Closure Mining Operations Plan

7 September 2015 – 6 September 2022

Canyon Coal Mine

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Whitehaven Coal Mining Pty Ltd

PO Box 600

GUNNEDAH NSW 2380

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Canyon Coal Mine	
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Name of Authorisation / Authorisation holder(s)	Whitehaven Coal Mining Limited
Name of Mine Operator	Whitehaven Coal Mining Limited
Name and Contact Details of the Mine Manager	Not Applicable
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Title	General Manager – Open Cut Operations
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Date	7.9.2015

TABLE OF CONTENTS

TABLES

APPENDICES

1 INTRODUCTION

1.1 History of Operations

The Whitehaven Coal Mine (now known as Canyon Coal Mine (Canyon)) is located within the Narrabri Shire, approximately 30 km north-west of Gunnedah and 15 km east of Boggabri in the Gunnedah coalfields of NSW (**Plan 1A**). The mine lies within the mining leases (MLs) 1464 and 1471. Canyon is wholly owned and managed by Whitehaven Coal Mining Ltd (WHC), a subsidiary company of Whitehaven Coal Limited (WCL) which is a publicly listed company on the Australian Stock Exchange.

WHC was initially formed to explore and develop the coal resource centred on the "Whitehaven" property, located east of Boggabri in north-west NSW. The mine, formerly known as the Whitehaven mine, was established in 2000 as a trial coal mining operation approved by Narrabri Shire Council. The mine progressed to long-term operations following approval by the (then) Minister for Urban Affairs and Planning in August 2000 (DA 72-03-2000).

The mine became known as the Canyon Open Cut Coal Mine following identification of additional coal reserves in the area (known as "The Canyon") and approval of Development Consent DA 8-1-2005 on 30 June 2005, to approve the extension of mining operations to the south (the Canyon Extension Area). Development Consent DA 8-1-2005 was modified on 22nd August 2007 (MOD 1) and again on 19th August 2008 (MOD 2) to approve two minor extensions to the open cut extraction area and extend the anticipated mining life by approximately 12 months.

During operations Canyon produced a low ash, high energy coal that was generally blended with coals from other sources to create semi-soft coking blends for domestic and export markets. Run of mine (ROM) coal was crushed at Canyon and transported by truck to the Whitehaven Coal Handling and Preparation Plant (CHPP) for processing, and loading on to trains for transport to the Port of Newcastle.

Since mining at Canyon ceased in July 2009 the site has undergone extensive rehabilitation. The majority of surface infrastructure, including all coal handling and processing infrastructure, has been removed from site and the areas rehabilitated. All exploration holes and associated ancillary disturbance has been rehabilitated in accordance with the NSW Trade and Investment – Division of Resources and Energy (DRE) requirements including three exploration drill holes drilled at the Canyon since mining ceased in 2009 for exploration associated with the Vickery Coal Project.

Some minor infrastructure currently remains at the site, including the former explosives magazine compound and hardstand areas, for ongoing use by nearby WHC operations and contractors. Unsealed access roads remain on site for access to rehabilitation areas and the water management structures. In addition, a maintenance facility has been constructed to provide a laydown area and maintenance equipment storage facilities for use by WHC contractors, under Narrabri Shire Council approval DA 31/2012.

DA 8-1-2005 MOD 3 was approved on the 3rd September 2015, to extend the expiry of the Consent beyond 7th September 2015.

1.2 Scope of this MOP

WHC has consulted with DRE regarding the scope of this MOP and agreed that this MOP considers the continued closure and rehabilitation of the mine and associated activities. Subsequently the scope of this MOP includes proposed activities associated with:

- Ongoing environmental monitoring;
- Ongoing rehabilitation monitoring and rehabilitation maintenance as required; and
- Continued use of the Whitehaven Maintenance Facility constructed at the former Canyon mining infrastructure area.

The scope of this MOP also includes development of rehabilitation objectives and agreed completion criteria to demonstrate relinquishment for all areas currently or previously disturbed by mining at Canyon. The period for this MOP is 7 years, commencing on 7th September 2015.

At the direction of the DRE this MOP has been prepared in accordance with the DRE guideline *ESG3 Mining Operations Plan (MOP) Guidelines* (ESG3) (DRE, September 2013). This MOP has also been prepared to meet all regulatory requirements including relevant consent conditions of mine leases and project approvals documented in **Table 2**.

An updated rehabilitation cost estimate (RCE) has been prepared for this MOP period. The RCE includes an estimate to decommission all built infrastructure and rehabilitate all disturbed areas. In accordance with the DRE guideline *ESG1 Rehabilitation Cost Estimate Guidelines* the RCE was calculated for the maximum disturbance during the MOP, represented on **Plan 3**.

This Closure MOP addresses the requirement of Schedule 3, Condition 43 of DA 8-1-2005 MOD 1, which requires the site to have a Mine Closure Strategy.

1.2.1 Consideration of the Vickery Coal Project

Canyon is adjacent to the proposed WHC owned Vickery Coal Project that was recently approved by the Department of Planning and Environment (DP&E) (State Significant Development [SSD] 5000). The Vickery Coal Project is approved to utilise the Canyon site for waste rock emplacement, including backfilling the final void. If developed, the Vickery Coal Project will integrate the proposed Vickery Coal Project waste rock emplacement with the final landform at Canyon, and will rehabilitate all areas at Canyon disturbed for the Vickery Coal Project in accordance with a new MOP prepared for the Vickery Coal Project.

1.3 History of MOPs

Table 1 lists the history of MOPs for Canyon.

Table 1 Canyon Coal Mine History of MOPs

Mining Operations Plan	Date Granted	Expiry	Status
Closure Mining Operations Plan Canyon Coal Mine	29 June 2015	7 September 2015	Amended
Canyon Open Cut Coal Mine Western Extension MOP Amendment	29 August 2008	30 June 2010	Expired; replaced by the Canyon Closure Plan
Mining Operations Plan for the “Whitehaven” Open Cut Coal Mine	8 August 2006	30 June 2008	Superseded

1.4 Consents, Authorisations and Licences

Canyon’s consents, authorisations and licenses are listed in **Table 2**. The mining leases are shown on MOP Plans**.**

Table 2 Canyon Coal Mine Consents, Authorisations and Licences

Type	Approval	Number	Approval Authority	Date Granted	Expiry / Renewal Date
Exploration Licences					
EL	Exploration Licence	4699	DTI	1994	22 September 2018
Mining Leases					
ML	Mining Lease	1464	DTI	21 December 1999	21 December 2020
ML	Mining Lease	1471	DTI	7 September 2000	7 September 2021
Licences					
EPL	Environment Protection Licence	10094	NSW EPA	10 February 2000	Anniversary Date 6 April
	Water Licence	90BL249901	NOW	6 September 2000	Nil
	Water Licence	90BL252067	NOW	12 May 2004	Nil
Development Approvals/ Modifications					
DA	Development Approval	DA72-03-2000	DUAP	10 August 2000	7 September 2009
MOD	Modification	MOD-8-2-2003	DIP	3 September 2003	7 September 2015
DA	Development Approval	DA 8-1-2005	DIPNR	30 June 2005	7 September 2015
MOD	Modification	DA 8-1-2005 MOD 1	DoP	22 August 2007	7 September 2015
MOD	Modification	DA 8-1-2005 MOD 2	DoP	19 August 2008	7 September 2015
MOD	Modification	DA 8-1-2005 MOD 3	DP&E	3 September 2015	N/A

1.5 Land Ownership and Land Use

Canyon is located on the former “Whitehaven” and “Womboola” properties, as well as a small section of the “Merton” property. Canyon comprises Lot 138 DP 754926 and Lot 2 DP 1038308, Parish of Boggabri and Lot 1 DP 1015797, Parish of Vickery, all within the County of Nandewar and Shire of Narrabri (**Plan 1B**). These parcels are held in freehold title by WHC. The subject land is zoned RU1 (Primary Production) under the *Narrabri Local Environment Plan 2012*.

Pre-mining land use is shown on **Plan 1B**. Prior to mining, Canyon had predominantly been cleared for agricultural cultivation and grazing, and was vegetated with open grassland and remnant native vegetation. Land use immediately surrounding Canyon is also predominantly pastoral land use.

Other landuses surrounding Canyon include the Vickery State Forest approximately 3.8 km to the east and open cut coal mining at Tarrawonga (approximately 8.6 km to the north). The project area for the approved Vickery Coal Project is shown on Plan 1A and coincides with the former Vickery Coal Mine immediately to the south of Canyon, and the southern portion of ML 1471.

1.6 Stakeholder Consultation

In accordance with DA 8-1-2005 MOD 2 Schedule 2 Condition 43 a *Mine Closure Plan* was developed in consultation with stakeholders including the former DPI (now DRE), Gunnedah Shire Council (GSC), Narrabri Shire Council (NSC), local Aboriginal communities represented by the Red Chief Local Aboriginal Land Council, and the Canyon Community Consultative Committee (CCC).

This Closure MOP has been prepared in consultation with DRE and will be provided to GSC, NSC and the Secretary for review following DRE's advice on the content.

Progress of rehabilitation and closure activities has been reported annually in the Annual Environmental Management Report (AEMR) which are made available on the Whitehaven website and presented at CCC meetings.

1.6.1 NSW Trade and Investment – Division of Resources and Energy

As outlined above the scope of this Closure MOP was developed in consultation with the DRE. A draft of this Closure MOP was presented to the DRE in October 2014 for comment before final submission. Some minor changes were made to the document following this feedback.

DRE advised during this consultation that the MOP would only be approved until the end of the Consent expiry and that a basic MOP Amendment would be required to update approvals details.

2 PROPOSED ACTIVITIES IN THE MOP TERM

2.1 Project Description

Mining ceased at Canyon in July 2009 and no additional mining activities will be undertaken during the MOP term. Activities proposed in the MOP term relate to monitoring in compliance with licences and approvals, rehabilitation maintenance, use or subletting of the Maintenance Facility for equipment storage and materials laydown and minor maintenance, and maintaining site security.

