area Woodland and Domain J - Conservation Area

Areas to be revegetated with woodland species will be planted so as to establish and enhance Koala habitat at the Sunnyside Coal Mine as described in the Koala Management Plan. The revegetation methodology will generally be as follows:-

- provenance seed of target overstorey species will be collected and provided to a nursery eg Narromine Transplants, for propagation into tubestock/hikos, Provision of seed will occur around the end of the calendar year, with receipt of propagated species in the following Autumn.
- target planting areas will be prepared in advance, including ripping and weed control,
- tubestock/hikos will be planted in Autumn; each planting will be provided a tree guard and an initial watering,
- ongoing watering to establish the plants will occur; the frequency of which being weather dependent,
- provenance seed of mid storey and ground cover species will be collected and sown in target planting areas by conventional agricultural methods ie preparation of surface to form seed bed, broadcast seeding and scarification.
- target revegetation areas will be subject to ongoing weed management control.

The species selected are shown in Table 22 and include a mix of Koala feed trees and non-Koala feed trees.

**Table 22**  
**Woodland Species for Koala Habitat**

Common Name	Species Name
White Box*	<i>Eucalyptus albens</i>
Yellow Box*	<i>Eucalyptus melliodora</i>
Tumbledown Red Gum	<i>Eucalyptus dealbata</i>
Wilga	<i>Geijera parviflora</i>
White Cypress	<i>Callitris glaucophylla</i>
Red Ash	<i>Alphitonia excelsa</i>
Poplar Box*	<i>Eucalyptus populnea</i>

Kurrajong	<i>Brachychiton populneus</i>
Motherumbah	<i>Acacia cheelii</i>

\*Indicates Koala feed trees (utilising those species endemic to the area as identified in the Koala Management Plan).

### 7.2.5 Ecosystem and Land Use Sustainability Phase

For the purposes of this Closure MOP the Ecosystem and Land Use Sustainability phase represents those activities required to develop sustainable ecosystems that have characteristics comparable to similar undisturbed vegetation associations in the area prior to mine closure.

#### All Domains

Activities associated with the ecosystem and land use sustainability phase of rehabilitation are generally ongoing maintenance and land management activities and rehabilitation monitoring. Maintenance at rehabilitated areas will include, but not be limited to:

- ongoing environmental management to minimise risks to rehabilitation;
- comparing specific ecosystem characteristics such as soil profile development, floristic composition and structure and faunal diversity and abundance with the characteristics of appropriate analogue sites; and
- undertaking adaptive management and remedial works where characteristics of the rehabilitation are not trending toward desired outcomes.

Rehabilitation monitoring will be undertaken throughout the ecosystem and land use sustainability phase until it can be demonstrated that rehabilitation areas have met all conditions for relinquishment.

Rehabilitation monitoring for the Closure MOP term is discussed in Section 8.

### 7.3 SUMMARY OF REHABILITATION AREAS DURING THE CLOSURE MOP TERM

Table 23 summarises the rehabilitation status for each domain at the start of the Closure MOP and anticipated status at the end of the Closure MOP period.

### 7.4 RELINQUISHMENT

Whitehaven do not intend to pursue relinquishment of any areas within ML 1624 within the Closure MOP term.

**Table 23**  
**Summary of Rehabilitation Proposed during the Closure MOP Term**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the Closure MOP (ha)	Area at the end of the Closure MOP (ha)	Comments
Infrastructure (1)	Rehabilitation areas – Pasture (D)	1D	Active	19.2	0	By the end of the Closure MOP term, it is anticipated that the entire Infrastructure area will be at the Ecosystem and Land Use Establishment phase.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	18	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	0	
			Total	19.2	18	
Infrastructure (1)	Rehabilitation areas – Woodland (E)	1E	Active	2.8	0	By the end of the Closure MOP term, it is anticipated that the entire Infrastructure area will be at the Ecosystem and Land Use Establishment phase.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	2.8	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	0	
			Total	2.8	2.8	
<b>Infrastructure Total:</b>				<b>22</b>	<b>20.8</b>	
Water Management Area (3)	Water Management Area (B)	3B	Active	1.4	0	This domain will remain active during the Closure MOP term, and these water storages would be retained in the post-mining landform.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	1.4	
			Total	1.4	1.4	
Water Management Area (3)	Rehabilitation areas – Pasture (D)	3D	Active	4	0	These water storages would be decommissioned and rehabilitated during the Closure MOP term.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	4	
			Total	4	4	
<b>Water Management Area Total:</b>				<b>5.4</b>	<b>5.4</b>	

**Table 23 (continued)**  
**Summary of Rehabilitation Proposed during the Closure MOP Term**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the Closure MOP (ha)	Area at the end of the Closure MOP (ha)	Comments
Overburden Emplacement Area (4)	Rehabilitation areas – Pasture (D)	4D	Active	6.5	0	This domain will be reshaped to the final landform during the Closure MOP term and rehabilitated to Ecosystem and Land Use Establishment phase.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	0	
			Total	6.5	0	
Overburden Emplacement Area (4)	Rehabilitation areas – Woodland (E)	4E	Active	2.2	0	This domain will be reshaped to the final landform during the Closure MOP term and rehabilitated to Ecosystem and Land Use Establishment phase.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	2.2	0	
			Total	2.2	0	
<b>Overburden Emplacement Area Total:</b>				<b>8.7</b>	<b>0</b>	
Stockpile Area (5)	Rehabilitation areas – Pasture (D)	5D	Active	3.0	0	All soil stockpiles will be used for rehabilitation works during the Closure MOP term. All soil stockpiles (except the soil stockpile to the east of the overburden emplacement) will be rehabilitated to Ecosystem and Land Use Establishment phase with Pasture species.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	2.0	
			Total	3.0	2.0	
Stockpile Area (5)	Rehabilitation areas – Woodland (E)	5E	Active	2.9	0	All soil stockpiles will be used for rehabilitation works during the Closure MOP term. The soil stockpile to the east of the overburden emplacement will be rehabilitated to Ecosystem and Land Use Establishment phase with Woodland species.
			Decommissioning	0	0	
			Landform Establishment	0		
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	2.9	
			Total	2.9	2.9	
<b>Soil Stockpile Area Total:</b>				<b>5.9</b>	<b>4.9</b>	

**Table 23 (continued)**  
**Summary of Rehabilitation Proposed during the Closure MOP Term**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the Closure MOP (ha)	Area at the end of the Closure MOP (ha)	Comments
Void (Open cut void) (6)	Rehabilitation areas – Pasture (D)	6D	Active	30.9	0	The open cut void will be reshaped to the final landform (i.e. final depression) during the Closure MOP term and rehabilitated to Ecosystem and Land Use Establishment phase to pasture, except for the final depression highwall and endwall [Domain 6I]).
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	31.5	
			Total	30.9	31.5	
Void (Open cut void) (6)	Final Depression Highwall and Endwall (I)	6I	Active	2.2	0	The final depression highwall will be retained in the post-mining landform at the end of the Closure MOP term.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	2.2	
			Total	2.2	2.2	
<b>Void (Open Cut Void)/Final Depression Highwall and Endwall Total:</b>				<b>33.1</b>	<b>33.7</b>	
Rehabilitation area (7)	Rehabilitation areas – Pasture (D)	7D	Active	13.4	0	13.4 ha of pasture rehabilitation is proposed to be completed to Ecosystem and Land Use Establishment phase on the out-of-pit dump crest. This will require reshaping during the Closure MOP term to achieve the desired final landform height of 345 m AHD.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	21.4	
			Total	13.4	21.4	
Rehabilitation area (7)	Rehabilitation areas – Woodland (E)	7E	Active	0	0	17.8 ha of woodland rehabilitation to Ecosystem and Land Use Establishment phase has been established on the batters of the out-of-pit dump.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	17.8	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	20.1	
			Total	17.8	20.1	
<b>Rehabilitation Area Total:</b>				<b>31.2</b>	<b>41.5</b>	

**Table 23 (continued)**  
**Summary of Rehabilitation Proposed during the Closure MOP Term**

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the Closure MOP (ha)	Area at the end of the Closure MOP (ha)	Comments
Undisturbed (8)	Rehabilitation areas – Pasture (D)	8D	Active	68.5	0	Undisturbed pasture areas within the ML will retain their existing land use post-mining.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	68.5	
			Total	68.5	68.5	
Undisturbed (8)	Rehabilitation areas – Woodland (E)	8E	Active	38.8	0	Undisturbed woodland areas within the ML will retain their existing land use post-mining.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	38.8	
			Total	38.8	38.8	
Undisturbed (8)	Conservation Area (J)	8J	Active	17.6	0	17.6 ha of undisturbed areas will be preserved and enhanced with supplementary plantings to enhance biodiversity values such as movement corridors.
			Decommissioning	0	0	
			Landform Establishment	0	0	
			Growth Medium Development	0	0	
			Ecosystem Establishment	0	0	
			Ecosystem Sustainability	0	0	
			Land Relinquishment	0	17.6	
			Total	17.6	17.6	
<b>Undisturbed Total:</b>				<b>124.9</b>	<b>124.9</b>	
<b>Overall Total</b>				<b>231.2</b>	<b>231.2</b>	

Note: ML 1624 spatial file was sourced from NSW Government data and the area of the polygon is 231.26 hectares. ML 1624 is listed as 233.9 ha in the formal documentation. All mine site disturbance has been accounted for in calculations and the 2.64 discrepancy between spatial data total area and formal document relates to undisturbed areas.

## **8 REHABILITATION AND CLOSURE MONITORING**

### **8.1 REHABILITATION MONITORING**

A multi-scale, multi-data source monitoring approach has been used, incorporating remote sensing to monitor the rehabilitation at Sunnyside Mine post closure. Monitoring aims to measure both analogue and impact areas for both grazing and native woodland land uses.

Rehabilitation monitoring reports include:

- remote-sensing based landscape assessment (multi-spectral imagery);
- monitoring of grazing areas (using a combination of pasture attributes);
- native vegetation surveys; and
- terrestrial fauna and habitat surveys.

Specific monitoring objectives include:

- quantitative tracking of rehabilitation performance and progression towards completion criteria;
- assessing key aspects of flora development (upper, mid and lower strata) in woodland areas;
- comparing rehabilitation monitoring data with previous years monitoring data;
- using monitoring data to improve rehabilitation performance by identifying areas requiring maintenance activities or improving monitoring methods.

Results of the rehabilitation monitoring are reported in the Annual Review.

As described in Section 8.2, rehabilitation monitoring results will be used to verify that the rehabilitation completion criteria have been met.

#### **8.1.1 Pasture Areas**

Monitoring for Domain D – Rehabilitation Area Pasture will provide quantitative data on key pasture and soil attributes as they relate to land agricultural capability. Pasture species, weed species, biomass, and groundcover composition as well as parameters related to soil erosion and soil nutrient status (pH, EC, OM, N or P, dispersivity) will be assessed as part of an agronomic assessment of pasture areas and grazed analogue areas. Contingency measures to be implemented if required are noted in Table 25.

Groundcover composition will be recorded during surveys of pasture areas for all plots and the percentage cover of weeds, pasture, bare ground and leaf litter will be considered. Records of groundcover composition allow for comparison between rehabilitation areas and analogue sites as well as changes between sampling periods. The number of pasture and weed species present in rehabilitated plots versus control plots at analogue sites will also be recorded and any recommended weed treatments documented in the annual monitoring report.

Biomass (kg/ha) will be measured during surveys of pasture areas, and generally reflect the variations in percentage of pasture cover. Some variation between rehabilitation areas and analogue sites is expected due to varying management practices (i.e. grazing pressure), however changes in biomass between sampling periods at rehabilitation areas will provide an indicator of the pasture areas' carrying capacity and potential for sustainable grazing with management inputs analogous to local grazing operations.

Biomass assessments will be supplemented with grazing trials to quantify the sustainable carrying capacity (DSE equivalent) of rehabilitated pasture areas. It is not expected that the grazing trials will commence within the Closure MOP term given the target rehabilitation phase at the end of MOP period is Ecosystem and Land Use Establishment.

### **8.1.2 Native Vegetation Monitoring**

Vegetation surveys will be undertaken for all Domain E – Rehabilitation Area Woodland, and Domain J - Conservation Areas, and will focus on the condition, composition and structure of woodland vegetation in rehabilitation areas and analogue sites.

The native vegetation monitoring program provides quantitative data on woodland structure and composition following the Biobanking Assessment Methodology (BBAM) (OEH, 2014) of ecological monitoring. Surveys of native vegetation areas will be used to detect any changes relative to benchmarks and analogue sites in each strata, specifically:

- overstorey: cover, health, richness, recruitment;
- mid-storey: cover, richness; and
- ground-cover: total percent ground cover, native ground cover (cover and richness), and weeds (percent cover, richness).

During native vegetation monitoring events native and exotic fauna observations, and soil erosion observations, will be recorded.

### **8.1.3 Terrestrial Fauna and Habitat Monitoring**

Terrestrial fauna and habitat monitoring will focus on native vegetation areas and targets:

- Woodland birds, as they are relatively mobile and are often one of the first fauna groups to make use of maturing rehabilitation areas;
- *Phascolarctos cinereus* (Koala), *Pyrrholaemus sagittata* (Speckled Warbler) and *Pomatostomus temporalis* (Grey-crowned Babbler) since they are listed under either the NSW *Biodiversity Conservation Act, 2016* and/or the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* and are locally important; and
- Reptiles, as specific habitat was established to attract these species. Analysis includes presence/absence, species diversity and use of habitat.

More detailed fauna surveys may be required when vegetation community structure develops and the habitat becomes more complex. Any revision to the scope of the fauna monitoring program will be reported in the Annual Review.

## **8.2 CLOSURE MONITORING**

Numerous environmental monitoring programmes are undertaken at the Sunnyside Coal Mine in accordance with PA 06\_0308 and its environmental management plans, including air quality, noise, blasting, spontaneous combustion, surface water, groundwater, rehabilitation and conservation area monitoring programmes.

Following the cessation of mining and supplementary earthworks some of these monitoring programmes would become redundant and would cease (e.g. blast, air quality and noise monitoring) or would be gradually refined once rehabilitation works have been completed and rehabilitation areas

develop/mature (e.g. surface water monitoring). Whitehaven would refine its monitoring programmes in consultation with the relevant government agencies during the Closure MOP term.

It is anticipated that the surface water monitoring programme will be progressively refined during the Closure MOP term to focus on runoff areas from the final landforms and any retained sediment dams/water storages. Considering the final void would be partially back-filled to create a free-draining final depression, it is anticipated that the groundwater monitoring programme would cease during the Closure MOP term in consultation with the EPA and relevant regulatory authorities.

Rehabilitation performance monitoring, including terrestrial fauna and habitat monitoring of the rehabilitation areas and conservation area, would continue throughout the Closure MOP term and results from the rehabilitation monitoring programme would be used to confirm that the rehabilitation completion criteria have been met.

Weed and feral/pest animal monitoring would also be continued throughout the Closure MOP term to control weed and feral animal/pest presence, and to confirm that the completion criteria relevant to weed and feral/pest animal control have been met.

Following mine closure, rehabilitation monitoring would cease, subject to consultation with relevant stakeholders.

### **8.3 RESEARCH AND REHABILITATION TRIALS AND USE OF ANALOGUE SITES**

#### **8.3.1 Rehabilitation Trials**

There are no specific rehabilitation trials or research proposed or undertaken to date at the Sunnyside Coal Mine. Rehabilitation monitoring and rehabilitation methodology records are, however, shared among Whitehaven operations to inform decision-making regarding rehabilitation campaigns.

#### **8.3.2 Analogue Sites**

Whitehaven undertakes monitoring at appropriate representative sites (known as reference or analogue sites), refer Figure 1, to quantify the key desirable qualities (indicators) of native vegetation, pasture rehabilitation areas, and fauna.

Monitoring at pasture analogue sites will be used to determine benchmarks for indicators including percent pasture cover, total biomass, pasture species composition and weed species presence. Native vegetation analogue site monitoring is used to determine benchmarks for indicators including percent foliar coverage for midstorey and canopy species, species presence and abundance for all strata (groundcover, midstorey and canopy) and weed species presence.

Native vegetation analogue sites will also be monitored to compare utilisation of rehabilitation areas and undisturbed areas by target fauna species including the Grey-crowned Babbler and Koala.

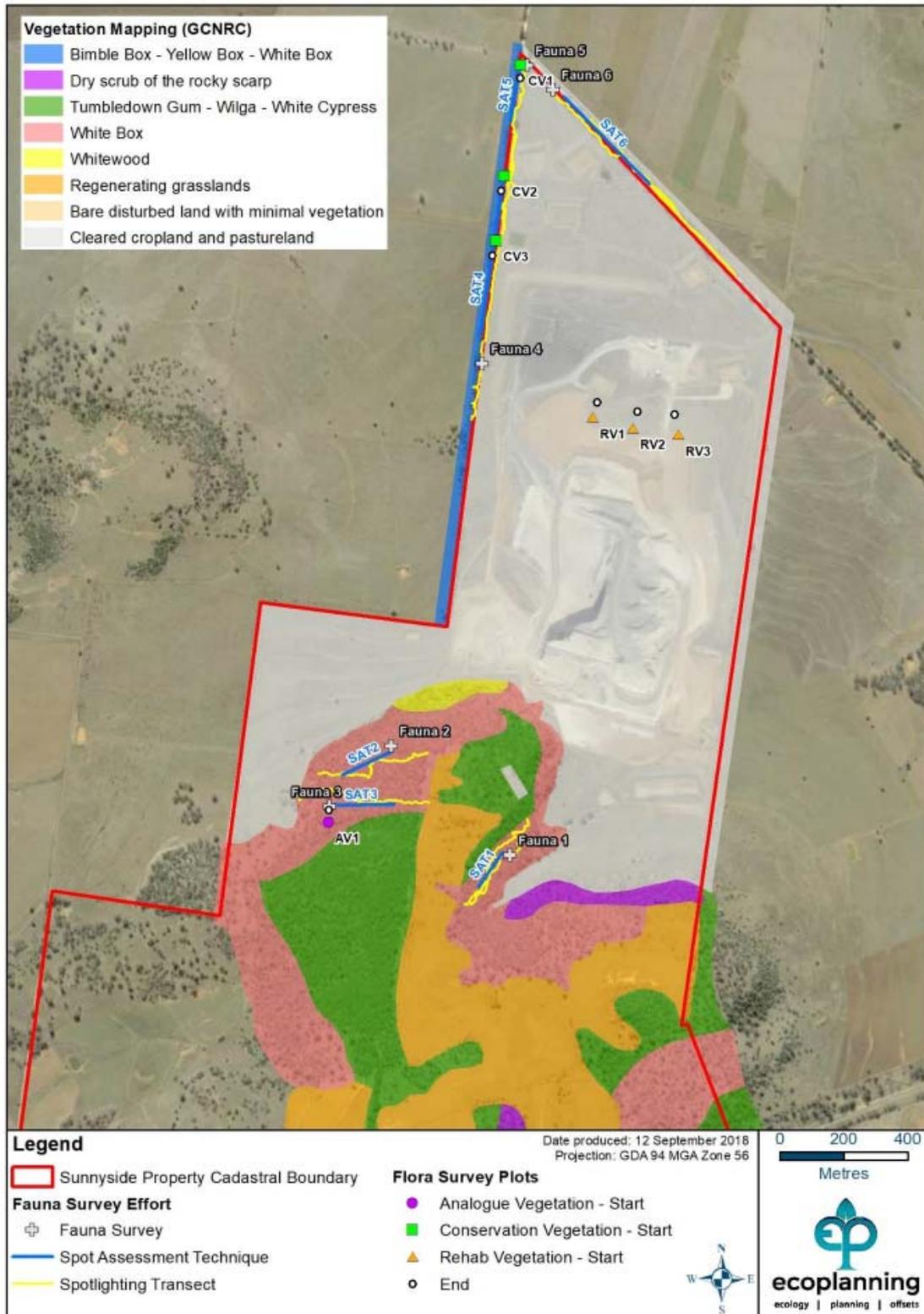


Figure 1: Sunnyside Coal Mine and Location of BBAM monitoring sites.

## 9 INTERVENTION AND ADAPTIVE MANAGEMENT

### 9.1 THREATS TO REHABILITATION AND CLOSURE

Unpredictable events such as bushfires, droughts and floods may present risks to rehabilitation both during the life of mine and post-closure. These events generally have significant consequences for rehabilitation quality and are likely to require adaptive management in order to mitigate risks and achieve relinquishment of affected rehabilitation areas within a satisfactory timeframe.

Although these events may have a high degree of unpredictability, monitoring the status of contributing factors enables an assessment of the likelihood of a major impact to rehabilitation occurring. For example, measuring fuel loads in and adjacent to woodland rehabilitation areas informs a periodic assessment of the likelihood of a bushfire event.

Other major risks to rehabilitation may not present as sudden events, but as an increasing impact over an extended period of time. For example, evolution of regulator or community expectations regarding post-mining land uses may present a risk to achieving relinquishment, or increasing feral pest numbers may increase pressure on native fauna and vegetation communities.

Threats to rehabilitation were identified in the Risk Assessment (Appendix B) and have been discussed in Section 3.2. The key threats (moderate or high risk) are listed in Table 24.

**Table 24**  
**Key Threats to Rehabilitation**

Threat	Caused by
Acid Mine Drainage	Poor knowledge of material characteristics.
Spontaneous Combustion	Poor management of materials with propensity for spontaneous combustion.
Geotechnical	Geotechnical failure.
Soil Type(s) and Quality	Inadequate soil availability and/or quality.
Flora	Inadequate revegetation methodology.

Where rehabilitation monitoring indicates that there is a significant threat to rehabilitation, adaptive management in accordance with the Rehabilitation and Closure Trigger Action Response Plan (TARP), described in Section 9.2, will be undertaken.

### 9.2 REHABILITATION AND CLOSURE TRIGGER ACTION RESPONSE PLAN

This Rehabilitation and Closure TARP has been developed to provide a framework to manage potential key risks to rehabilitation during the Closure MOP term and has been developed based on rehabilitation and closure risks. The Rehabilitation and Closure TARP includes:

- Identification of the principal contributing factors and impacts for each major risk to rehabilitation;
- Identification of upper limits (trigger values) for causes and impacts that are considered to represent an unacceptable level of risk; and
- Identification of appropriate responses to mitigate or remediate the causes and impacts, including a notification protocol.

The Rehabilitation and Closure TARP provides management responses for lower (first tier) and upper (second tier) trigger values. First tier trigger values identify opportunities for closer monitoring or early intervention that may mitigate potential impacts before notable impact to rehabilitation occurs. Second

tier trigger values identify when indicators have reached a threshold that requires more substantive or widespread remedial actions to remediate or mitigate rehabilitation failure.

Should any trigger conditions be met resulting in the requirement for intervention or adaptive management, actions will be reported in the Annual Review. Whitehaven will notify the Resource Regulator and other relevant stakeholders of any incident (such as bushfire or disease) that results in major impacts to rehabilitation that are likely to significantly impact the potential to achieve rehabilitation success.

The Rehabilitation and Closure TARP is provided in Table 25, and will be revised as conditions at the Sunnyside Coal Mine change or new risks to rehabilitation are identified.

**Table 25**  
**Rehabilitation and Closure TARP**

Aspect/Category	Key Element	Trigger/Response	1 <sup>st</sup> Level Trigger	2 <sup>nd</sup> Level Trigger
Landform stability	Slope gradient	Trigger	<70% of the rehabilitation area has slopes within the limits stipulated in this Closure MOP (including overburden emplacement areas and the highwall and endwall).	<55% of the rehabilitation area has slopes within the limits stipulated in this Closure MOP (including overburden emplacement areas and the highwall and endwall).
		Response	Undertake re-grading and revegetation of the area.	Undertake a review of the landform design, and an assessment of the stability of the landform including material characterisation.  Undertake stability enhancement works including revegetation, if required.  Consider re-grading to achieve stability.
	Stability	Trigger	Survey or remote sensing of the rehabilitated landforms indicates settlement or slumping that could compromise stability.	Survey or remote sensing of the rehabilitated landforms indicates major settlement or slumping.
		Response	Undertake a review of the landform design to assess risks to stability and free-draining design.	Engage a specialist to assist with the management of settlement or slumping and consider rehandling material and/or regrading if required.
	Erosion control	Trigger	Minor gully or tunnel erosion present and/or minor rilling (up to 300 mm in depth).	Slumping and/or significant gully or tunnel erosion present and/or significant rilling, which is compromising landform stability.
		Response	An inspection of the site will be undertaken by a specialist. Investigate opportunities to install (or augment existing) water management infrastructure to address erosion. Remediate as appropriate.	Engage a specialist 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.
	Free-draining landforms	Trigger	Landforms exhibiting ponding in excess of design.	Landforms exhibiting significant drainage issues, threatening or causing material harm to the environment.
		Response	An inspection of the site will be undertaken by a specialist. Investigate opportunities to address issues. Remediate as appropriate.	Undertake a review of the landform design, including survey if required. Undertake re-grading and re-vegetation of the area.
	Water Management Structures	Trigger	Water management structures (sediment dams, channels, contour banks) exhibit minor erosion and/or scouring.	Water management structures fail or display significant scouring/erosion.
		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 specialist consultant to develop a site specific remediation plan and review water management structure design criteria. Provide for physical works on the basis of design review.
	Spontaneous Combustion	Trigger	Monitoring using infrared imaging indicates areas of heating.	Monitoring indicates visible signs of spontaneous combustion or slight sulphur odour.
		Response	An inspection of the site will be undertaken to assist to identify appropriate remedial measures.	Management of the material with the propensity for spontaneous combustion in accordance with the SCMP.