As outlined in **Section 1.1** the final void at Canyon has been proposed as a waste rock emplacement area for the Vickery Coal Project. Any activities associated with waste rock emplacement are subject to development of the Vickery Coal Project, and subsequently are not considered further in this Closure MOP. In the event that WHC do develop the Vickery Coal Project, WHC will transfer the relevant areas of ML 1471 to the Vickery Coal Project and undertake operations in accordance with a MOP developed for the Vickery Coal Project.

2.2 Primary Domains

Primary domains have been defined in accordance with the requirements of ESG3 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. Primary domains at Canyon are defined in **Table 3**. The footprint of each Primary Domain at the commencement of the MOP term is depicted on **Plan 2**.

Table 3 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, the partially demolished workshop and wash down bay, the Whitehaven Maintenance Facility and associated laydown area, gravel production area and explosives magazine.
Final Void	2	Footprint of the open cut pit area at the completion of mining that is below natural (pre-mining) ground level.
Water Management Area	3	The network of clean water and dirty water dams and associated infrastructure used for operational water management.
Overburden Emplacement Area	4	Footprint of rehabilitated out of pit waste and in-pit waste rock dumps.
Reject Emplacement Area	5	The footprint of two backfilled and rehabilitated coarse reject emplacements.
Topsoil Stockpile Area	6	The footprint of areas disturbed for topsoil stockpiling.
Other Lands	7	All remaining areas within ML 1471 not proposed to be disturbed by mining. This primary domain includes areas of remnant native vegetation proposed to be managed for enhanced biodiversity outcomes (Enrichment Zones 1 to 3).

2.3 Asset Register

The asset register (**Table 4**) provides a summary of the key features of each primary domain (see **Section 2.2**), and principal activities required for decommissioning and rehabilitation, that are costed in the Canyon RCE. The areas for each primary domain represent the footprint for each domain depicted on **Plan 2**.

Table 4 Asset Register

Domain	Area (ha)	Major Assets	Comments
Domain 1 Infrastructure	50.3	Ablutions block, unsealed access roads. Former Orica hardstand. Former workshop (decommissioned to basic structure). Vehicle washdown sump. Maintenance Facility. Tarrawonga Haul Road. Explosives Magazine and bund, unsealed access roads	Decommissioning activities include: Pumping out and removing septic tank, dismantling and removing the ablutions block and piers, and ripping compacted surfaces. Removing any contaminated or hazardous materials from the remaining workshop structure. Demolition of the remaining workshop structure. Relocation of the explosives magazine containers and weighbridge. Re-grading the explosives magazine earthen bund. *The Maintenance Facility and Tarrawonga Haul Road will be retained for future use.*
Domain 2: Final Void	22.1	Shaped final void under rehabilitation	Rehabilitation activities include ongoing water quality monitoring and rehabilitation monitoring and tubestock planting where required.
Domain 3: Operational Water Management Area	10	Sediment dams, clean water storage dams, pipelines and pumps	Decommissioning activities include dewatering and de-silting sediment dams, and converting sediment dams to clean water dams or backfilling.
Domain 4: Overburden Emplacement Areas	120.2	Shaped spoil emplacements under rehabilitation for native vegetation and pasture land uses	Rehabilitation activities include monitoring and maintenance as required.
Domain 5: Rejects Emplacement Areas	3.1	Capped and rehabilitated coarse rejects emplacements	Rehabilitation activities include monitoring and maintenance as required.
Domain 6: Topsoil Stockpile Areas	21.1	Topsoil reserves for remaining rehabilitation works, and former stockpile areas rehabilitated with native vegetation or pasture species.	Rehabilitation activities include monitoring and maintenance as required.
Domain 7: Other Lands	192.1	Site boundary fencing, stock management fencing, Enrichment Zones 1, 2, and 3.	Activities to be completed prior to relinquishment include maintaining fencing (if required), demonstrating completion criteria for Enrichment Zones and rehabilitating any minor disturbance associated with environmental monitoring.

2.4 Key Activities in the MOP Term

2.4.1 Exploration

It is unlikely that any further exploration associated with the Vickery Coal Project will occur on the Canyon site.

2.4.2 Construction

There will be no construction activities undertaken in the MOP term.

2.4.3 Mining Operations

No mining operations will be undertaken during the MOP term.

2.4.4 Whitehaven Maintenance Facility

Maintenance plant and equipment and materials will continue to be stored at the Maintenance Facility for use at nearby operations including Tarrawonga and Rocglen mines. Any activities including road transport of equipment and materials will be in accordance with approvals and environmental management plans.

2.4.5 Waste Management

Domestic Waste

Since mine closure, waste produced at Canyon is limited to non-production related wastes such as domestic-type wastes. WHC will maintain general waste bins at Canyon for the collection of putrescible wastes. Waste bins will be regularly inspected and serviced on a needs basis by contractors.

Hydrocarbon Waste

Minor amounts of hydrocarbon materials may be stored at the Maintenance Facility and may result in minor volumes of hydrocarbon wastes. Any waste hydrocarbons will be transported from site for disposal in accordance with legislation.

Sewage Waste

WHC will maintain portable toilet facilities for visitors and contractors and toilet facilities at the Maintenance Facility. Toilet facilities will be regularly inspected and serviced by contractors on a needs basis.

2.4.6 Land Contamination

There are no known land contamination issues at Canyon. All known contaminated soils (associated with the previously decommissioned fuel storage area and workshops) have previously been remediated at an on-site bioremediation area, which was subsequently removed. No further instances of significant land contamination are anticipated since ongoing exposure to hydrocarbons and chemicals since cessation of mining has been minimal. If, however, any land contamination is identified during the demolition of the remaining workshop structure, contaminated materials will be sampled and appropriately remediated in situ or removed from site by licenced contractors.

2.4.7 Water Management

Water management at Canyon is undertaken in accordance with the approved *Water Management Plan*. Since rehabilitation of the final void and all coal handling infrastructure, water management is limited to water monitoring and managing sediment basins in accordance with the Water Management Plan and EPL. Surface and ground water management are discussed further in **Section 3.2.2.**

2.4.8 Forecast Rehabilitation

Remaining rehabilitation activities required to meet criteria for lease relinquishment include the demolition of the remaining workshop structure and explosives magazine and, rehabilitation of hardstand areas and the former gravel production area (**Plan 2**).

There is also additional rehabilitation work required to supplement native vegetation tubestock plantings on the batters of the final void. However, it is not proposed to undertake these remaining rehabilitation activities until such time as development of the Vickery Coal Project is confirmed. Once there is a determination on the development of the Vickery Coal Project WHC will develop a schedule for the final rehabilitation of disturbance areas not required for future use, in consultation with the DRE.

3 ENVIRONMENTAL ISSUES MANAGEMENT

3.1 Environmental Risk Assessment

Environmental risks associated with the Canyon project were assessed during development of the *Canyon Open Cut Mine Closure Plan* (2009). The Risk Assessment was undertaken in accordance with the WHC Qualitative Likelihood Rating and Risk Rating Matrix which is consistent with the requirements of Joint Australian and New Zealand Standard *AS/NZS 31000:2009 Risk Management – Principles and Guidelines.*

The focus of the risk assessment was to identify key risks associated with closure and rehabilitation, and analysed risks using a qualitative approach that identified:

- Issue areas, associated risks, and the unmitigated risk rating;
- The anticipated consequences and likelihood;
- Existing and proposed additional controls, and
- The residual risk rating after implementation of nominated controls.

The key risks to rehabilitation identified for the *Canyon Open Cut Mine Closure Plan* (2009) are reproduced in **Table 5** below.

Table 5 Key Risks to Rehabilitation

Issue	Risk	Unmitigated Consequence	Unmitigated Probability	Unmitigated Risk Rating	Controls	Residual Risk
Water	Surface water contamination	3	D	M	Water Quality Monitoring Erosion control structures	L
Water	Contamination of Groundwater	3	E	M	Water Quality Monitoring	M
Water	Erosion and Sedimentation	2	B	H	Appropriate design of erosion and sediment control structures	M
Air Quality	Air Pollution	3	D	M	Restrict Grazing Control of vehicular access	L
Visual Impact	Inadequate tree screening	2	E	L	Ongoing tree planting for visual screening	L
Contaminated Land	Chemical spills	3	D	M	No chemical storage on site	L
Contaminated Land	Hydrocarbon Contamination	4	D	M	Soil sampling Treatment Verification of clean up samples	M
Contaminated Land	Final void contamination	4	D	H	Water quality monitoring	M
Rehabilitation	Rehabilitation fails to match control plots	4	D	H	Ongoing monitoring and enhancement where required	M
Rehabilitation	Seedling and cover crop failure	3	C	H	Watering Reseed in appropriate conditions	M
Rehabilitation	Re-shaped landform slumping	3	E	M	Visual inspection	M
Rehabilitation	Final void failure	3	D	M	Monitoring of bank stability	M
Rehabilitation	Spontaneous combustion	3	D	M	Site Observation Cover of emplacement area with 3m inert material	L
Climate	Flooding	2	E	L	-	L
Climate	Drought	3	C	H	-	H

Issue	Risk	Unmitigated Consequence	Unmitigated Probability	Unmitigated Risk Rating	Controls	Residual Risk
Climate	Bushfire	4	E	H	Visual inspection Access to site water Maintenance of fire breaks	M
Pests and Weeds	Feral animal infestation	2	D	L	Observation Liaise with adjacent land owners and RLPB	L
Pests and Weeds	Weed Infestation	2	A	H	Site inspection Spot Spray application	M
Flora and Fauna	Impacts to threatened fauna	4	E	H	Ongoing fauna monitoring Linking remnant vegetation	M
Flora and Fauna	Impacts to threatened flora	4	E	H	Ongoing flora monitoring Linking remnant vegetation Restricting grazing	M
Heritage	Loss of Aboriginal Heritage	3	E	M	Consultation with Local Aboriginal community Fencing Signage	L

3.2 Environmental Risk Management

All operations at Canyon are undertaken in accordance with the approved Environmental Management Plans which have been developed in accordance with the requirements of Development Consent DA 8-1-2005, EPL 10094, and MLs 1464 and 1471.