**Table 25 (continued)**  
**Rehabilitation and Closure TARP**

Aspect/Category	Key Element	Trigger/Response	1 <sup>st</sup> Level Trigger	2 <sup>nd</sup> Level Trigger
Soil Quality and Volume	Salinity	Trigger	Increasing trend in soil/overburden salinity levels.	Presence of salt scalds.
		Response	Undertake soil/overburden testing to verify EC and recommend further soil/spoil amelioration.	Engage a specialist to develop a site specific management report to be implemented to remediate salinity scalds. Undertake works as required.
	Soil dispersion	Trigger	Increasing trend in soil dispersivity (Emmerson Aggregate Test C [EAT]).	Topsoils are > moderately dispersive.
		Response	Undertake testing to determine required amelioration and undertake amelioration as required.	Review material handling practices. Ameliorate dispersive spoils (for example with coarse gypsum). Re-vegetate if required.
	Soil EC	Trigger	Soil EC greater than 0.6 deciSiemens (dS/m).	Soil EC greater than 1 dS/m.
		Response	Engage a specialist to recommend appropriate measures to reduce soil EC. Undertake consultant recommendations where possible and viable.	Engage a specialist to recommend appropriate measures to reduce soil EC. Undertake consultant recommendations to reduce EC to an appropriate level.
	Soil pH	Trigger	Soil pH > 8 but < 8.5 or < 5 but > 4.5.	Soil pH is < 4.5 or > 8.5.
		Response	Undertake analytical soil testing and evaluation. Where appropriate implement recommendations for amelioration to increase/reduce pH to within rehabilitation guidelines.	Undertake analytical soil testing and evaluation. Where appropriate, implement recommendations for amelioration to bring pH to within rehabilitation guidelines. Undertake evaluation recommendations to achieve soil pH within appropriate range.
	Soil Volume	Trigger	Soil balance indicates potential deficit.	Soil balance identifies deficit
		Response	Undertake continued characterisation of soil type and placement methodology.	Undertake review of potential additional sources/alternate application methods and seek Resource Regulator endorsement of preferred options.
Water Quality	Groundwater	Trigger	Monitoring detects decreasing groundwater depth.	Monitoring detects ongoing trend in decreasing groundwater levels relative to predictions.
		Response	Undertake additional monitoring to identify if there is a decreasing trend that indicates groundwater loss.	Engage specialist to investigate groundwater interaction with final depression and develop remedial actions.
	Discharge water quality	Trigger	Sediment basin discharge exceeds EPL12957 criteria.	Progressive deterioration of discharge water quality to be consistently outside EPL12957 criteria ANZECC water quality guideline limits.
		Response	Repeat sampling to confirm results exceed limits, and investigate potential causes.	Review water management structure maintenance and discharge procedures, and sediment basin capacity requirements.

**Table 25 (continued)**  
**Rehabilitation and Closure TARP**

Aspect/Category	Key Element	Trigger/Response	1 <sup>st</sup> Level Trigger	2 <sup>nd</sup> Level Trigger
Land Management	Weeds	Trigger	Monitoring indicates the density of weeds in rehabilitation areas exceeds analogue sites in Ecosystem Establishment phase.	Monitoring indicates substantial weed infestation in Ecosystem Establishment phase significantly exceeding analogue sites.
		Response	Undertake weed management to remove/spray introduced weed species. Treatment of infestations as appropriate to the species.	Undertake weed management to remove introduced weed species. Investigate management measures to reduce weeds including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate.
	Pest animals	Trigger	Pest animal species are causing damage to rehabilitation.	Continued damage to rehabilitation from pests after tree guards and fencing has been installed.
		Response	Consult with relevant government agencies to recommend and implement appropriate pest animal control campaign.	Liaise with government agencies and consider a culling program in accordance with OEH regulations.
Biodiversity (Native Vegetation Rehabilitation Areas)	Native Species Richness	Trigger	Less than the relevant mean target criteria for the “Time Since Initial Revegetation” (i.e. BVT 226 Year 1 = 1) in Table 16	Less than the relevant minimum target criteria for the “Time Since Initial Revegetation” (i.e. BVT 226 Year 3 = 2) in Table 16.
		Response	Review methods used by revegetation contractor; seed or seedling quality, soil quality or weather conditions since time of revegetation to determine if it is 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.
Biodiversity (Native Vegetation Rehabilitation Areas)	Native Groundcover (Grasses)	Trigger	Less than the relevant mean target criteria for the “Time Since Initial Revegetation” (i.e. BVT 226 Year 1 = 2%) in Table 16.	Less than the relevant minimum target criteria for the “Time Since Initial Revegetation” (i.e. BVT 226 Year 3 = 5%) in Table 16.
		Response	Review methods used by revegetation contractor; seed or seedling quality, soil quality or weather conditions since time of revegetation to determine if it is 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.

**Table 25 (continued)**  
**Rehabilitation and Closure TARP**

Aspect/Category	Key Element	Trigger/Response	1 <sup>st</sup> Level Trigger	2 <sup>nd</sup> Level Trigger
Pasture areas	Pasture Composition	Trigger	Pasture composition is not consistent with the sewn seed mix and or, analogue sites during the Ecosystem Establishment phase.	Ongoing decline in pasture composition away from analogue site composition during the Ecosystem Establishment phase.
		Response	Investigate the likely causes of unsatisfactory germination and or, growth rates. Re-seed unsatisfactorily covered areas. Review seeding procedures including seasonal mixes, timing and seed rate per hectare.	Undertake analytical soil testing and evaluation. Where appropriate implement recommendations for amelioration. Implement appropriate management actions including revising rehabilitation procedures if required.
	Ground cover percent	Trigger	During Ecosystem Establishment, a minimum of 85% vegetative cover is not present.	During Ecosystem Establishment, vegetative cover (< 85%) continues to decline between monitoring events.
		Response	Investigate the likely causes of unsatisfactory germination and or, growth rates. Re-seed areas with unsatisfactory cover. Review seeding procedures including seasonal mixes, timing and seed rate per hectare.	Undertake analytical soil testing and evaluation, Where appropriate implement recommendations for amelioration. Implement appropriate management actions including revising rehabilitation procedures if required.

## **10 SOCIO-ECONOMIC EFFECTS**

The Sunnyside Coal Mine currently has an operational workforce of approximately 14 full time employees and contractors. The workforce is expected to reduce following cessation of coal extraction and supplementary earthworks, and continue to reduce over the Closure MOP term as rehabilitation is completed.

Given the number of Whitehaven operations in the broader region, employees and contractors would be encouraged to seek employment at other ongoing Whitehaven operations.

Whitehaven would continue to work in partnership with the GSC and the local community to anticipate, identify and minimise potential social impacts due to closure of the Sunnyside Coal Mine.

## **11 REPORTING**

Results of rehabilitation monitoring will be reported in the Annual Review. The Annual Review will record monitoring results and discuss rehabilitation performance against key performance measures/indicators; compliance with regulatory requirements and Whitehaven commitments. The Annual Review will also discuss identified trends and instances where potential rehabilitation failure has been identified triggering intervention in accordance with a Rehabilitation and Closure TARP.

The Annual Review, along with any independent audits undertaken, will be submitted to relevant government agencies and made publicly available via the Whitehaven website.

## **12 PLANS**

The following plans relevant to this MOP have been prepared in consideration of the Plan requirements in the Closure MOP Guidelines, and provided in Appendix A:

- Plan 1A: Project 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 Year 1 – November 2019 (End of Coal Extraction).
- Plan 3B: Mining and Rehabilitation Year 2 – November 2020.
- Plan 4: Final Rehabilitation and Post-Mining Land Use.
- Plan 5: Rehabilitation and Post-Mining Land Use Cross – Sections.

## **13 REVIEW AND IMPLEMENTATION OF THE CLOSURE MOP**

### **13.1 REVIEW OF THE CLOSURE MOP**

Periodic reviews will be conducted to assess the effectiveness of this Closure MOP. This Closure MOP may also be revised due to:

- deficiencies being identified;
- results from the monitoring and review program;
- recommendations resulting from the monitoring and review program;
- changing environmental requirements;
- improvements in knowledge or technology becoming available;
- change in legislation;
- where a risk assessment identifies the requirement to alter the Closure MOP; and
- change in the activities, operations or rehabilitation and closure at the Sunnyside Coal Mine.

### **13.2 IMPLEMENTATION**

The Sunnyside Coal Mine is managed by the Operations Superintendent/MEM, or equivalent.

Annual inspections (as well as additional opportunistic inspections) would be held with the DP&E Resources Regulator and other relevant regulators.

## 14 REFERENCES

- Australian and New Zealand Environment Conservation Council (2000) *Australian Water Quality Guidelines for Fresh and Marine Waters*.
- Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia (2000) *Strategic Framework for Mine Closure*.
- Commonwealth of Australia (2016) *Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure*.
- Geoff Cunningham Natural Resource Consultants Pty Ltd (2008) *Soils and Land Capability Assessment of the Sunnyside Coal Project via Gunnedah*.
- GeoTerra Pty Ltd (2018) *Surface Water and Groundwater Assessment*. Report prepared to support the Sunnyside Coal Mine Final Landform Modification – Environmental Assessment.
- Landcom (2004) *Managing Urban Stormwater: Soils and Construction – Volume 1 4th Ed*.
- New South Wales Trade Investment Division of Resources and Energy (2013) *ESG3: Mining Operations Plan (MOP) Guidelines*.
- Olsen Environmental Consulting Pty Limited and R.W. Corkery & Co. Pty Ltd (2008) *Sunnyside Coal Project, via Gunnedah, Environmental Assessment*. Report prepared for Namoi Mining Pty Ltd.
- Whitehaven Coal Limited (2015) *Sunnyside Coal Mine Modification – Environmental Assessment*.
- Whitehaven Coal Limited (2018a) *Sunnyside Coal Mine Final Landform Modification – Environmental Assessment*.
- Whitehaven Coal Limited (2018b) *Draft Whitehaven Coal Manual – Closure Planning*.
- Whitehaven Coal Limited (2018c) *Draft Whitehaven Coal Environmental Standard – Closure*.
- Whitehaven Coal Limited (2018d) *Whitehaven Sunnyside Coal Mine Asset Retention and Disposal Review*.

**APPENDIX A**  
**CLOSURE MOP PLANS**

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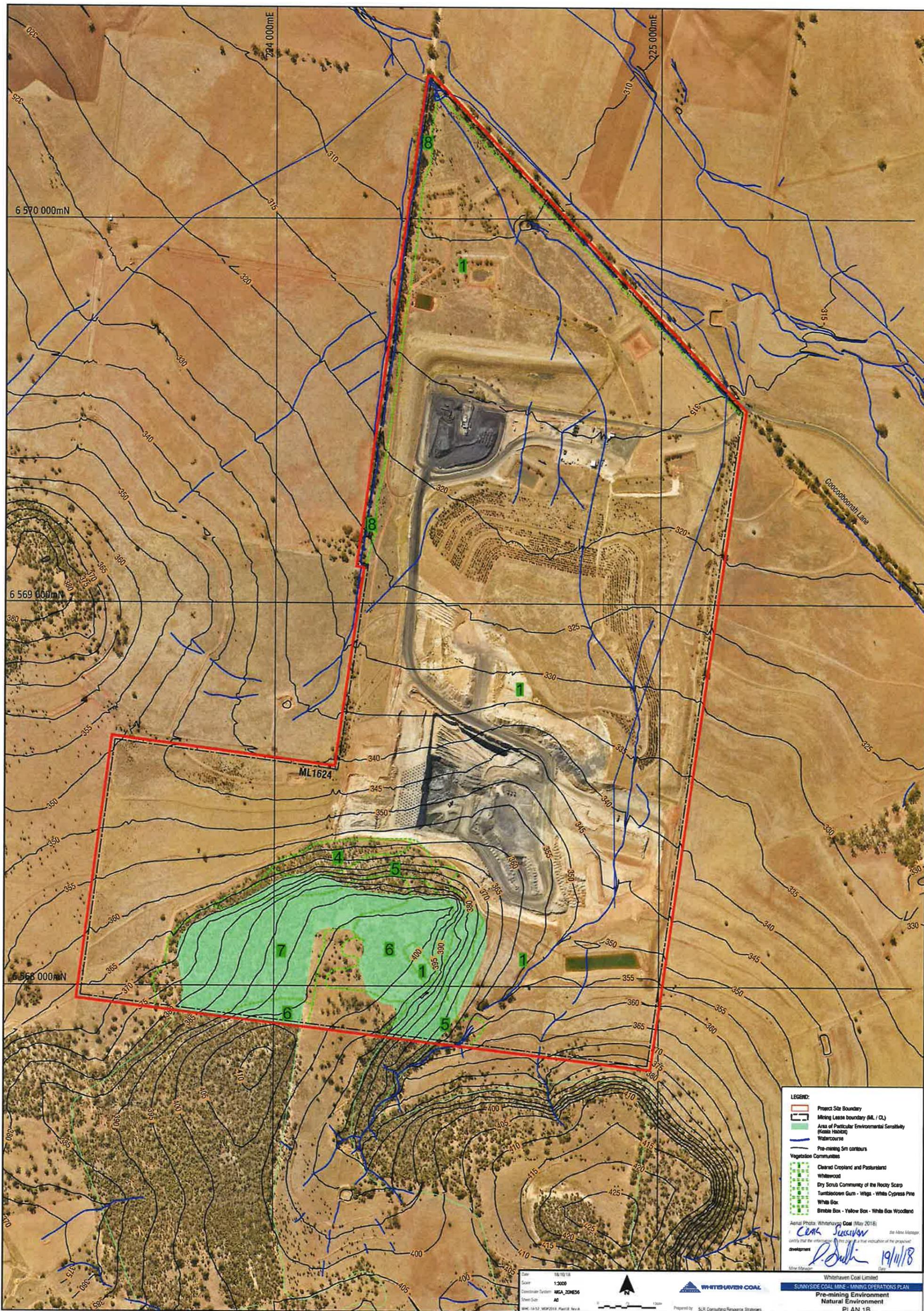
**LEGEND**

- Project Site Boundary (offset for clarity)
- Road
- Railway
- Watercourse
- Land Subject to Inundation
- Local Government Area boundary
- Authority boundary (AUTH)
- Mining Lease Application boundary (ML/MLA/CL/EL)
- Coal Transport Route

*Craig Secor* Mine Manager  
 certifies that the information contained in this plan is a true and accurate representation of the project.  
 Date: 19/11/18

Whitehaven Coal Limited  
 SUNNYSIDE COAL MINE - MINING OPERATIONS PLAN  
 Project Locality  
 PLAN 1A

Scale: 1:50,000  
 Map Datum: MGA\_2011  
 Sheet Size: A0  
 Date: 18/10/18  
 Prepared by: SLR Consulting Resource Strategists

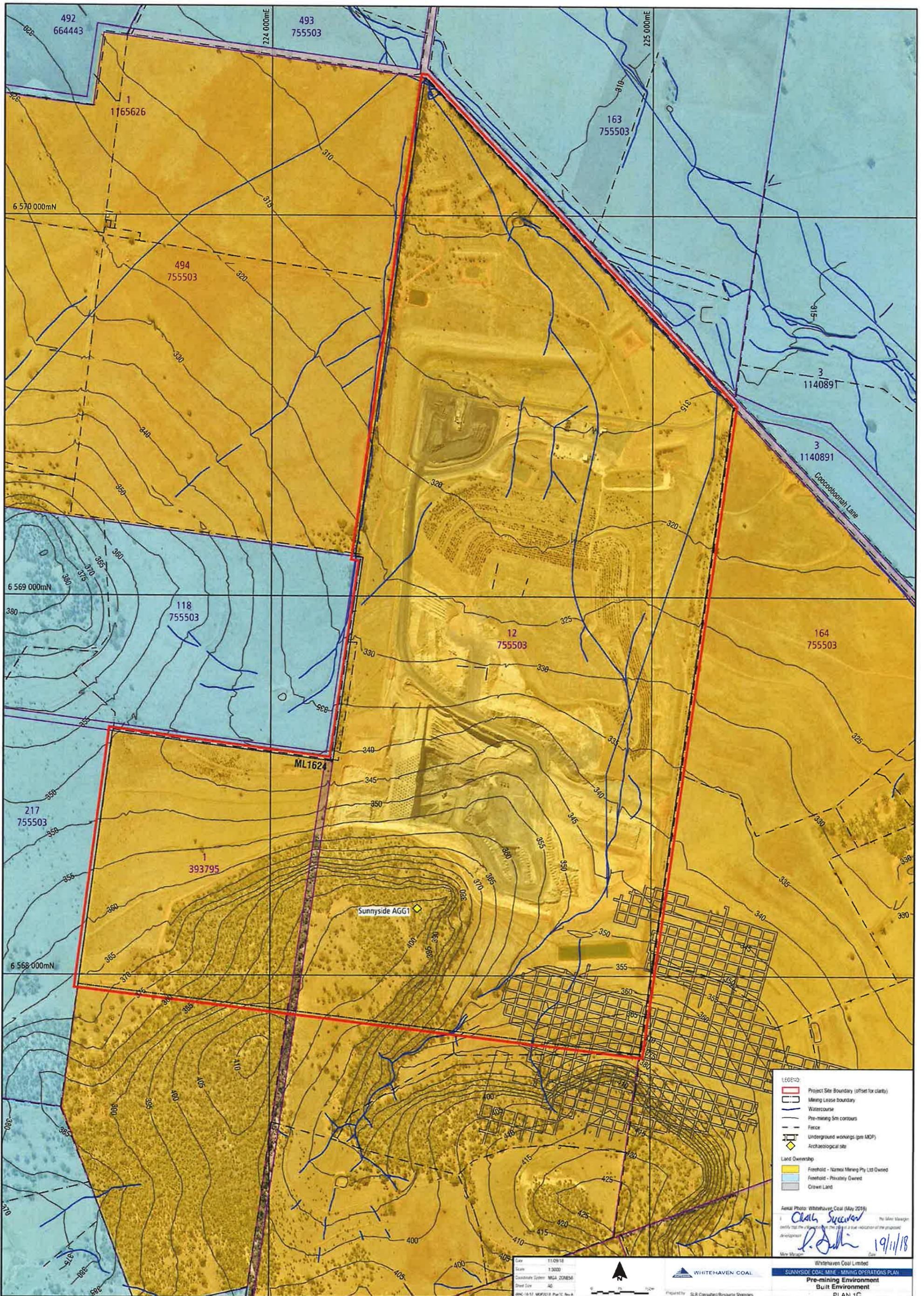


**LEGEND:**

- Project Site Boundary
- Mining Lease boundary (ML / CL)
- Area of Particular Environmental Sensitivity (Riparian Habitat)
- Watercourse
- Pre-mining 5m contours
- Vegetation Communities**
- Cleared Cropland and Pastureland
- Whitebark
- Dry Scrub Community of the Rocky Scarp
- Tumblidown Gum - Wags - White Cypress Pine
- White Box
- Brimble Box - Yellow Box - White Box Woodland

Aerial Photo: Whitehaven Coal (May 2018)

*Craig Sullivan* As Mine Manager  
*P. Dulli* 19/11/18  
 As Mine Manager



**LEGEND**

- Project Site Boundary (offset for clarity)
- Mining Lease boundary
- Watercourse
- Pre-mining 5m contours
- Fence
- Underground workings (pre MOP)
- Archaeological site

**Land Ownership**

- Freehold - Mineral Mining Pty Ltd Owned
- Freehold - Privately Owned
- Crown Land

Aerial Photo: Whitehaven Coal (May 2018)

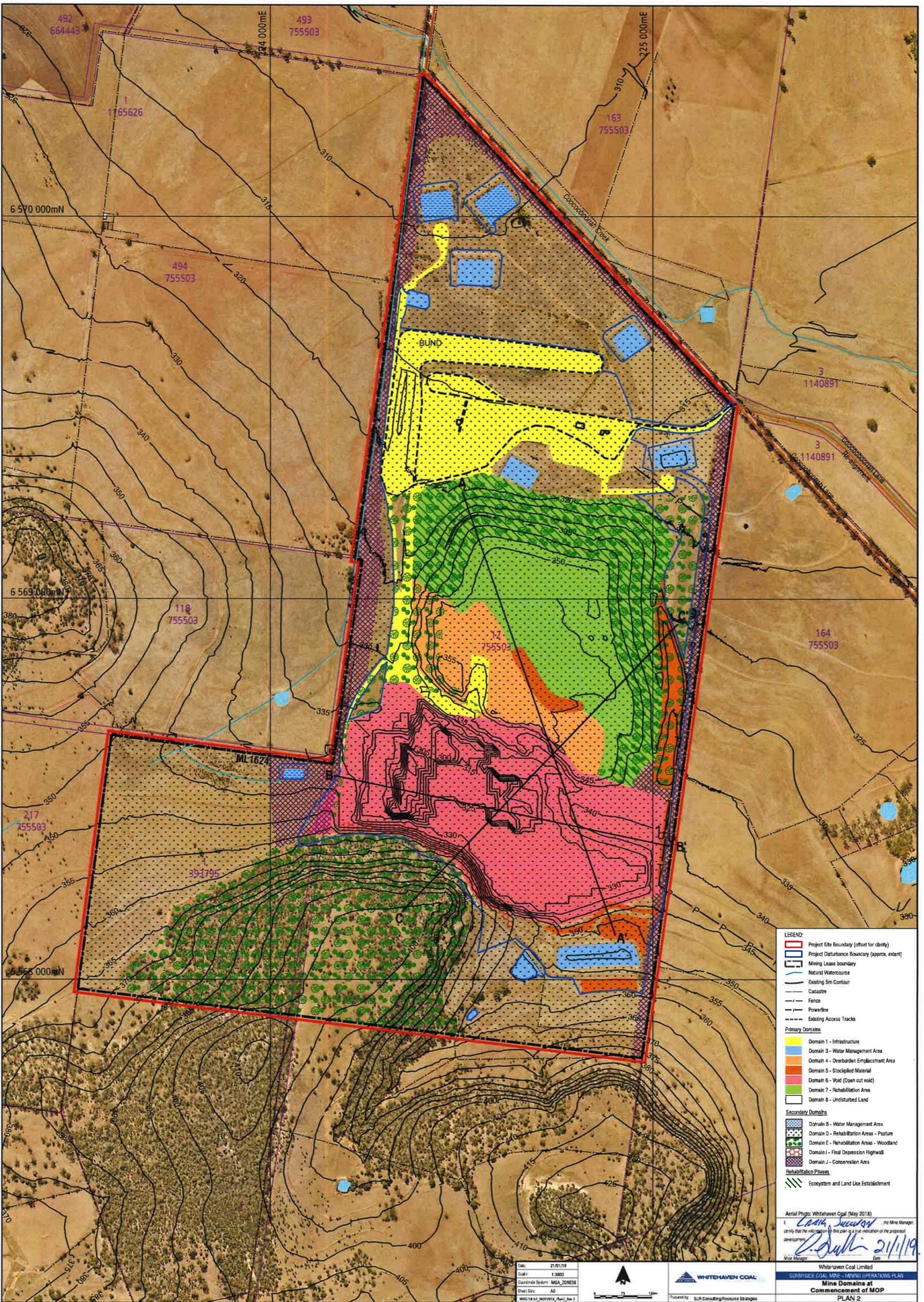
*Chris Sullivan* (Signature)  
*P. D. [Signature]* (Signature)  
 19/11/18

Whitehaven Coal Limited  
 SUNNYSIDE COAL MINE - MINING OPERATIONS PLAN  
 Pre-mining Environment  
 Built Environment  
 PLAN 1C

Date: 11.09.18  
 Scale: 1:3000  
 Coordinate System: MGA 201836  
 Sheet Size: A0  
 MNC-18-57\_MOP2018\_Plan 1C\_Nov A



WHITEHAVEN COAL  
 Prepared by: SLR Consulting/Resource Strategies



**LEGEND:**

- Project Site Boundary (offset for clarity)
- Project Disturbance Boundary (approx. extent)
- Mining Lease boundary
- Natural Watercourse
- Existing 5m Contour
- Cadastre
- Fence
- Powerline
- Existing Access Tracks

**Primary Domains:**

- Domain 1 - Infrastructure
- Domain 3 - Water Management Area
- Domain 4 - Overburden Emplacement Area
- Domain 5 - Stockpiled Material
- Domain 6 - Void (Open cut void)
- Domain 7 - Rehabilitation Area
- Domain 8 - Undisturbed Land

**Secondary Domains:**

- Domain B - Water Management Area
- Domain D - Rehabilitation Areas - Pasture
- Domain E - Rehabilitation Areas - Woodland
- Domain F - Final Depression Highwall
- Domain J - Conservation Area

**Rehabilitation Phases:**

- Ecosystem and Land Use Establishment

Aerial Photo: Whitehaven Coal (May 2016)