- *Environmental Management Strategy (2006);*
- *Environmental Monitoring Program (2007);*
- *Archaeology and Cultural Heritage Management Plan (2006);*
- *Flora and Fauna Management Plan (2006);*
- *Noise Monitoring Program (2007);*
- *Road Noise Management Plan (2006);*
- *Blasting Monitoring program (2006)*
- *Air Quality Monitoring Program (2006);*
- *Water Management Plan (comprising Erosion and Sediment Control Plan) (2007);*
- *Hydrocarbon Management plan (2006);*
- *Bushfire Management Plan (2006);*
- *Weed Management Strategy;*
- *Waste Management Strategy; and*
- *Biodiversity Offset Management Plan (2013).*

The latest approved version of all external plans and programs are available on the Whitehaven Coal website (http://www.whitehavencoal.com.au). Monitoring requirements documented in the above Environmental Management Plans are consolidated in the *Environmental Monitoring Program*.

3.2.1 Air Quality

In accordance with the *Air Quality Monitoring Program*, air quality is monitored monthly, with the intention of staged removal of monitoring points on relinquishment of area.

Now that the mine is closed, the greatest capacity for ongoing dust generation off the site is from insufficiently established groundcover, allowing wind to generate dust.

Current controls to minimise the impact and risk of air pollution are:

- Maintenance of groundcover at rehabilitation areas by (generally) restricting or excluding grazing;
- Restriction of vehicular access to minimise exposed surfaces from traffic;
- Ongoing monitoring of established groundcovers to ensure sufficient cover is maintained; and
- Re-planting to cover crop where required.

In the event that any remaining infrastructure is decommissioned and removed prior to lease relinquishment air quality impacts will be managed by:

- Utilising water carts to suppress dust where required during any demolition or earthworks activities (such as ripping hardstand areas); and
- Establishing cover crops as soon as practicable upon completion of surface preparation.

3.2.2 Surface and Ground Water

Surface water and groundwater impacts at Canyon Mine are managed in accordance with the approved *Water Management Plan*. The *Water Management Plan* includes an *Erosion and Sediment Control Plan*.

The surface water management system at Canyon includes:

- Diversion banks to divert clean water flows away from disturbance areas to clean water storage dams;
- Storage dams that harvest clean water and clarified dirty water discharged from sediment dams. Storage Dams SD-1 to SD-5 are licenced discharge points (LDPs) for water discharges from site;
- Catch drains to collect and direct potentially sediment-laden water generated from the existing mining operations to sediment basins;
- Sediment basins to detain potentially sediment-laden water and the controlled release of clarified water;
- Contour banks and rock lines waterways on, or to direct water from, the post-mining landform to the natural surface; and
- Agricultural contour banks and farm dams.

Discharges from Canyon report to Driggle Draggle Creek. 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 LDP during each overflow event (i.e. while discharging), and upstream and downstream of Canyon in Driggle Draggle 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 LDP satisfies the NSW EPA's requirements to remove the LDP for the catchment from the EPL. Once discharge from a given catchment is considered clean water, sediment dams will be dewatered, desilted, and (where required) embankments will be graded and seeded to convert the basins to clean water storage dams for post mining use.

Groundwater

There are two principal groundwater resources within the vicinity of Canyon, being:

- Consolidated coal measures and basement rocks; and
- Unconsolidated colluvial / alluvial surficial sediments.

The coal measures and basement rocks exhibit low intergranular porosity and permeability, with resultant ground water storage and flows being low, tending to be highest in the coal seams themselves or in the fracture systems (faults and joints) in the rock mass. These fracture systems tend, however, to be of limited spatial extent and connectivity.

The unconsolidated sediments aquifer tends to be confined to areas removed from the Whitehaven Coal Mine, principally to the areas to the north.

During final shaping of the void, care was taken to ensure the RL of the void floor was higher than the RL of the extracted coal seam in order to avoid groundwater seepage into the void. Initial water quality testing since completion of the final void is indicative of EC levels expected in surrounding surface water storages, with no indication of groundwater infiltration.

Groundwater Interaction with the Final Void

The final void has been designed as a permanent storage dam that receives flows from rehabilitation areas to the east of the void. The void high walls and low walls were battered back to provide sufficient backfill to raise the floor of the void above the RL of the extracted coal seams, and prevent saline groundwater contaminating the clean water stored in the void lake.

Water monitoring in the void has been undertaken since 2009 and does not indicate a rising trend in EC indicating that there is no significant groundwater inflow into the void lake. Quarterly groundwater monitoring incorporates Standing Water Level (SWL), field Electrical Conductivity (EC) and field pH. Six monthly monitoring includes SWL, field pH and EC as well as laboratory analysis of EC, pH, metals and trace elements. Monitoring shows the void water EC has been stable from 2012 through 2013, with a maximum of 864 µS/cm compared to typical pit water recordings of 3000 – 4000 µS/cm.

Groundwater monitoring will be ceased through staged removal of relevant monitoring points on relinquishment of the area.

3.2.3 Erosion and Sedimentation

Erosion and sedimentation impacts are managed in accordance with the *Erosion and Sediment Control Plan*, included in the *Water Management Plan*. Final landform drainage structures including contour banks, drains and rock lines structures have been designed and constructed on rehabilitated landforms to manage run-off from rehabilitation areas at sub-erosive velocities.

As outlined in **Section 3.2.2** above, all runoff from rehabilitation areas is directed to sediment basins and storage dams prior to discharge from site, or into the void lake. Water quality monitoring data (TSS) indicates that the water management system is generally effective in minimising erosion, and discharges are (with a few isolated exceptions) in accordance with EPL discharge water quality criteria.

Erosion is assessed in annual rehabilitation monitoring events and any significant erosion features are remediated as required. Since rehabilitation of the final void commenced in 2009 there have been isolated instances of minor gullying and contour bank failure that are remediated with conservation earthworks and re-seeding as required.

3.2.4 Contaminated Land

Land contamination is managed in accordance with the *Waste Management Plan*. As outlined in **Section 2.4.6** there are no known instances of land contamination remaining at Canyon. Since closure the ROM coal handling and stockpiling facilities, workshops, fuel storage and chemical storage facilities have all been decommissioned and (with the exception of the remaining workshop structure)_ rehabilitated.

As outlined in **Sections 2.4.5** and **2.4.6**, any hydrocarbon wastes or contaminated materials identified in the MOP term will be remediated or disposed of in accordance with legislation by appropriately qualified contractors.

Current controls to prevent instances of land contamination are:

- No disposal of any waste materials on the mine site. Minimal volumes of wastes generated at the Maintenance Facility and toilet facilities are segregated in waste bins that are regularly inspected and collected on a needs basis; and
- All materials requiring disposal are collected by appropriately licensed contractors for off-site disposal.

3.2.5 Flora and Fauna

Flora

Over the life of operations, flora monitoring across the site has not identified any threatened flora species. Extensive clearing for agriculture and intensive grazing pre-mining diminished the potential for the occurrence of threatened flora species at the site.

Since entering closure in 2009, flora surveys undertaken for the adjacent Vickery Coal Project have identified four occurrences (totalling 420 individuals) of the species Winged Peppercress (*Lepedium monoplocoides*) in the north west of ML 1471. Winged Peppercress is listed as Endangered under both the *NSW Threatened Species Conservation Act* (TSC Act) 1995 and the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999. Winged Peppercress is highly palatable to grazing fauna and stock. In accordance with the recommendations of the *National Recovery Plan for the Winged Peppercress* (Victorian Government Department of Sustainability and Environment) the population is fenced within a 20 m exclusion zone to exclude grazing and unauthorised access.

Since no further disturbance is anticipated to facilitate the closure process, there are not anticipated to be any impact on threatened flora in the MOP term.

Controls to reduce the potential for impacts to threatened flora include:

- Fencing populations of Winged Peppercress to exclude grazing fauna and stock;
- Enhancement of woodland communities by replanting and linking with remnant vegetation;
- Exclusion of vehicular traffic other than on designated access roads;
- Weed and feral animal control; and
- Ongoing monitoring to confirm improving biomass across the rehabilitation zone to levels consistent with those in established control plots.

Fauna

Management of fauna is undertaken in accordance with the sites *Flora and Fauna Management Plan*.

Sixty nine fauna species were identified within or surrounding ML 1471, of which four (the Grey Falcon, Glossy Black Cockatoo, Grey Crowned Babbler and Yellow-bellied Sheathtail Bat) are listed under the TSC Act 1995. Of these all but the Grey Crowned Babbler were located distant from or overflying ML 1471. A breeding family and four nests of the Grey Crowned Babbler were identified with one of the four nests being located within the area to be disturbed and the other three being within 50m. The calls of the threatened bat (Yellow-bellied Sheathtail bat) have continued to be recorded throughout the life of the mine with no perceptible impact on this species. Over the life of operations, fauna monitoring across the site has not identified any significant impacts on threatened fauna.

Management controls to reduce impact on threatened fauna include:

- No additional clearing as part of rehabilitation process;
- Replanting of the majority of the site to native vegetation to provide linkages with existing remnant vegetation and to enhance habitat value;
- Ongoing control of weeds and feral animals;
- Placement of felled/hollow timber back across the rehabilitation for habitat purposes; and
- Ongoing monitoring to establish levels of fauna habitation across the rehabilitated area to confirm improving biodiversity and consistency with control plots.

3.2.6 Weeds and Pests

Weed Management

Under the NSW *Noxious Weeds Act 1993,* Canyon has a statutory responsibility to prevent the spread of noxious weeds on all Whitehaven lands. Failure of rehabilitation due to inadequate control of weeds is considered a high risk if weeds are not controlled. Weed species presence and abundance is assessed in the annual rehabilitation monitoring program on both rehabilitation areas and analogue sites.