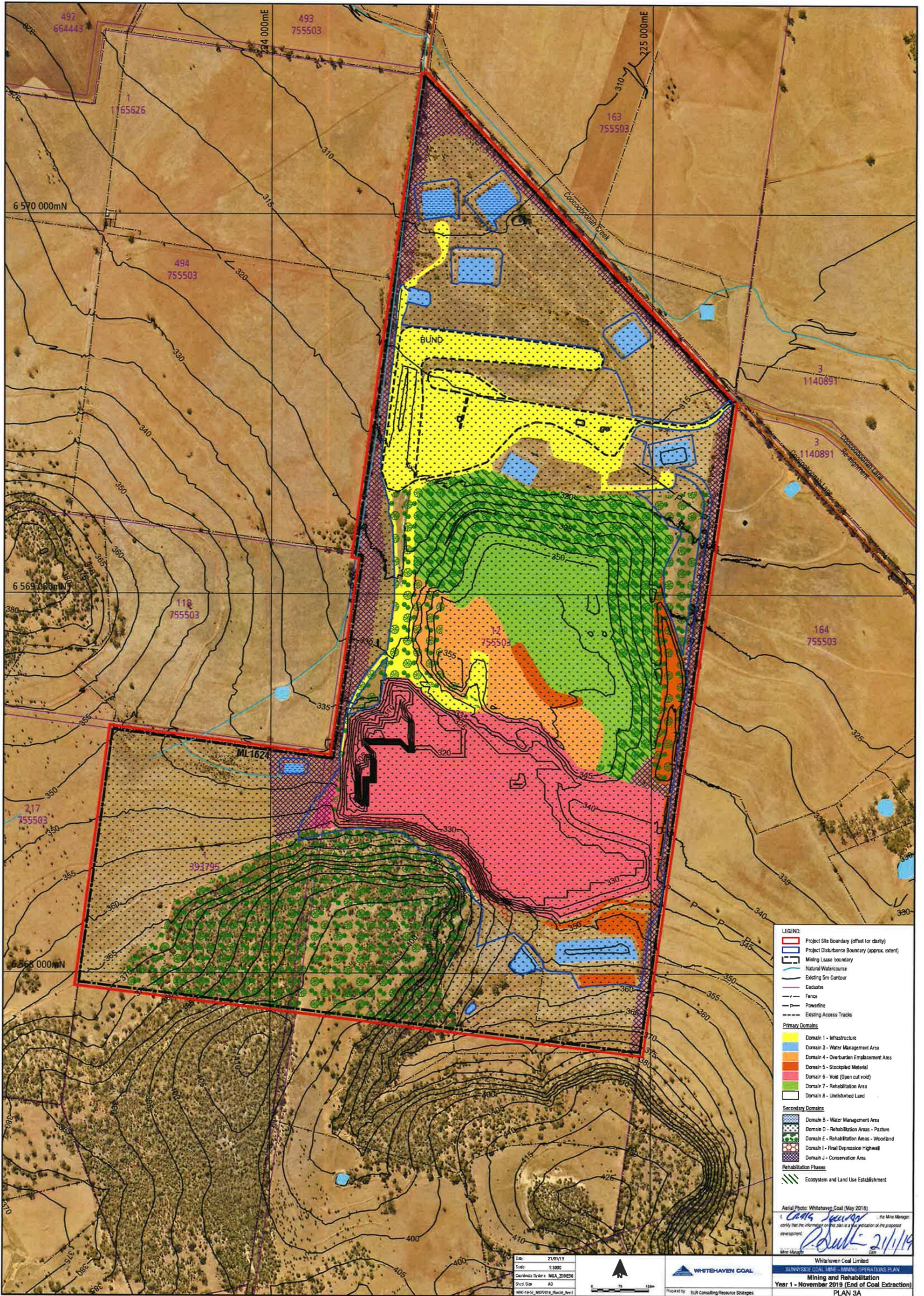
I, *Carly Jackson*, the Mine Manager, certify that the information in this plan is a true indication of the proposed development.

*C. Dublin* 21/1/19  
 Mine Manager Date

Whitehaven Coal Limited  
 SURFACE COAL MINE - MINING OPERATIONS PLAN  
 Mine Domains at  
 Commencement of MOP  
 PLAN 2

Date: 21/01/19  
 Scale: 1:3000  
 Coordinate System: MGA\_ZONE58  
 Sheet Size: A0  
 WMC/18-1/MOP/OPS\_Plan\_1





**LEGEND:**

- Project Site Boundary (offset for clarity)
- Project Disturbance Boundary (approx. extent)
- Mining Lease boundary
- Natural Watercourse
- Existing 5m Contour
- Cadastral
- Fence
- Powerline
- Existing Access Tracks

**Primary Domains**

- Domain 1 - Infrastructure
- Domain 3 - Water Management Area
- Domain 4 - Overburden Emplacement Area
- Domain 5 - Stockpiled Material
- Domain 6 - Void (Open cut void)
- Domain 7 - Rehabilitation Area
- Domain 8 - Undisturbed Land

**Secondary Domains**

- Domain B - Water Management Area
- Domain D - Rehabilitation Areas - Pasture
- Domain E - Rehabilitation Areas - Woodland
- Domain I - Final Depression Highwall
- Domain J - Conservation Area

**Rehabilitation Phases**

- Ecosystem and Land Use Establishment

Aerial Photo: Whitehaven Coal (May 2018)

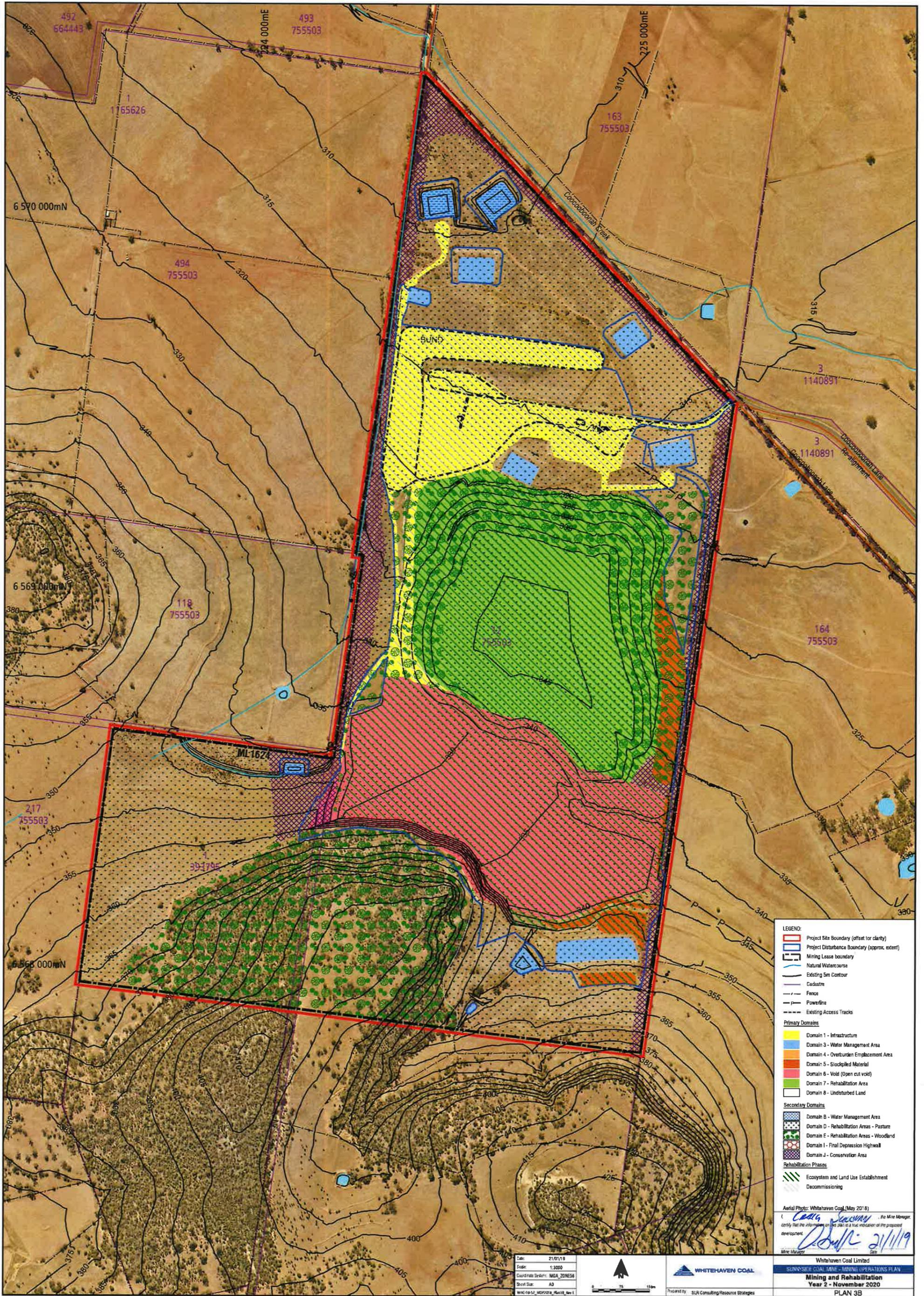
I, *Chris Swain*, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

*Chris Swain* 21/1/19

Whitehaven Coal Limited  
 SUNNYSIDE COAL MINE - MINING OPERATIONS PLAN  
 Mining and Rehabilitation  
 Year 1 - November 2019 (End of Coal Extraction)  
 PLAN 3A

Date: 21/01/19  
 Scale: 1:3000  
 Coordinate System: MGA\_ZONE58  
 Sheet Size: A0  
 WKK-19-51\_MOP019\_Plan3A\_Rev1





**LEGEND:**

- Project Site Boundary (offset for clarity)
- Project Disturbance Boundary (approx. extent)
- Mining Lease boundary
- Natural Watercourse
- Existing 5m Contour
- Cadastral
- Fence
- Powerline
- Existing Access Tracks

**Primary Domains**

- Domain 1 - Infrastructure
- Domain 3 - Water Management Area
- Domain 4 - Overburden Emplacement Area
- Domain 5 - Stockpiled Material
- Domain 6 - Void (Open cut void)
- Domain 7 - Rehabilitation Area
- Domain 8 - Undisturbed Land

**Secondary Domains**

- Domain B - Water Management Area
- Domain D - Rehabilitation Areas - Pasture
- Domain E - Rehabilitation Areas - Woodland
- Domain I - Final Depression Highwall
- Domain J - Conservation Area

**Rehabilitation Phases**

- Ecosystem and Land Use Establishment
- Decommissioning

Aerial Photo: Whitehaven Coal (May 2018)

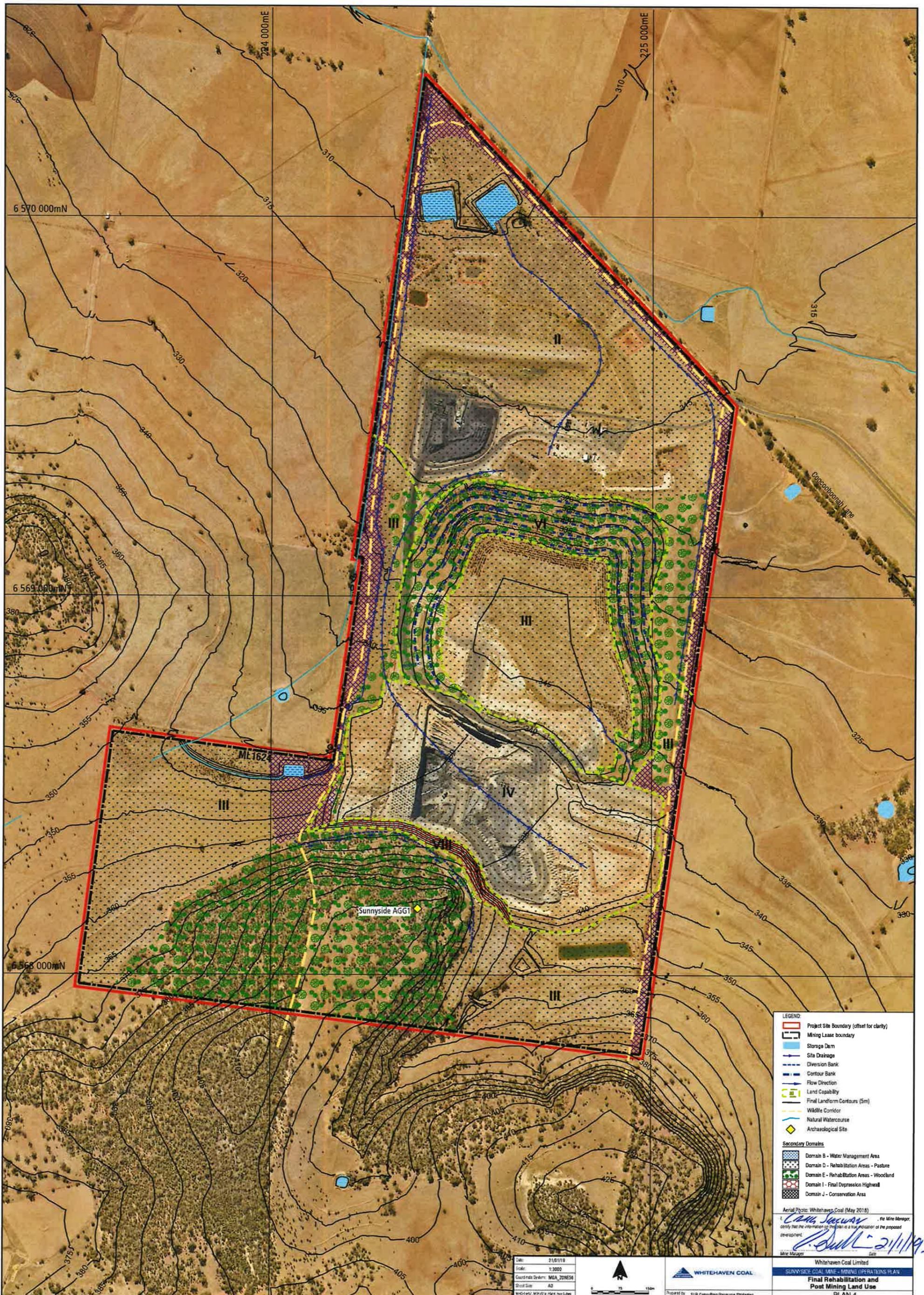
*Craig Seaman* the Mine Manager  
 certify that the information on this plan is a true reflection of the proposed development.  
*D. Duffin* 21/11/19  
 Mine Manager

Date: 21/01/19  
 Scale: 1:3000  
 Coordinate System: MGA\_20NES4  
 Sheet Size: A0  
 WNC-19-14\_MD02018\_Plan3B\_Sev 1



**WHITEHAVEN COAL**  
 Project by: SUR Consulting/Resource Strategies

Whitehaven Coal Limited  
**SUNNYSIDE COAL MINE - MINING OPERATIONS PLAN**  
**Mining and Rehabilitation**  
**Year 2 - November 2020**  
**PLAN 3B**



**LEGEND**

- Project Site Boundary (offset for clarity)
- Mining Lease boundary
- Storage Dam
- Site Drainage
- Diversion Bank
- Contour Bank
- Flow Direction
- Land Capability
- Final Landform Contours (5m)
- Wildlife Corridor
- Natural Watercourse
- Archaeological Site

**Secondary Domains**

- Domain B - Water Management Area
- Domain D - Rehabilitation Areas - Pasture
- Domain E - Rehabilitation Areas - Woodland
- Domain I - Final Depression Highwall
- Domain J - Conservation Area

Aerial Photo: Whitehaven Coal (May 2018)

*Craig Secor*, the Mine Manager, certifies that the information on this plan is a true and accurate representation of the proposed development.