Several weed species including the noxious weeds Bathurst Burr and Prickly Pear were recorded in the 2013 rehabilitation monitoring event. The most commonly occurring weeds recorded are Saffron Thistle and Cotton Fireweed (pasture areas) and Scarlett Pimpernell, Haresfoot Clover and Rhodes Grass (native vegetation areas). Rhodes Grass has been used in initial cover crop seed mixes and has been found to have persisted in all rehabilitation areas. Due to the competition Rhodes Grass presents, this species represents a threat to the establishment of sustainable native pasture.

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

- Ongoing visual assessments and annual weed monitoring;
- Application of herbicides where required to control weed infestations;
- Recording and controlling any occurrences of Class 4 noxious weeds in accordance with the Narrabri Shire Council management plan;
- Restriction of grazing and vehicular traffic to minimise spread of weeds; and
- Liaison with the North West Local Land Services (LLS) and adjacent landowners.

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.
- Liaison with adjoining landholders and the North West LLS, and participation with any local landholder and/or North West LLS vertebrate pest control programmes. Pest control actions may include 1080 poison baiting for European Rabbits, Feral Pigs and European Red Foxes, and the trapping of Feral Pigs.

Seedlings (tubestock) planted in rehabilitation areas may be protected from grazing pest animals including rabbits by installing plastic tree guards if required.

3.2.7 Soil Resources and Management

Soil Resources

Soil resources at Canyon were assessed for the Stage 2 Statement of Environmental Effects (SEE) by Geoff Cunningham Natural Resource Consultants (GCNRC) in 2005. GCNRC (2005) identified and classified soils to be stripped for the Canyon extension and assessed soils previously stripped and stockpiled.

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

- Shallow sandy clay loams and silty clay loams on the upper crests;
- Duplex soils with loamy topsoils and clayey subsoils on the mid slopes; and
- Deep clay soils on the flats.

Topsoils and subsoils were stripped and stockpiled separately for pasture rehabilitation, general rehabilitation and native vegetation rehabilitation in order to optimise the soil qualities for the intended final land use. Soils stripped from the Womboola property were identified for use in native vegetation rehabilitation to conserve the native seed bank from vegetated areas associated with this area for native vegetation rehabilitation.

GCNRC undertook a soil balance for the Stage 2 SEE (GCNRC, 2005) and identified sufficient suitable material to replace soils in rehabilitation areas at average depths of up to (approximately):

- 25 cm topsoil in pasture rehabilitation areas at infrastructure areas where topsoils only were stripped (e.g. office areas and access roads);

25 cm topsoil and 50 cm subsoil on pasture rehabilitation areas where both topsoil and subsoil replacement is required, such as the ROM pad and hardstand areas;

- 7 cm topsoil and 50 cm subsoil (or friable weathered overburden) at native vegetation rehabilitation areas; and
- 15 cm topsoil and 50 cm subsoil on areas nominated to be returned to Rural Land Capability Class II land (refer to **Plan 4**).

Soil Stripping and Stockpiling

All topsoils and subsoils were salvaged during operations in accordance with the soil stripping depth recommendations in the 2005 Stage 2 SEE. Topsoils and subsoils were assessed to have a generally good structure but susceptible to structural damage from excessive or improper handling. To minimise structural damage WHC stripped soils using scraper fleets and stockpiled soils adjacent to the intended rehabilitation area to minimise future re-handling. Long term soil stockpiles have been shaped and stabilised with grass and legume seed mixes and have erosion and sediment controls where appropriate. Remaining soil stockpiles are shown on **Plan 2** and **Plan 3.**

Soil Management during the MOP Term

Since there will be no additional disturbance there will be no additional soil resources stripped for rehabilitation at Canyon prior to relinquishment Existing soil stockpiles will continue to be monitored during routine inspections to identify erosion issues or presence of weeds. Routine maintenance including weed control, re-seeding with pasture species, and repairing erosion and sediment controls will be undertaken as required during the MOP term.

It is anticipated that there is a surplus of available stockpiled soil resources to complete rehabilitation at infrastructure areas at Canyon that are not retained at closure. WHC will undertake a soil balance review during this MOP term to verify that there is sufficient remaining soil resources stockpiled to complete rehabilitation for the site and, if necessary, review the proposed soil replacement depths and / or available soil substitutes.

3.2.8 Noise

Potential noise impacts during operations were managed in accordance with the Noise Monitoring Program. Since closure, sources of noise emissions are minimal, and subsequently the EPL was varied in November 2011 and noise monitoring is no longer a requirement of the EPL, and is no longer undertaken.

Noise emission limits at sensitive receivers (surrounding residences) documented in the EPL (Condition L3.1) continue to apply. Anticipated sources of noise in the MOP term are associated with vehicular movements at the Maintenance Facility, demolition and removal of materials associated with the remaining workshop structure and ablution facilities, and minor earthworks associated with re-grading the explosives magazine bund, decompacting hardstands and access roads, and rehabilitation maintenance.

In order to minimise the potential for any noise limit exceedances, all rehabilitation activities in the MOP term will be undertaken in daytime hours only.

3.2.9 Visual and Lighting

The progressive rehabilitation to date has been designed to produce a final landform that is consistent with the surrounding topography. The site remains obscured from view from the Blue Vale Road to the east with the battered slopes on the northern and western sides obscuring views of the mine from Hoad Lane and adjoining rural properties.

Additional controls to minimise visual impact includes:

- Seedling plantings to screen the site from adjacent areas;
- Plantings undertaken around the final void to provide a natural screen to the void; and
- Fencing works using rural type fencing styles consistent with fencing in the general locality.

3.2.10 Aboriginal and Cultural Heritage

Archaeological investigations undertaken at Canyon since 1999 have identified four Aboriginal heritage sites in addition to a previously known site recorded in the AHIMS database (site No 24-4-0013). Of these sites, only two, referred to as “Whitehaven 3” and “Whitehaven 4” lie within the Canyon mining leases (refer to MOP Plan 2).

In keeping with a request from the Red Chief LALC, site “Whitehaven 3”, a scarred tree located adjacent to the southern mine lease boundary, has been protected by fencing and assigned “no go status”. This site is the only known Aboriginal Heritage site that was within close proximity to the mine operations. The site is fenced and known to WHC staff.

“Whitehaven 4” was located within the extraction area. Artefacts at this site were salvaged by representatives of the Red Chief LALC in accordance with a Section 90 Permit (No 2051) prior to disturbance.

The area external to ML 1471 incorporating Sites “Whitehaven 1” and “Whitehaven 2” and No 24-2-0013 are not within the Canyon project boundary, however, to minimise any potential for adverse impacts these sites have also been fenced and demarcated as “no go” areas.

Aboriginal cultural heritage is managed in accordance with the approved *Archaeology and Cultural Heritage Management Plan* (ACHMP) (WHC, 2005) which was prepared by WHC in accordance with condition 32 (Schedule 3) of DA 8-1-2005 and in consultation with Red Chief Local Aboriginal Land Council.

3.2.11 European Heritage

There are no known features with European heritage value located within or immediately surrounding Canyon.

3.2.12 Spontaneous Combustion

Coal resources mined at Canyon were not considered a high risk of spontaneous combustion due to the low percentage of inorganic sulphur. There was one incidence of spontaneous combustion during the operational phase of the project that was attributed to an extended period of stockpiling heat affected coal at the ROM stockpile.

Since entering closure, carbonaceous material has been removed from the former ROM area and all exposed coal in the void has been covered during reshaping of the void batters. Also, two reject emplacement areas (REAs) that received coarse reject material from the Whitehaven CHPP were capped, shaped, topsoiled and seeded with pasture mix in 2010 (refer to **Plan 2**). Subsequently the risk of spontaneous combustion is considered low on the rehabilitated landform. Regardless, WHC maintains visual inspections of REAs to identify and evidence of spontaneous combustion.

3.2.13 Bushfire

Fire prevention is undertaken in accordance with the *Canyon Bushfire Management Plan* which has been developed in consultation with the Rural Fire Service (RFS) local bushfire controller and Narrabri and Gunnedah Shire Councils.

Despite Canyon being located in an area that has been predominantly cleared for agriculture and grazing, bushfire and grassfires are considered a high risk and have the potential to significantly impact juvenile vegetation in native vegetation rehabilitation areas. A bushfire event impacted approximately 17.5 ha of native vegetation rehabilitation at Canyon in 2013 (refer to **Plan 2**) causing significant damage to the shrub and tree species. Recovery of the bushfire affected rehabilitation will be assessed in the annual rehabilitation monitoring program (refer to **Section 8.1.3)**. Monitoring results and any recommended maintenance activities for bushfire affected rehabilitation will be reported in the AEMR.

Control measures to minimise the potential for further occurrences of uncontrolled bushfire during closure are:

- Maintaining fire breaks;
- Ongoing consultation with the RFS;
- Maintaining access to site and to water sources (storage dams) for fire-fighting; and
- Monitoring fuel loads and fuel load reduction (back burning, slashing or controlled grazing) if required.

In addition, the nearby Tarrawonga and Rocglen operations maintain sufficient firefighting resources to respond to an incident of bushfire at Canyon if required and as directed by the Rural Fire Service.

3.2.14 Drought

The probability of drought occurring during the rehabilitation is relatively high based on conditions that have been experienced over the last few years. Seasonal conditions will have a significant bearing on the success, or otherwise, of the rehabilitation process, however, there is little that can be done to prevent, or minimise the impact of drought. WHC will monitor seasonal conditions and make planting decisions based on weather patterns and chances of planting success.

Control features to reduce impact of drought may include:

- Supplementary watering of seedlings to improve establishment;
- Seeding and planting in appropriate conditions;
- Restriction of grazing across rehabilitated areas;
- Infill planting in areas affected by drought; and
- Deep ripping (>30cm) for new plantings to enhance infiltration capacity for storage of moisture in the profile.

4 POST MINING LAND USE

4.1 Regulatory Requirements

The regulatory and approval requirements relating to post mining land use and rehabilitation are summarised in **Table 6** below.