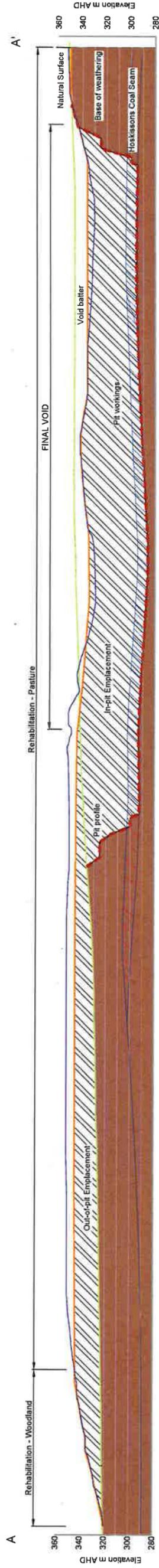
*[Signature]* 21/11/19  
Mine Manager

Whitehaven Coal Limited  
SUNNYSIDE COAL MINE - MINING OPERATIONS PLAN  
**Final Rehabilitation and Post Mining Land Use**  
PLAN 4

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Coordinate System: MGA\_ZONE56  
Sheet Size: A0  
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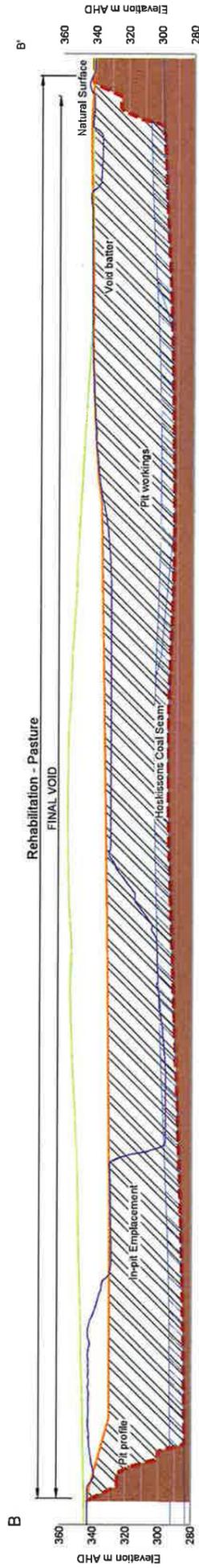
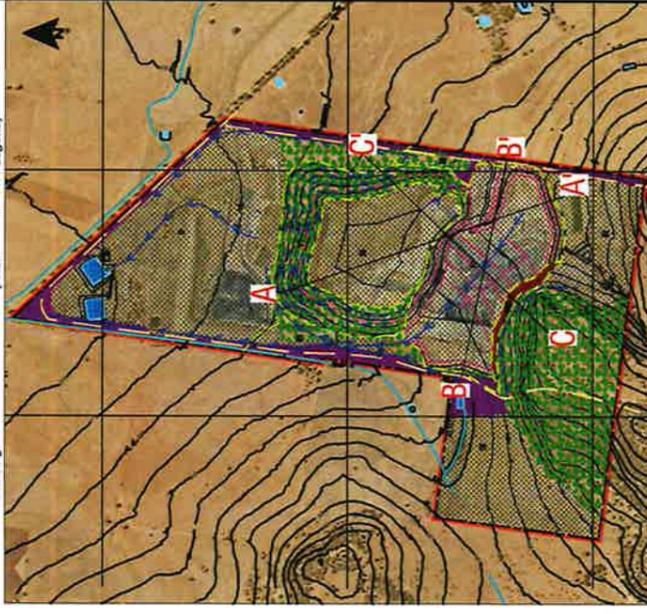


**WHITEHAVEN COAL**  
Project by: SLR Consulting/Resource Strategies

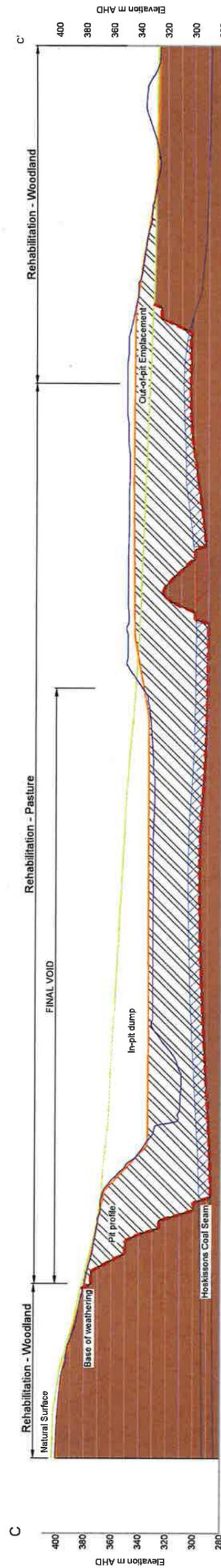


SECTION A - A'

INSET - PLAN 4 showing SECTION LOCATIONS - (refer to PLAN 4 for Legend)



SECTION B - B'



SECTION C - C'

- LEGEND:
- Project Site Boundary (offset for clarity)
  - Mining Lease boundary
  - Watercourse
  - Pre-mining 5m contours
  - Overburden emplacement
  - Undisturbed material
  - Natural surface
  - Final landform
  - Current landform (2016)
  - Existing mine pit surface

Whitehaven Coal Limited  
 SHINGIDE OPERATIONS  
 Rehabilitation and Post Mining Land Use  
 Cross - Sections  
 PLAN 5

*Chris Gorman*  
 21/11/19

Date:	21/01/19
Scale:	AS SHOWN
Drawn by:	WSP/PAJ/EL
Checked by:	AD
Project:	SHINGIDE OPERATIONS
Sheet:	AD



PROJECT: SHINGIDE OPERATIONS  
 SHEET: AD  
 DATE: 21/01/19  
 SCALE: AS SHOWN  
 DRAWN BY: WSP/PAJ/EL  
 CHECKED BY: AD

**APPENDIX B**  
**RISK REGISTER**

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Sunnyside Coal Mine									
Key Element	Issue	Caused By	Consequence	Current Controls (are in place)	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating
Surface Water	Impact to surface water.	Sediment laden water leaving site. Water quality not with EPL criteria. Diverting water around and within the site.	Impact on water quality and quantity. Water retained on site.	Site Water Management Plan. Minimising water retention through separation of clean and dirty water. Minimising water retention at the site.	Satisfactory	Legal and Compliance	2	D	L
Groundwater	Impact to rehab from groundwater	Use of pre-existing underground mine workings as a source or storage for water.	Impact on water quality and quantity.	Backfilling final depression to a level above the predicted groundwater recovery level.	Satisfactory	Environment	2	D	L
Erosion and Sediment Control	Erosion and sediment on disturbed areas. Uncontrolled discharge offsite of sediment laden water.	Failure to manage rehabilitation areas. Failure of existing water management system and/or design.	Impact on rehabilitation. Pollution.	Erosion and Sediment Control Plan (part of Water Management Plan).	Satisfactory	Environment	2	D	L
Acid Mine Drainage	Failure to achieve the rehabilitation outcome prescribed in the MOP.	Poor knowledge of material characteristics.	Inability to reach closure and relinquishment of the lease. Requirement to treat water long-term. Impact on environment.	Material characterisation has been undertaken and determined minimal propensity for generation of AMD.	Satisfactory	Financial	4	D	M
Spontaneous Combustion	Spontaneous combustion impedes rehabilitation.	Poor management of materials with propensity for spontaneous combustion.	Inability to complete rehab. Impact on established rehab. Cost of managing spontaneous combustion outbreak.	MOP. Selective handling of carbonaceous material. Regular inspections. Training.	Satisfactory	Financial	3	A	H
Geotechnical	Failure of highwall or endwall or slumping of dumps around final void.	Geotechnical failure.	Inability to reach closure and relinquishment of the lease. Additional costs for rework. Safety concerns.	Engineering landform design. Geotechnical review. Inspections.	Satisfactory	Financial	4	D	M
Soil Type(s) and Quality	Inadequate type and/or quality of soil to achieve the rehabilitation outcome prescribed in the MOP.	Inadequate soil available. No additional stripping opportunities due to full disturbance footprint.	Inability to reach closure and relinquishment of the lease. Cost of sourcing ameliorants and alternates.	Soil mass balance estimate has been completed. Soil quality assessment has been completed. Ongoing assessment program of stockpiled material.	Satisfactory	Financial	2	C	M
Flora	Failure to achieve the rehabilitation outcome prescribed in the MOP.	Inadequate revegetation methodology. Not considering requirements in rehabilitation planning (correct species). Failure to manage weeds.	Inability to reach performance and/or completion criteria. Inability to reach closure and relinquish lease.	Closure MOP – revegetation methodology. Closure MOP – monitoring against performance and completion criteria. Closure MOP – TARP for revegetation	Satisfactory	Legal and Compliance	2	C	M
Fauna	Failure to achieve the rehabilitation outcome prescribed in the MOP.	Failure to manage pests.	Inability to reach closure and relinquish lease.	Closure MOP.	Satisfactory	Legal and Compliance	2	D	L
Bushfire	Damage to rehabilitation.	Bushfire.	Loss of established rehabilitation. Additional costs for rework of rehabilitation. Exposed areas (erosion, sediment, dust).	Firebreak establishment and maintenance. Engagement with Rural Fire Service.	Satisfactory	Financial	2	D	L
Contaminated Land	Contaminated land occurring at the Sunnyside Coal Mine at closure.	Long-term use of the site, spills, leaks etc.	Impact on environment. Constraint for future land use.	Closure MOP.	Satisfactory	Environment	2	D	L

## APPENDIX C

## INDICATIVE TIMELINE AND ASSET REGISTER OF REHABILITATION AND DECOMMISSIONING ACTIVITIES

End of Year 1 (November 2019)	End of Year 2 (November 2020)	End of Year 3 (November 2021)	End of Year 7 (November 2025)
<ul style="list-style-type: none"> <li>• Coal extraction ceases.</li> <li>• Ongoing rehabilitation of out-of-pit emplacement batter.</li> <li>• Drilling and blasting to make highwall and endwall safe.</li> <li>• Decommissioning of exploration boreholes.</li> </ul>	<ul style="list-style-type: none"> <li>• All carbonaceous material from re-handled overburden and infrastructure area transferred to in-pit emplacement and capped.</li> <li>• Supplementary earthworks completed (including removal of amenity bund).</li> <li>• Decommissioning of infrastructure commenced (e.g. coal handling infrastructure that is no longer required).</li> <li>• Rehabilitation of in-pit and reshaped out-of-pit emplacement commenced.</li> <li>• Highwall and endwall treatment including trench and safety berm commenced.</li> <li>• Development of a physical barrier to exclude stock from the highwall area to replace the Koala fence (i.e. removal or repurposing of the Koala fence).</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing rehabilitation of mine site.</li> <li>• Disconnection and termination of services (e.g. water and electricity).</li> <li>• Demolition and removal of site office and facilities, weighbridge, any remaining coal handling infrastructure, pads and footings and carpark commenced.</li> <li>• Decommissioning of internal access roads/tracks that are no longer required.</li> <li>• On-site remediation of contaminated areas commenced (if necessary).</li> <li>• Decommissioning of water dams that are not being retained as part of the final landform.</li> </ul>	<ul style="list-style-type: none"> <li>• Final landform is geotechnically stable, safe and non-polluting.</li> <li>• Rehabilitation to Ecosystem and Land Use Establishment established across all relevant areas of the mining lease.</li> <li>• Decommissioning of any residual infrastructure not being retained, and on-site remediation of any remaining contaminated areas.</li> <li>• Ongoing rehabilitation, monitoring and management.</li> </ul>