Table 6 Regulatory and Approval Requirements Relating to Post Mining Land Use and Rehabilitation

Condition	Requirement	Status
DA 88-1-2005 MOD 3		
Schedule 2, Condition 1	The applicant shall implement all practicable measures to prevent or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.	In progress.
Schedule 2, Condition 10	The applicant shall ensure all demolition work is carried out in accordance with the Australian Standard AS2601-2001: The Demolition of Structures, or its latest version.	In progress.
Schedule 3, Condition 25	At least 6 months before the cessation of mining, the Applicant shall prepare and implement a final *Void Management Plan* for the site, in consultation with the DPI, and to the satisfaction of the Director-General. This plan must: investigate options for the future use of the final void; assess the potential interactions between the final void and the adjacent groundwater and surface water resources; and describe what actions and measures would be implemented to: minimise any potential adverse impacts with the final void; and manage and monitor the potential impacts of the final void over time.	Complete.
Schedule 3, Condition 28	Within 6 months of this consent, the Applicant shall prepare and implement a detailed *Flora and Fauna Management Plan* for the site, to the satisfaction of the Director-General. This plan must include: a description of the offset strategy in broad terms, including its objectives and its relationship to the rehabilitation of the mine over time; completion criteria for the offset strategy; a description of what actions and measures will be implemented over the next 3 years; a flora and fauna monitoring program that is based on sound statistical principles; and a description of the procedures that would be implemented to: salvage and reuse material from the site; clear vegetation on site; collect and propagate seed from the local area; control weeds and feral pests (particularly fox control); and control access to the offset area	Complete.
Schedule 3, Condition 43	At least 6 months prior to the cessation of mining, the Applicant shall prepare a Mine Closure Strategy for the development, in consultation with the DPI, GSC and NSC, and to the satisfaction of the Director-General.	Canyon Open Cut Coal Mine – Closure Plan (2009), (superseded by this MOP).

Condition	Requirement	Status
Schedule 3, Condition 44	The Applicant shall rehabilitate the site to the satisfaction of DRE. This rehabilitation must be consistent with the approved Mine Closure Strategy required under Condition 43 above.	In progress.
ML 1471		
2	Mining Operations Plan (MOP) Mining operations, including mining purposes, must be conducted in accordance with a Mining Operations Plan (the Plan) satisfactory to the Director-General. The Plan together with the environmental conditions of development consent and other approvals will form the basis for:- Ongoing mining operations and environmental management; and Ongoing monitoring of the project The Plan must be prepared in accordance with the Director-General's guidelines current at the time of lodgement. A Plan must be lodged with the Director-Genera:- Prior to the commencement of operations; Subsequently as appropriate prior to the expiry of any current Plan; and In accordance with any direction issued by the Director-General. The Plan must present a schedule of proposed mine development for a period of up to seven (7) years and contain diagrams and documentation which identify:- Area(s) proposed to be disturbed under the Plan; Mining and rehabilitation method(s) to be used and their sequence; Areas to be used for disposal of tailings/waste; Existing and proposed surface infrastructure; Progressive rehabilitation schedules; Areas of particular environmental sensitivity; Water management systems (including erosion and sediment controls); Proposed resource recovery; and Where the mine will cease extraction during the term of the Plan, a closure plan including final rehabilitation objectives/methods and post mining landuse/vegetation The Plan when lodged will be reviewed by the Department of Mineral Resources. The Director-General may within two (2) months of the lodgement of a Plan, require modification and re-lodgement. If a requirement in accordance with clause (6) is not issued within two months of the lodgement of a Plan, lease holder may proceed with the implementation of the Plan submitted subject to the lodgement of the required security deposit within the specified time. During the life of the Mining Operations Plan, proposed modifications to the Plan must be lodged with the Director-General and will be subject to the review process outlined in clause (5)-(7) above.	This MOP.
15	Dumps The lease holder shall comply with any direction, given or which may be given by the Inspector regarding the dumping, depositing or removal of material extracted as well as the stabilisation and revegetation of any dumps of coal, minerals, mine residues, tailings or overburden situated on the subject area or the associated colliery holding.	In progress.
21	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister any lands within the subject area which may have been disturbed by the lease holder.	In progress.

Condition	Requirement	Status
22	Upon completion of operations on the surface of the subject area or upon the expiry or sooner determination of this authority or any renewal thereof, the lease holder shall remove from such surface such buildings, machinery, plant, equipment, constructions and works as may be directed by the minister and such surface shall be rehabilitated and left in a clean, tidy and safe condition to the satisfaction of the Minister.	In progress.
23	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister any lands within the subject area which may have been disturbed by mining or prospecting operations whether such operations were or were not carried out by the leaseholder.	In progress.
24	The lease holder shall take all precautions against causing outbreak of fire on the subject area.	In progress.
25	The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment.	Contamination assessments for the former workshop and fuel stores complete.
EPL10094		
O4.1	As soon as practical after mining activities cease on any disturbed areas, the area must be restored to an environmentally stable, safe and revegetated condition with minimal visual impact.	In progress.

4.2 Post Mining Land Use

The overall closure goal for Canyon is to restore the landform to be capable of sustaining pre-mining land-uses. WHC considers that rehabilitating Canyon to produce a mix of grazing and native vegetation landuses is most appropriate and compatible with the surrounding land uses and landscapes. In accordance with the rehabilitation strategy proposed in the 2005 SEE, biodiversity values in and surrounding Canyon will be improved by establishing native vegetation on rehabilitation areas.

4.2.1 Vickery Coal Project

As outlined in **Section 0** Canyon is adjacent to the approved but undeveloped Vickery Coal Project that proposed to utilise the Canyon void for waste emplacement. If the Vickery Coal Project is developed, WHC will transfer statutory responsibility for the proposed emplacement area to Vickery via a partial mine lease transfer, and a new Canyon Closure MOP will be prepared that excludes the transferred lease area.

4.2.2 Biodiversity Enhancement

In accordance with the rehabilitation strategy proposed in the 2005 SEE the post mining landform will include at least 132 ha rehabilitated with native vegetation to contribute to regional biodiversity connectivity. Native vegetation rehabilitation areas will link with biodiversity enrichment zones that were initially proposed as biodiversity offsets in remnant native vegetation areas within ML 1471, and have since been voluntarily retained since the establishment of the off-site Whitehaven offset site, known as the Whitehaven Biobank Site, which incorporates Canyon offsets.

The landscape surrounding Canyon has been predominantly cleared for agriculture, with isolated pockets of remnant vegetation resulting in very little habitat connectivity between the Vickery State Forest to the east and Pilliga State Forest and National Park to the west. Subsequently, native vegetation areas and enrichment zones established at Canyon will provide valuable native fauna refuge and foraging opportunities, particularly for woodland birds, and will contribute to improved regional connectivity. Native vegetation rehabilitation areas and enrichment zones are depicted on **Plan 4**.

4.2.3 Pasture

The post mining landform will include at least 41.4 ha of land rehabilitated with native pasture. Pasture rehabilitation areas will be created with a mix of land capability classes that reflect the pre-mining environment and restore the potential for productive grazing areas with characteristics similar to pasture areas in the general locality.

4.2.4 Final Void

In accordance with DA 8-1-2005 MOD 2, one final void in the south western limits of the open cut extraction area has been retained in the final landform. The final void area has been designed and constructed to function as a permanent clean water storage dam. The highwalls and lowwalls have been regraded with batters generally less than 14 degrees and stabilised with pasture species.

The void batters above the permanent water level are proposed to be rehabilitated with native vegetation in the event that the Vickery Coal Project will not be developed as outlined in **Section 0**.

4.2.5 Retained Infrastructure

Canyon is in close proximity to the Tarrawonga and Rocglen operations. The Tarrawonga Haul Road traverses ML 1471 and is anticipated to be used to transport ROM coal to the Whitehaven CHPP for several more years. Consequently WHC proposes to retain the Tarrawonga Haul Road in the final landform at relinquishment.

Following closure WHC obtained approval from Narrabri Shire Council to construct the Maintenance Facility comprising maintenance supplies and parts stores and office building at the former Orica hardstand area (**Plan 2**). The Maintenance Facility is immediately adjacent to the Tarrawonga haul road and provides a central location for use by WHC operations for materials and parts storage. WHC propose to also retain the Maintenance Facility following lease relinquishment for ongoing use by WHC operations.

4.3 Rehabilitation Objectives

The primary objective of Canyon's rehabilitation is to establish a low maintenance, geotechnically stable and safe landform that blends the created post-mining landform with the surrounding land fabric.

Key rehabilitation objectives to achieve the desired post mining land use are to:

- Minimise visual impacts by creating a landform that blends with the adjoining landscape, and, with the exception of the final void, provides no obvious evidence of a prior mining land use;
- Design and construct the final landform, including appropriate slopes and surface water management, to create a low maintenance, geo-technically stable, and non-polluting final landform;
- Reinstate native pasture areas that are capable of sustaining grazing with a mix of land capability that reflects the pre-mining environment; and
- Rehabilitate native vegetation areas to provide suitable habitat for native fauna and improve connectivity between rehabilitation areas, regrowth areas and remnant vegetation.

5 REHABILITATION PLANNING

5.1 Domain Selection

Primary and secondary domains have been defined in accordance with the methodology prescribed in ESG3 (DRE 2013). Primary domains are discussed in **Section 2.2** and depicted on **Plans 2** and **3**.

Secondary Domains are land management units with similar post mining land use objectives, such as pasture and native vegetation rehabilitation areas. Secondary Domains reflect the proposed post mining land use described in **Section 4.1** and have been selected in accordance with all relevant regulatory requirements for rehabilitation as described in **Table 6**.

Secondary domains are depicted on **Plans 2** to **4**, and are described in **Table 7**.

Table 7 Secondary Domains

Secondary Domains	Code	Description
Final Void	A	The footprint of the open cut extraction area not backfilled to the pre-mining RL. The final void is designed and constructed to capture and store run off from rehabilitated emplacement areas to provide a reliable water source.
Rehabilitation Area - Native Vegetation	B	The footprint of areas rehabilitated with native vegetation species analogous to adjacent remnant vegetation communities. Native vegetation areas will have characteristics similar to analogue sites established at adjacent analogue native vegetation areas to provide suitable habitat for native fauna.
Rehabilitation Area - Pasture	C	Footprint of areas rehabilitated with native pasture species and a rural land capability of (at least) Class VI, sufficient to sustain a grazing land use.
Enrichment Zones	D	The footprint of remnant vegetation areas preserved and enhanced with supplementary plantings to enhance biodiversity values.
Water Management Area	E	The network of dams and water management structures retained in the final landform. Dams will provide water resources for grazing areas and native fauna.
Retained Infrastructure	F	Infrastructure proposed to be retained following relinquishment including the Tarrawonga Haul Road through the eastern portion of ML 1471 and the adjacent Maintenance Facility and associated hardstand / laydown area.

5.2 Domain Rehabilitation Objectives

Rehabilitation objectives for the domains identified in the sections above are described in **Table 8**.

Table 8 Domain Rehabilitation Objectives

Domain	Code	Rehabilitation Objective
Primary Domains		
Infrastructure	1	Infrastructure will be progressively decommissioned and removed from site when no longer required. Unless agreed with regulators, all infrastructure and services will be removed from site (except the Maintenance Facility and Tarrawonga Haul Road) prior to relinquishment. All hazardous and contaminated materials will be identified and remediated on site or removed by appropriately licenced contractors in accordance with legislation. Infrastructure areas will be rehabilitated with a combination of native vegetation and pasture areas analogous to analogue sites.
Open Cut Void	2	Post mining landforms will be geo-technically stable, safe and non-polluting. The final void will be minimised by backfilling the open cut pit with waste rock. The final void will be designed and constructed in accordance with the approved final void design. Final void will be partially backfilled with overburden and shaped to a depth of approximately RL 25m to maintain a barrier between the void and groundwater inflows. The final void highwalls and low walls will be shaped to improve visual amenity and geotechnical stability, and achieve batters generally less than 14 degrees (the northern, western and southern batters), and 6 degrees (eastern batter).
Operational Water Management Area	3	Downstream water users are not adversely affected by the mine's operation. Where practical clean water will be diverted around disturbance areas. Dirty water run-off (including rehabilitation areas) will be captured and treated prior to discharge in accordance with EPL discharge criteria. 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. Sediment dams will be progressively decommissioned when no longer required (dewatered and de-silted) and converted to clean water dams for retention in the final landform.
Overburden Emplacement Area	4	Post mining landforms will be geo-technically stable, safe and non-polluting. Overburden emplacement areas will be adequately drained with drainage structures designed and constructed in accordance with the Blue Book. Overburden emplacement areas will be shaped with slopes generally less than 11 degrees. Overburden emplacement areas will be rehabilitated with a combination of native vegetation and pasture areas analogous to analogue sites.
Reject Emplacement Area	5	Post mining landforms will be geo-technically stable, safe and non-polluting. Rejects will be capped with at least 3 m of inert overburden material, subsoil and topsoil. Rejects emplacement areas will be shaped to be free draining and exhibit an absence of ponding. Reject emplacement areas will be rehabilitated with pasture species analogous to analogue sites.

Domain	Code	Rehabilitation Objective
Topsoil Stockpile Area	6	Topsoil stockpiles will be established and maintained to minimise loss of soil structure, retain biological health and minimise establishment of weeds. Topsoil stockpiles will be located in appropriate areas (relatively flat, away from drainage lines). Topsoil stockpiles will be located in areas not proposed to be disturbed for mining to minimise the potential for stockpiles to require relocation. Following topsoil re-use, stockpile areas will be lightly ripped and revegetated with a combination of pasture and native vegetation communities.
Other Lands	7	All other lands within ML 1471 not disturbed by mining will be managed to control weeds and pest animal species. Lands not disturbed by mining will include at least 19.2 ha of native vegetation enrichment areas that are managed to improve biodiversity and habitat connectivity within and adjacent to ML1471. Enrichment areas will be maintained through the life of the operation to minimise the impacts of mining on native fauna.
Secondary Domains		
Final Void	A	The final void will be geo-technically stable, safe and non-polluting. The catchment reporting to the final void will be designed and constructed to provide flows that fill the void. The final void lake will provide a permanent water resource with water quality suitable for native fauna and agricultural use. Embankments above the permanent water level will be vegetated with native vegetation consistent with native vegetation rehabilitation areas to contribute to fauna habitat connectivity.
Rehabilitation Area - Native Vegetation	B	At least 132 ha of native vegetation with characteristics analogous to analogue sites will be established on areas disturbed by mining. Native vegetation areas will contribute to maintaining the genetic diversity of flora occurring in the locality by utilising locally collected seed and preserving the topsoil seedbank. Native vegetation areas will contribute to habitat resources and linkages with adjacent native vegetation including the Vickery State Forest.
Rehabilitation Area - Pasture	C	At least 41.4 ha of perennial native pasture with characteristics analogous to analogue sites will be established on areas disturbed by mining. Grazing rehabilitation areas will comply with (at least) a Rural Land Capability of Class VI. Approximately 16 ha of Rural Land Capability Class II land will be reinstated using soils salvaged from Class II areas disturbed by mining. Management inputs required to sustain grazing will be in the range of analogue sites.
Enrichment Zones	D	At least 19.2 ha of remnant native vegetation will be retained and be managed for enhanced biodiversity outcomes. 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.
Water Management Area	E	The final landform drainage will be designed and constructed to integrate with surrounding catchments. 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.
Retained Infrastructure	F	The Maintenance Facility and associated hardstand area, and Tarrawonga Haul Road will be retained in the final landform for use by adjacent mining operations. Any contamination and hazardous materials will be remediated and/or removed prior to lease relinquishment and/or land ownership transfer.

5.3 Rehabilitation Phases

The rehabilitation process can be described as a sequence of conceptual rehabilitation phases to achieve a final land use that is self-sustaining. These phases of rehabilitation are described in **Table 9**.

Table 9 Rehabilitation Phases

Phase	Description
Decommissioning	The process of removing plant and equipment from active services and rendering the area safe.
Landform Establishment	The process of shaping unformed rock of other sub-stratum material into a desired land surface profile. This includes earthworks activities such as cut and fill, 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 soil 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 an ecosystem to grow and develop towards a desired and sustainable post mining land use outcome. Incorporates features including species reproduction, nutrient recycling and community structure.

Section 6 provides a general overview of the rehabilitation methodology for each rehabilitation phase.

5.4 Rehabilitation Completion Criteria

Completion criteria represent the minimum qualitative and/or quantitative standard for specific characteristics of rehabilitation areas for each phase of rehabilitation. Rehabilitation completion criteria are inextricably linked to the regulatory requirements and rehabilitation objectives of the site.

Completion criteria specific to each rehabilitation phase have been developed for each rehabilitation domain at Canyon, and are documented in **Tables 10** to **15**. The proposed completion criteria reflect:

- Review of regulatory and approval requirements (**Section 4.1**);
- Industry knowledge including industry guidelines and scientific literature;
- Site data; and
- Characteristics of analogous environments identified by selecting and analysing appropriate representative (analogue) sites.

Specific completion criteria to characterise qualities of native vegetation and grazing rehabilitation areas were initially quantified and subsequently refined, by monitoring key parameters of analogue sites and rehabilitation areas as described in **Section 8.3.2**.

Progress toward satisfactory completion of each rehabilitation phase is established by assessing the status of each criteria against rehabilitation monitoring data as well as verifying compliance with rehabilitation records (such as ‘as built’ surveys and demolition certificates).

6 REHABILITATION COMPLETION CRIETRIA

Tables 10 to **15** detail rehabilitation objectives, indicators and completion criteria for each rehabilitation phase for all domains.

Table 10 Decommissioning Phase

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Domain 1 - Infrastructure Area						
All infrastructure not required in the final landform is removed from site.	Demolition of infrastructure	All demolition work has been carried out in accordance *with AS2601-2001: The Demolition of Structures* or its latest version.	AS2604 - 2001	No	No	Not Complete.
		All surface infrastructure that is not required for the post-mining land use has been demolished (or dismantled) and removed from the site (including buildings and fixed plant, conveyors, sewage treatment plant, workshop, vehicle wash down bay, ROM stockpile, car parks, explosive magazines, fuel farm and waste oil/lubricant storage areas.	MOP Section 5.2	No	No	Not Complete.
	Site services	All site electricity and telecommunication services have been disconnected and removed.	MOP Section 5.2	No	No	Not Complete.
	Foundations and pavements	All concrete footings, foundation pads and pavements have been removed.	MOP Section 5.2	No	No	Not Complete
All hazardous and contaminated materials are appropriately removed or remediated.	Carbonaceous Material	All carbonaceous material has been removed from the footprint of the ROM pad and disposed of in the void, (supported by records).	MOP Section 5.2	Yes	No	Complete
	Hazardous materials	Site investigation records indicate that infrastructure areas are free of any hazardous materials (e.g. petroleum, chemicals and explosive products).	MOP Section 5.2 and 7.2.1	No	No	Commenced
	Contaminated Soils	Records indicate that contaminated soils have been identified and remediated or removed in accordance with legislation.	MOP Section 5.2 and 7.2.1	No	No	Commenced
Domain 2 - Final Void						
No decommissioning activities in the final void						
Domain 3 – Water Management Area						

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Mine water dams and sediment dams are decontaminated prior to conversion to clean water dams in the final landform.	Dam Sediments	Sediments accumulated in mine water and sediment dams is removed and disposed of in accordance with legislation (supported by records).	*Water Management Plan*	No	No	Active
Domain 4 – Overburden Emplacement Area						
No decommissioning activities in existing overburden emplacement areas.						
Domain 5 – Rejects Emplacement Area						
No proposed decommissioning activities in the Rejects Emplacement Area.						
Domain 6 –Soil Stockpile Area						
No proposed decommissioning activities in the Soil Stockpile Area.						
Domain 7 – Other Lands						
Infrastructure will be progressively decommissioned and removed from site when no longer required.	Removal of exploration infrastructure	All drill holes (and excavations that remain abandoned from previous mining or exploration), have been backfilled and sealed in accordance with *EDG01 – Borehole Sealing Requirements on Land* and any other infrastructure removed	ML 1471 *EDG01 – Borehole Sealing Requirements on Land*	Yes	No	Complete