Sunnyside Coal Mine – Closure Mining Operations Plan

Domain	Asset ID Number	Description	Management into Perpetuity <sup>1</sup>
Domain 1A - Infrastructure	1	Access Road	Retained
	2	Car Park	Removed End of Year 3
	3	Administration Building	Removed End of Year 3
	4	Ablutions Building	Removed End of Year 3
	5	Workshop Building	Removed End of Year 3
	6	ROM Hopper and Conveyor	Removed End of Year 3
	7	Load Out Bin	Removed End of Year 3
	8	Weigh Bridge	Removed End of Year 3
	9	Underground Telstra Line	Disconnected End of Year 3
	10	Signage	Removed End of Year 7
Domain 3 - Water Management Area	11	Pumps/Suction Pipe/Foot Valves	Removed End of Year 7
	12	Pipeline	Removed End of Year 7
	13	Stand Pipe	Removed End of Year 7
	14	Groundwater Piezometers (P3,P7-8, refer Water Management Plan Figure 3)	Removed End of Year 7 <sup>2</sup>
	15	Signage	Removed End of Year 7
	16	Sediment Basins (SB2-5, refer Water Management Plan Figure 3)	Decommissioned End of Year 3
	17	Storage Dams (SD2, refer Water Management Plan Figure 3)	Decommissioned End of Year 3
	18	Storage Dams (SD1, SD3-4, refer Water Management Plan Figure 3)	Retained
	19	Pit Water Storage (Turkeys Nest, refer Water Management Plan Figure 3)	Decommissioned End of Year 3
Domain 4 - Overburden Emplacement Area	20	Signage	Removed End of Year 3
Domain 5 - Stockpiled Material	21	Sediment Fencing	Removed End of Year 3
	22	Signage	Removed End of Year 3
Domain 6 - Void (Open Cut Void)	23	Two-way communication tower	Removed End of Year 7
	24	Bore pump and power box (Production No.5, refer Water Management Plan Figure 3)	Removed End of Year 3
Domain 8 - Undisturbed Land	25	Koala Fence	Removal or Repurposing End of Year 2
	26	Agricultural Equipment	Removed End of Year 3
	27	Windmill (27356, refer Water Management Plan Figure 3)	Removed End of Year 3
	28	Boreholes	Removed End of Year 1 <sup>2</sup>
	29	Signage	Removed End of Year 7

<sup>1</sup> method of asset removal will be in accordance with AS 2601-2001 (or its latest version) and Exploration and Petroleum Drilling and Well Servicing Competencies (DISRD,2015), as applicable.

<sup>2</sup> some piezometers/boreholes may be retained beyond End of Year 7 for ongoing monitoring or agricultural use and will require licensing under the Water Management Act.

**APPENDIX D**  
**TOPSOIL QUALITY**

## Topsoil Analysis 2012

In 2012 soil testing was undertaken by Ag Solutions Australia for the following sites;

- West Rehab dams,
- Western Stockpile
- Topsoil Southern Dump
- Eastern Rehab Area

Quality results are presented below.

Ag Solutions Australia general recommendation was to add a NatraMin Cal-S at a ratio of 1-1.5 t/ha, and consideration should be given to adding organic matter to the soil at a ratio of 10-20m<sup>3</sup> per ha.

Date: 20/04/2012			Customer ID: 1387				
Danny Young			Block Identification: Topsoil Southern Dump				
Whitehaven Coal Mine			Sunnyside				
PO Box 600			Phone Number: 6742 4337				
Gunnedah NSW 2380			Fax Number:				
			Crop Type: Pastures				
Element or Category	Your Level	Optimal Level	Nutrient Status				
			Low	Marginal	Optimal	High	Excessive
pH 1:5 water	8.6	5.7 – 7.3	[Bar chart showing status]				
Elec. Cond. 1:5 water	0.07 mS/cm	0.06 – 0.5	[Bar chart showing status]				
Nitrate (N) water-soluble	4 ppm	20 – 55	[Bar chart showing status]				
Phosphate (P) BSES	16 ppm		[Bar chart showing status]				
Phosphate (P) Colwell	9 ppm	35 – 90	[Bar chart showing status]				
Potassium (K) Am Ac	280 ppm		[Bar chart showing status]				
	meq	0.72	[Bar chart showing status]				
	cations	4.6%	[Bar chart showing status]				
Calcium (Ca) Am Ac	2645 ppm		[Bar chart showing status]				
	meq	13.23	[Bar chart showing status]				
	cations	84.7%	[Bar chart showing status]				
Magnesium (Mg) Am Ac	197 ppm		[Bar chart showing status]				
	meq	1.63	[Bar chart showing status]				
	cations	10.4%	[Bar chart showing status]				
Sodium (Na) Am Ac	9 ppm		[Bar chart showing status]				
	meq	0.04	[Bar chart showing status]				
	cations	0.3%	[Bar chart showing status]				
Sulphate (S) KCl	6 ppm	30 – 50	[Bar chart showing status]				
Zinc (Zn) DTPA	0.15 ppm	1 – 10	[Bar chart showing status]				
Copper (Cu) DTPA	0.51 ppm	1 – 10	[Bar chart showing status]				
Manganese (Mn) DTPA	9.11 ppm	5 – 55	[Bar chart showing status]				
Iron (Fe) DTPA	4.05 ppm	5 – 170	[Bar chart showing status]				
Boron (B) CuCl <sub>2</sub>	0.41 ppm	0.1 – 1.1	[Bar chart showing status]				
Organic Carbon W&S	0.16	2.4 – 6.0	[Bar chart showing status]				
Chloride (Cl) Water-soluble	11 ppm	<150	[Bar chart showing status]				
Ca:Mg Ratio	8.12	2.7 – 5.0	[Bar chart showing status]				
Cation Exch. Capacity	15.61	Clay	[Bar chart showing status]				

Sunnyside Coal Mine – Closure Mining Operations Plan

Date: 20/04/2012  
 Danny Young  
 Whitehaven Coal Mine  
 PO Box 600  
 Gunnedah NSW 2380

Customer ID: 1387  
 Block Identification: Eastern Rehab Area Sunnyside  
 Phone Number: 6742 4337  
 Fax Number:  
 Crop Type: Pasture

Element or Category	Your Level	Optimal Level	Nutrient Status				
			Low	Marginal	Optimal	High	Excessive
pH <i>1:5 water</i>	8.9	5.7 – 7.3	[Bar chart showing status]				
Elec. Cond. <i>1:5 water</i>	0.2 mS/cm	0.06 – 0.5	[Bar chart showing status]				
Nitrate (N) <i>water-soluble</i>	5 ppm	20 – 55	[Bar chart showing status]				
Phosphate (P) <i>BSES</i>	745 ppm		[Bar chart showing status]				
Phosphate (P) <i>Colwell</i>	13 ppm	35 – 90	[Bar chart showing status]				
Potassium (K) <i>Am Ac</i>	213 ppm		[Bar chart showing status]				
	meq 0.54	0.35 – 0.8	[Bar chart showing status]				
	cations 1.2%	2.8 – 6.0	[Bar chart showing status]				
Calcium (Ca) <i>Am Ac</i>	6440 ppm		[Bar chart showing status]				
	meq 32.20	8 – 16	[Bar chart showing status]				
	cations 72.0%	63 – 78	[Bar chart showing status]				
Magnesium (Mg) <i>Am Ac</i>	1290 ppm		[Bar chart showing status]				
	meq 10.66	2.0 – 5.3	[Bar chart showing status]				
	cations 23.8%	14 – 22	[Bar chart showing status]				
Sodium (Na) <i>Am Ac</i>	304 ppm		[Bar chart showing status]				
	meq 1.32	0.25 – 0.55	[Bar chart showing status]				
	cations 3.0%	1.3 – 3.5	[Bar chart showing status]				
Sulphate (S) <i>KCl</i>	5 ppm	30 – 50	[Bar chart showing status]				
Zinc (Zn) <i>DTPA</i>	0.24 ppm	1 – 10	[Bar chart showing status]				
Copper (Cu) <i>DTPA</i>	0.57 ppm	1 – 10	[Bar chart showing status]				
Manganese (Mn) <i>DTPA</i>	6.48 ppm	5 – 55	[Bar chart showing status]				
Iron (Fe) <i>DTPA</i>	4.9 ppm	5 – 170	[Bar chart showing status]				
Boron (B) <i>CaCl<sub>2</sub></i>	0.49 ppm	0.1 – 1.1	[Bar chart showing status]				
Organic Carbon <i>W&amp;B</i>	0.07	2.4 – 6.0	[Bar chart showing status]				
Chloride (Cl) <i>Water-soluble</i>	93 ppm	<150	[Bar chart showing status]				
Ca:Mg Ratio	3.02	2.7 – 5.0	[Bar chart showing status]				
Cation Exch. Capacity	44.73	Clay	[Bar chart showing status]				

Date: 19/04/2012  
 Whitehaven Coal Sunnyside  
 PO Box 600  
 Gunnedah NSW 2380

Customer ID: 1387  
 Block Identification: WEST REHAB - DAMS  
 Phone Number: 6742 4337  
 Fax Number:  
 Crop Type: pasture

Element or Category	Your Level	Optimal Level	Nutrient Status				
			Low	Marginal	Optimal	High	Excessive
pH <i>1:5 water</i>	6.6	5.7 – 7.3	[Bar chart showing status]				
Elec. Cond. <i>1:5 water</i>	0.05 mS/cm	0.06 – 0.5	[Bar chart showing status]				
Nitrate (N) <i>water-soluble</i>	2 ppm	20 – 50	[Bar chart showing status]				
Phosphate (P) <i>BSES</i>	17 ppm		[Bar chart showing status]				
Phosphate (P) <i>Colwell</i>	12 ppm	30 – 70	[Bar chart showing status]				
Potassium (K) <i>Am Ac</i>	225 ppm		[Bar chart showing status]				
	meq 0.58	0.35 – 0.6	[Bar chart showing status]				
	cations 9.4%	2.8 – 6.0	[Bar chart showing status]				
Calcium (Ca) <i>Am Ac</i>	822 ppm		[Bar chart showing status]				
	meq 4.11	4.0 – 11	[Bar chart showing status]				
	cations 67.0%	63 – 78	[Bar chart showing status]				
Magnesium (Mg) <i>Am Ac</i>	143 ppm		[Bar chart showing status]				
	meq 1.18	1.3 – 3.7	[Bar chart showing status]				
	cations 19.3%	14 – 22	[Bar chart showing status]				
Sodium (Na) <i>Am Ac</i>	61 ppm		[Bar chart showing status]				
	meq 0.27	0.14 – 0.32	[Bar chart showing status]				
	cations 4.3%	1.3 – 3.5	[Bar chart showing status]				
Sulphate (S) <i>KCl</i>	25 ppm	23 – 40	[Bar chart showing status]				
Zinc (Zn) <i>DTPA</i>	0.33 ppm	1 – 10	[Bar chart showing status]				
Copper (Cu) <i>DTPA</i>	0.4 ppm	1 – 10	[Bar chart showing status]				
Manganese (Mn) <i>DTPA</i>	72.78 ppm	5 – 55	[Bar chart showing status]				
Iron (Fe) <i>DTPA</i>	30.63 ppm	5 – 170	[Bar chart showing status]				
Boron (B) <i>CaCl<sub>2</sub></i>	0.05 ppm	0.1 – 1.1	[Bar chart showing status]				
Organic Carbon <i>W&amp;B</i>	0.24	2.2 – 5.3	[Bar chart showing status]				
Chloride (Cl) <i>Water-soluble</i>	26 ppm	<150	[Bar chart showing status]				
Ca:Mg Ratio	3.48	2.7 – 5.0	[Bar chart showing status]				
Cation Exch. Capacity	6.13	Loam/Clay	[Bar chart showing status]				

Date: 19/04/2012			Customer ID: 1387				
Whitehaven Coal Sunnyside			Block Identification: EST. WESTERN STOCKPILE				
PO Box 600			Phone Number: 6742 4337				
Gunnedah NSW 2380			Fax Number:				
			Crop Type: Pastures				
Element or Category	Your Level	Optimal Level	Nutrient Status				
			Low	Marginal	Optimal	High	Excessive
pH 1:5 water	7.6	5.7 – 7.3	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Elec. Cond. 1:5 water	0.09 mS/cm	0.06 – 0.5	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Nitrate (N) water-soluble	6 ppm	20 – 50	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Phosphate (P) BSES	132 ppm		[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Phosphate (P) Colwell	49 ppm	30 – 70	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Potassium (K) Am Ac	409 ppm		[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
meq cations	1.05	0.35 – 0.6	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
	8.6%	2.8 – 6.0	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Calcium (Ca) Am Ac	1615 ppm		[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
meq cations	8.08	4.0 – 11	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
	66.4%	63 – 78	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Magnesium (Mg) Am Ac	341 ppm		[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
meq cations	2.82	1.3 – 3.7	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
	23.2%	14 – 22	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Sodium (Na) Am Ac	50 ppm		[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
meq cations	0.22	0.14 – 0.32	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
	1.8%	1.3 – 3.5	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Sulphate (S) KCl	20 ppm	23 – 40	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Zinc (Zn) DTPA	0.97 ppm	1 – 10	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Copper (Cu) DTPA	0.63 ppm	1 – 10	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Manganese (Mn) DTPA	18.34 ppm	5 – 55	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Iron (Fe) DTPA	11.14 ppm	5 – 170	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Boron (B) CaCl <sub>2</sub>	0.13 ppm	0.1 – 1.1	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Organic Carbon W&B	0.77	2.2 – 5.3	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Chloride (Cl) Water-soluble	52 ppm	<150	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Ca:Mg Ratio	2.87	2.7 – 5.0	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				
Cation Exch. Capacity	12.16	Loam/Clay	[Bar chart showing status in Low, Marginal, Optimal, High, Excessive zones]				

### Soil Sampling July 2018

Follow up soil testing of topsoil and subsoil located in various stockpiles and amenity bunds (refer Figure 1) was undertaken in July 2018, with a total of 24 sample taken. Sampling was done by trenching through the 'stockpiles' using an excavator and each material type encountered was sampled.