Table 11 Landform Establishment Phase

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
All Domains						
Post mining landforms will be stable, safe, and non-polluting	Slopes	Rehabilitated slopes are verified by survey to be generally less than 11 degrees (or 14 degrees in the final void).	2005 SEE	No	No	Commenced
	Stability	Survey or remote sensing of the rehabilitated landforms shows an absence of slumping.	MOP Section 6.2.2	No	No	Operations ongoing
	Discharge water quality	Dirty water is captured and discharged in accordance with the EPL, (supported by records).	EPL *Water Management Plan*	No	No	Operations ongoing
Domain 2 - Final Void						
Post-mining landforms will be geotechnically stable, safe, and non-polluting.	Void Depth	The void is backfilled to a depth no greater than 25 m, verified by survey stable	2005 SEE	Yes	Yes	Complete
	Void lake EC	Surface water monitoring demonstrates that EC trend is stable at less than 450 µS/cm prior to commencement of growth medium development phase.	MOP Section 3.2.2	Yes	Yes	Complete
	Carbonaceous materials	All coal and carbonaceous material is capped with inert overburden.	2005 SEE	Yes	Yes	Complete
	Erosion	There is no evidence of slumping or uncontrolled erosion prior to commencement of growth medium development phase.	DECC 2008	No	Yes	Operations ongoing
		Active erosion is assessed to be minimal prior to commencement of growth medium development phase.	DECC 2008	No	Yes	Operations ongoing
	Spontaneous Combustion	There is no evidence of spontaneous combustion prior to commencement of growth medium development phase.	2005 SEE	No	No	Operations ongoing
Domain 3 – Water Management Area						
Downstream water users are not adversely affected.	Final landform drainage	Final landform drainage structures including drains, banks, drop structures and dams have been constructed in accordance with Blue Book requirements.	DECC 2008	No	Yes	Commenced

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
	Geomorphic stability	Visual assessment by a suitably qualified person 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.	DECC 2008	No	Yes	Commenced
Domain 4 – Overburden Emplacement Areas						
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.	2005 SEE	Yes	No	Complete
	Maximum Height	Survey verifies that overburden emplacement areas are no higher than 286 m to be compatible with local peaks (Red Hill)	2005 SEE	Yes	No	Complete
Domain 5 – Reject Emplacement Area						
Final landforms are safe, stable, non-polluting and free-draining.	Capping	Records verify that rejects are capped with at least 3 m of inert material including select inert overburden, subsoils and topsoils.	2005 Sect 100 Report	Yes	No	Complete
	Ponding	Capped rejects emplacement areas are free draining and exhibit an absence of ponding.	2005 Sect 100 Report	Yes	No	Complete
Domain 6 – Topsoil Stockpile Area						
No proposed landform establishment activities in Topsoil Stockpile Areas						
Domain 7 – Other Lands						
No proposed landform establishment activities in Domain 7 – Other Lands.						

Table 12 Growth Medium Development Phase

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
All Domains						
Topsoil and subsoil resources are salvaged and maintained for use in rehabilitation.	Soil Depth	Rehabilitation records verify that topsoil and/or subsoil average depth meets the specified depth for the final land use.	MOP Section 3.2.7 and 5.2	No	Yes	Commenced
Erosion is minimised.	Temporary ESC	Temporary ESCs are installed prior to topsoil re-spreading.	DECC 2008	No	Yes	Not Complete
		Topsoiled rehabilitation areas are sown with a non-persistent cover crop at the recommended sowing rate per hectare.	DECC 2008	No	Yes	Not Complete
Native Vegetation (Domain A – Final Void and Domain B – Rehabilitation Area Native Vegetation)						
Habitat features are salvaged and re-used in native vegetation rehabilitation to provide fauna habitat resources.	Habitat features	Mapping shows where all available habitat features have been incorporated into woodland rehabilitation areas (including felled hollow bearing logs and coarse woody debris).	MOP Section 6.3.2	No	No	Commenced
Domain C – Pasture Rehabilitation Areas						
Pasture areas will be capable of sustaining grazing with land capability that reflects the pre-mining environment.	Surface rock density	Visual monitoring verifies that surface spoils are generally rock free.	MOP Section 6.2.2	Yes	No	Complete

Table 13 Ecosystem Establishment Phase

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at Start of MOP
All Domains						
Weeds and feral animals do not present a risk to rehabilitation.	Weed presence	The densities of weed species in the rehabilitated areas are to be no worse than the analogue sites. All measurements will be undertaken in accordance with the methodology outlined in the Department *of Agriculture, Fisheries and Forestry (2008) Field Manual for surveying and Mapping Nationally Significant Weeds*.	MOP Section 3.2.6	No	Yes	Ongoing
	Feral animal density	Feral animal pests are controlled in accordance with legislation and the MOP.	MOP Section 3.2.6	No	Yes	Ongoing
Grazing stock are excluded from rehabilitation areas and enrichment zones prior to relinquishment.	Stock exclusion fencing	Rehabilitation areas and enrichment zones are fenced to exclude grazing stock.	MOP Section 3.2.5	Yes	Yes	Ongoing
Bushfire risks are managed to minimise the risk to rehabilitation.	Fuel loads	Fuel loads across ML 1471 are assessed and managed as required including, maintaining fire-breaks.	MOP Section 3.4.10	Yes	Yes	Ongoing
	Access	Firefighting access across rehabilitation areas and water sources (dams) is maintained in accordance with the *Bushfire Management Plan*.	2005 SEE MOP Section 3.2.13	Yes	Yes	Ongoing
Erosion does not present a safety hazard or compromise the post mining land capability.	Erosion and Sediment Control	Monitoring verifies there is no evidence of significant erosion.	MOP Section 7.2.3 DECC 2008	No	Yes	Ongoing
Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer).	Soil Quality	Soil testing indicates that soil characteristics (pH, EC, ESP) meet the following criteria: • pH – between 4.5 and 8.5 • EC - < 2ds/m • ESP – that is comparable to the analogue sites.	Closure Plan (2009)	No	Yes	Ongoing
	Surface cover	Rehabilitation monitoring records verify that ground cover (vegetation, leaf litter, mulch) greater than 50%.	Closure Plan (2009)	No	Yes	Ongoing
Domain A – Final Void, Domain B – Native Vegetation Rehabilitation Areas						
Species composition is analogous to analogue native vegetation	Vegetation health	More than 75% of trees are healthy and growing as indicated by rehabilitation monitoring.	This MOP	No	Yes	Ongoing

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at Start of MOP
communities.	Species composition	Species diversity is shown (using a recognised statistical methodology) to demonstrate no significant differences when compared to the analogue sites.	MOP Section 7.2.4 and 8.1.4	No	Yes	Ongoing
Domain C – Grazing Rehabilitation Areas						
Pasture areas will be capable of sustaining grazing with land capability that reflects the pre-mining environment.	Erosion	No significant erosion is present that compromises the land capability and intended final land use.	MOP Section 7.2.5 DECC 2008	No	Yes	Ongoing
	Soil Quality	Soil testing indicates that soil characteristics (pH, EC, ESP) meet the following criteria: • pH – between 4.5 and 8.5 • EC - < 2ds/m • ESP – that is comparable to the analogue sites.	Closure Plan (2009)	No	Yes	Ongoing
	Species composition	A mix of native and exotic perennial pasture species are sown at the recommended rate per hectare in accordance with approved specifications.	Closure Plan (2009) MOP Section 5.2	No	Yes	Ongoing
Domain 3 – Water Management Area						
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.	EPL *Water Management Plan*	Yes	Yes	Ongoing
	Geomorphic stability	Drainage structures are assessed to be stable after at least 5 years.	2005 SEE This MOP	No	Yes	Not commenced
Domain 7 – Enrichment Zones						
At least 19.2 ha of remnant native vegetation will be retained and managed for enhanced biodiversity outcomes.	Disturbance	Enrichment Zones are retained and to improve condition of existing flora and fauna habitat values.	MOP Section 4.2.2 and 5.2	No	No	Ongoing
	Infill Planting	Additional tubestock representative of the vegetation community is planted to improve habitat values (where required).	MOP Section 7.2.4	No	No	Ongoing

Table 14 Ecosystem Sustainability Phase

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at Start of MOP
All Secondary Domains						
Weeds are controlled	Weed presence	The densities of weed species in the rehabilitated areas are to be no worse than the analogue sites. All measurements will be undertaken in accordance with the methodology outlined in the Department *of Agriculture, Fisheries and Forestry (2008) Field Manual for surveying and Mapping Nationally Significant Weeds*.	MOP Section 7.2.5	No	Yes	Ongoing
Feral animal pests are controlled.	Feral animal density	Feral animal pests are controlled in accordance with legislation and do not present a risk to biodiversity.	Closure Plan (2009)	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 in accordance with the *Bushfire Management Plan*.	2005 SEE MOP Section 3.2.13	No	Yes	Ongoing
Erosion does not present a safety hazard or compromise the post mining land capability.	Erosion and Sediment Control	Net annual average soil loss is less than or equal to 40t/ha/year	MOP Section 5.2	No	Yes	Ongoing
		By using a qualitative Risk Assessment methodology it is determined that no significant erosion is present that constitutes a safety hazard or compromises the capability of the supporting the end land use.	MOP Section 5.2 and 7.2.5	No	Yes	Ongoing
Domain B – Native Vegetation Rehabilitation Areas						
Woodland rehabilitation areas species diversity is analogous to analogue native vegetation community.	Vegetation health	More than 75% of trees are healthy and growing as indicated by rehabilitation monitoring.	MOP Section 5.2	No	Yes	Ongoing
	Species composition	Woodland rehabilitation areas contain species diversity that is shown (using a recognised statistical method) to demonstrate no significant differences when compared to the analogue sites.	Closure Plan (2009) This MOP	No	No	Ongoing
	Reproduction	Second generation tree seedlings are present or likely to be (e.g. presence of flowering).	Closure Plan (2009)	No	No	Ongoing
	Habitat Structure	Woodland rehabilitation areas provide a range of structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer etc.).	MOP Section 5.2	No	Yes	Ongoing