Soil quality is presented in Table 1. Metals analysed (Boron, copper, Iron, Manganese and Zinc) were low and below contamination guidelines. Levels of iron were high ranging between 13,000 and 31,000 mg/kg. Looking at a combination of all the material in the stockpiles pH is high between 8 and 9.4.

In general electrical conductivity, exchangeable calcium and exchangeable sodium are slightly evaluated. Nutrient levels are good with around 400mg/kg of total nitrogen, and total phosphorus around 300mg/kg. There is very low organic matter in the soils mostly below 1%.

Calculation of gypsum to apply to the soils had similar results as proposed by Ag Solutions (2012) of a recommendation of 1.5t/ha (Table 2).

Consideration should be given to adding organic material to the soils.

Table 1 – Soil Analysis Results July 2018

Stockpile 3 Key Analytes																	
	pH Value	Sodium Adsorption Ratio	EC	Moisture Content	Color (Munsell)	Texture	Emerson Class Number	Exch. Ca	Exch. Mg	Exch. K	Exch. Sodium	Cation Exchange Capacity	Exch. Na %	Sulfate as SO4 2-	Total Nitrogen as N	Total Phosphorus as P	Organic Matter
	pH Unit		µS/cm	%				meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	mg/kg	mg/kg	mg/kg	%
Stk 3 Trial 1A	8.6	1.3	156	4.8	Yellowish Red	Sandy Clay	3	7.3	4.4	2	0.3	14.1	2.2	<10	410	183	<0.5
Stk 3 Trial 1B	8.5	1.27	107	11.4	Yellowish Red	Sandy Clay	3	6.2	3.9	1.6	0.3	12.1	2.3	<10	380	263	0.9
Stk 3 Trial 1C	8.7	0.96	132	11.3	Yellowish Red	Sandy Clay	3	6.7	3.8	2.3	0.2	13	1.7	<10	350	228	0.7
Stk 3 Trial 1D	8	0.48	255	5.2	Dark Reddish Brown	Sandy Clay	3	5.6	2.2	1.4	<0.2	9.1	<0.2	20	690	348	0.7
Stockpile 4 Key Analytes																	
	pH Value	Sodium Adsorption Ratio	EC	Moisture Content	Color (Munsell)	Texture	Emerson Class Number	Exch. Ca	Exch. Mg	Exch. K	Exch. Sodium	Cation Exchange Capacity	Exch. Na %	Sulfate as SO4 2-	Total Nitrogen as N	Total Phosphorus as P	Organic Matter
	pH Unit		µS/cm	%				meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	mg/kg	mg/kg	mg/kg	%
Stk 4 Trial 1A	8.9	6.97	131	15.2	Strong Brown	Sandy Clay	3	8.9	7.5	1.3	1.5	19.2	7.9	10	220	194	<0.5
Stk 4 Trial 1B	8.9	3.78	175	13.6	Strong Brown	Sandy Clay	3	7.3	7.6	1.6	0.9	17.4	5.3	10	290	206	0.6
Stk 4 Trial 1C	8.6	0.47	116	11.6	Dark Brown	Sandy Clay	3	6.7	1.6	1.2	<0.2	9.5	<0.2	<10	390	423	<0.5
Stk 4 Trial 1D	8.6	0.93	154	10.3	Dark Reddish Brown	Sandy Clay	4	6.2	3.8	1.4	<0.2	11.3	<0.2	<10	400	471	0.6
Stk 4 Trial 2A	8.6	2.11	174	8.7	Yellowish Red	Sandy Clay	3	5.3	4.9	1.5	<0.2	11.6	<0.2	10	340	244	0.6
Stk 4 Trial 2B	8.7	2.56	140	12	Yellowish Red	Sandy Clay	3	6.5	5.2	1.9	0.3	13.8	2.1	<10	320	285	0.6
Stk 4 Trial 2C	8.7	0.79	142	9.4	Yellowish Red	Sandy Clay	3	5.2	4.9	3.9	0.2	14.2	1.8	<10	350	208	0.5
Stockpile 6 Key Analytes																	
Stockpile 6	pH Value	Sodium Adsorption Ratio	EC	Moisture Content	Color (Munsell)	Texture	Emerson Class Number	Exch. Ca	Exch. Mg	Exch. K	Exch. Sodium	Cation Exchange Capacity	Exch. Na %	Sulfate as SO4 2-	Total Nitrogen as N	Total Phosphorus as P	Organic Matter
	pH Unit		µS/cm	%				meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	mg/kg	mg/kg	mg/kg	%
Stk 6 Trial 1A	8.8	5.62	208	6.7	Dark Reddish Brown	Sandy Clay	2	6.4	3.3	0.8	0.6	11.1	5.7	20	560	293	<0.5
Stk 6 Trial 1B	9.2	16.8	248	6.6	Dark Brown	Sandy Clay	3	3.6	4.2	1.1	1.6	10.5	15.8	20	380	348	<0.5
Stk 6 Trial 1C	9.2	19	318	9.7	Brown	Sandy Clay	3	2.1	2.8	0.7	1.2	6.9	17.8	50	310	359	0.6
Stk 6 Trial 2A	9.6	32.9	453	9.8	Strong Brown	Sandy Clay Loam	2	3.1	7.6	0.9	4.3	15.9	27.1	100	180	395	<0.5
Stk 6 Trial 2B	8.5	4.91	65	3.7	Very Dark Brown	Sandy Clay	3	3.1	0.5	0.7	0.5	4.9	10.7	10	420	269	1
Stk 6 Trial 2C	8.4	2.01	159	8.2	Dark Red	Sandy Clay	3	3.3	0.8	0.4	<0.2	4.5	<0.2	<10	310	204	0.7
Stk 6 Trial 3A	9.4	37.3	580	11.8	Brown	Sandy Clay	2	3.5	8.5	1	5.7	18.7	30.5	250	220	392	<0.5
Stk 6 Trial 3B	9.4	26.1	360	8.3	Brown	Sandy Clay	2	3.8	5.9	1.8	3.7	15.3	24.2	110	360	285	<0.5
Stk 6 Trial 3C	8.3	0.88	248	14.2	Dark Red	Sandy Clay	4	7.8	4.2	1.6	<0.2	13.5	<0.2	<10	750	337	1.1
Stk 6 Trial 3D	8.4	0.9	161	8.1	Dark Reddish Brown	Sandy Clay	4	4	8.2	1.4	2.2	15.8	14	<10	450	280	0.8
Stk 6 Trial 4A	9.3	13.5	278	13.4	Strong Brown	Sandy Clay Loam	3	4.3	9.6	1.7	2.8	18.4	15.2	40	180	541	<0.5
Stk 6 Trial 4B	8.5	2.13	189	5.2	Dark Brown	Sandy Clay	4	3.6	1.9	1.4	0.3	7.3	3.8	10	520	271	<0.5
Stk 6 Trial 4C	8.4	0.39	158	10.4	Dark Brown	Sandy Clay	3	8.3	5.1	7.2	1	21.6	4.6	<10	490	275	<0.5

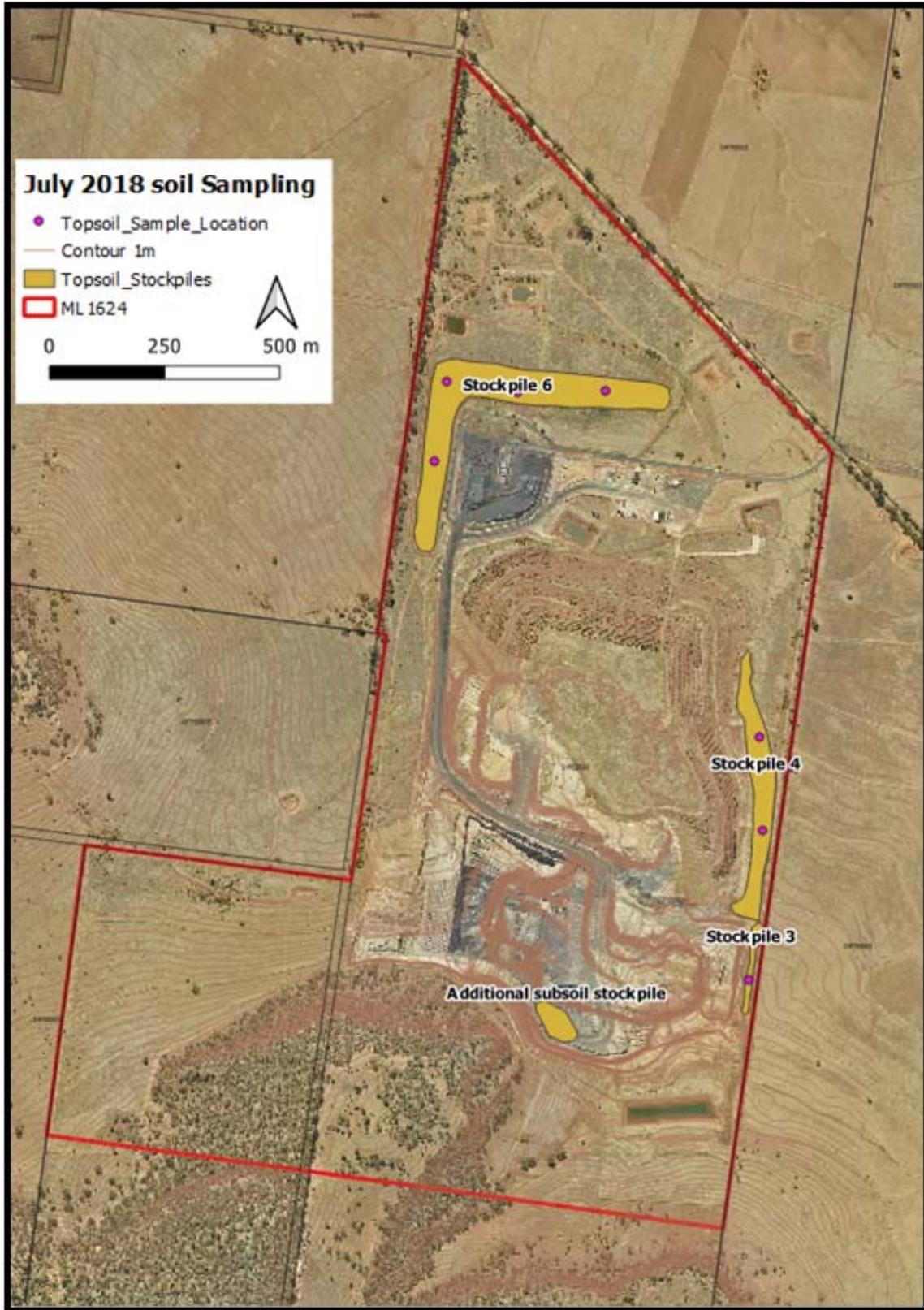


Figure 1 – Location of July 2018 Soil Sampling

Table 2 – Gypsum Application Recommendation

<b>Gypsum Recommendation</b>					
<b>Stockpile</b>	<b>Sample 1</b>	<b>Sample 2</b>	<b>Sample 3</b>	<b>Sample 4</b>	<b>Combined</b>
<b>6</b>	1.13	1.00	1.88	1.87	<b>1.52</b>
<b>4</b>	1.70	1.56			<b>1.64</b>
<b>3</b>	1.43				<b>1.43</b>

Note: (calculated using subsoil manual, 2006, p.57)

### **Subsoil Recovery**

Current (November 2018) open cut mining has extended into a zone of good quality subsoils which are being stockpiled separately (refer Figure 1). In total approximately 60 - 80bcm's will be recovered and stockpiled. The subsoil fits within layer 2 (15-65cm depth) described by Natural Resource Consultants, June 2007, specialist consultant studies compendium Part 9) and is classified as being suitable for rehabilitation of the final landscape.