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at Start of MOP
Soil nutrient cycling and structure is self-sustaining.	Soil Quality	Soil testing indicates that soil characteristics (pH, EC, ESP) meet the following criteria: • pH – between 4.5 and 8.5 • EC - < 2ds/m • ESP – that is comparable to the analogue sites.	Closure Plan (2009)	No	Yes	Ongoing
	Surface cover	Ground cover (vegetation, leaf litter, mulch) is in the range of analogue sites at Year 10. Species diversity is shown (using a recognised statistical methodology) to demonstrate no significant differences to analogue sites.	Closure Plan (2009) MOP Section 5.2	No	No	Ongoing
Domain C – Pasture Rehabilitation Areas						
Pasture areas will be capable of sustaining grazing with land capability that reflects the pre-mining environment.	Productivity	Total biomass at rehabilitation areas is shown (using multi-spectral imaging) to demonstrate no significant differences to analogue sites subject to similar management regimes.	MOP Section 5.2	No	No	Ongoing
	Species composition	At least 75% of species surveyed are representatives of the specified perennial pasture species mix.	2005 SEE MOP Section 5.2	No	Yes	Ongoing
	Natural regeneration	There is evidence of second generation pasture plants.	Closure Plan (2009)	No	No	Ongoing
	Land Capability	Pasture Rehabilitation Areas are assessed to have a Rural Land Capability Class VI or better (capable of sustaining grazing).	MOP Section 4.3	No	No	Ongoing
		Pasture Rehabilitation Areas have at least 16 ha of land with Rural Land Capability Class II	2005 SEE MOP Section 5.2	Yes	No	Complete
	Soil Quality	Soil testing indicates that soil characteristics (pH, EC, ESP) meet the following criteria: • pH – between 4.5 and 8.5 • EC - < 2ds/m • ESP – that is comparable to the analogue sites.	Closure Plan (2009)	No	Yes	Not Complete

Table 15 Relinquishment

Domain Objective	Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at end of MOP
All Secondary Domains						
Canyon will be restored to a landform capable of sustaining the pre-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 DRE (or contemporary equivalent).	MOP Section 5.2	No	No	Not complete
	Access Tracks	Access tracks not required in the final landform are decommissioned and rehabilitated.	MOP Section 7.2.1, 7.2.5 and 7.3	No	No	Not complete
	Monitoring Points	Any ancillary disturbance or equipment associated with surface water and rehabilitation monitoring points is removed and/or rehabilitated.	MOP Section 3.2.1 and 3.2.2	No	No	Not complete
	Groundwater bores	Groundwater monitoring bores are decommissioned and sealed in accordance with guidelines.	MOP Section 3.2.2	No	No	Not complete
Domain E – Water Management Area						
Downstream water users are not impacted by mining at Canyon	EPL	EPL is extinguished by the NSW EPA	EPL *Water Management Plan*	No	No	Operations ongoing
Domain F – Retained Infrastructure						
Land associated with the maintenance facility and hardstand areas will be retained for post mining use.	Statutory Responsibility	Statutory responsibility for retained infrastructure is transferred (if required) and excised from ML1471	MOP Section 5.2	No	No	Operations ongoing
	Land Ownership	Land ownership and/’or lease arrangements are finalised (if applicable)	MOP Section 5.2	No	No	Operations ongoing

7 REHABILITATION IMPLEMENTATION

7.1 Status at MOP Commencement and Proposed Rehabilitation Activities

Table 16 describes the status of each domain at the commencement this MOP period, and outlines the principal rehabilitation activities proposed in the MOP term. This information is also presented graphically in **Plan 2** and **Plan 3.** The asset register (**Section 2.3**) provides a summary of the total area and key features of each domain in the MOP period. Rehabilitation methodologies for the proposed activities are described in **Section 7.2**.

Table 16 Rehabilitation Status and Proposed Activities at MOP Commencement

Domain	Status at MOP Commencement	Activities During the MOP Term
Primary Domains		
Domain 1 – Infrastructure	All coal handling and processing infrastructure areas have been decommissioned and rehabilitated (Phase 5). Remaining assets will remain active in the MOP term.	Rehabilitation monitoring Ongoing land management Relocation of explosives magazine container.
Domain 2 – Final Void	Undergoing rehabilitation (Phase 5)	Rehabilitation monitoring Ongoing land management Water quality monitoring
Domain 3–Water Management Area	Operational sediment dams will remain active until EPL extinguishment	Maintenance Surface water monitoring
Domain 4 – Overburden Emplacement Area	Undergoing rehabilitation (Phase 5)	Rehabilitation monitoring Ongoing land management
Domain 5 – Reject Emplacement Area	Undergoing rehabilitation (Phase 5)	Rehabilitation monitoring Ongoing land management
Domain 6 – Topsoil Stockpile Area	Remaining soil stockpiles are temporarily stabilised and will be retained for future rehabilitation of infrastructure areas.	Ongoing maintenance
Domain 7 – Other Lands	Active	Ongoing land management
Secondary Domains		
Domain A – Final Void	Undergoing rehabilitation (Phase 5)	Rehabilitation monitoring Ongoing land management Water quality monitoring
Domain B – Rehabilitation Area - Native Vegetation	Approx. 134.8 ha of native vegetation has been established (Phase 5) on overburden dumps and infrastructure areas. An additional 21.6ha of native vegetation has been established on the batters of the final void.	Rehabilitation monitoring Ongoing land management
Domain C – Rehabilitation Area - Pasture	Approx. 47.2 ha of pasture has been established (Phase 5 of rehabilitation)	Rehabilitation monitoring Ongoing land management
Domain D – Enrichment Area	19.2 hectares identified to be retained for conservation purposes within ML 1471	Rehabilitation monitoring Ongoing land management
Domain E – Water Management Area	Final landform drainage structures are constructed for all rehabilitation areas.	Ongoing maintenance Ongoing water quality monitoring
Domain F – Retained Infrastructure	Infrastructure to be retained is currently active (Domain 1).	Hazardous material and contamination assessments (if required).

7.2 Rehabilitation Methodologies for Proposed Activities in the MOP Term

This section describes the general rehabilitation methodologies for each domain undertaken to date, the status of rehabilitation for each domain, and remaining activities to be completed prior to relinquishment.

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. Methodologies and works competed to date are summarised in the sections below. Completion criteria are listed in **Table 10**.

Decommissioning and Demolition

Decommissioning and demolition works undertaken prior to the commencement of the MOP are detailed in the 2012 – 2013 AEMR. Works to date include:

- Disconnection and removal of all services:
- Dismantling and removal of buildings including site offices, crib room and first aid room and weighbridge;
- Removal of concrete piers and foundation pads, concrete paths and car parks;
- Decommissioning the fuel farm including removal of two 50,000 diesel fuel tanks, the plastic and clay liner in the bunded fuel storage area, and associated equipment (pipes and valves);
- Partial dismantling of the workshop to a basic structure, removal of the oil separation tank, and removal from site of bulk stores including hydrocarbon and chemical products; and
- Decommissioning the ROM Pad including removing the coal loading bin and associated equipment.

Remaining infrastructure that will be decommissioned and demolished or removed prior to lease relinquishment includes the:

- Remaining workshop structure and wash down sump; and
- Ablution block and septic tank.

The remaining workshop structure and ablutions block will be demolished in this MOP term. The ablutions block septic tank will be pumped out and removed, and the building dismantled and removed from site. Demolition materials will be segregated into recyclable and non-recyclable waste streams and transported to appropriate waste facilities.

WHC proposes to retain the Maintenance Facility and access road, and Tarrawonga Haul Road in the final landform. Subsequently, decommissioning activities associated with these assets are limited to verification that there is no contaminated land or hazardous materials to be remediated and or removed from site. The hardstand area associated with the weighbridge provides a truck parking area and will also remain until haulage from Tarrawonga ceases.

Contaminated Materials

Decommissioning works associated with the workshops and ROM pad facilities (Domains 1b and 1c) required assessments to identify and remediate any land contamination or hazardous materials. Soil testing undertaken at the workshop and fuel farm areas undertaken in August 2010 identified two locations with hydrocarbon contaminant concentrations exceeding the threshold for sensitive lands use prescribed by the NSW EPA Guidelines for Assessing Service Station Sites (2004).

The soil under and around the workshop will be tested for contamination and remediated as required.

Contaminated soils materials were excavated and moved to a bunded area on site for bio-remediation prior to being disposed of offsite at a licenced facility, once they met the solid waste classification

There are minimal quantities of hydrocarbons or chemicals stored at the remaining facilities including the Maintenance Facility. Regardless, prior to lease relinquishment WHC will verify that there are no contaminants or hazardous materials present at the Maintenance Facility and hardstand area.

Water Management Structures

All operational water storages will be retained in the final landform for (predominantly) agricultural post mining landuse. Sediment dams will be decommissioned and converted to clean water storage dams following verification that individual dam catchments are satisfactorily rehabilitated and discharges are considered clean water.

Decommissioning activities include dewatering the dams and de-silting (prior to use as clean water dams) re-grading and vegetating dam embankments (if required) and removal of associated infrastructure such as pumps, pipes and access tracks. Dams retained in the final landform are shown on **Plan 4**.

7.2.2 Landform Establishment Phase

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.

All key landform establishment activities required to achieve closure have been completed prior to the commencement of the MOP term, including constructing the final void, shaping overburden emplacements and capping rejects emplacements. Further landform establishment activities that may be undertaken in this MOP term are associated with:

- De-compacting decommissioned hardstand areas;
- Re-grading the explosives magazine bund; and
- Augmenting decommissioned sediment basin embankments to convert basins to clean water storage dams.

Landform establishment methodologies for each domain are summarised in the sections below. Proposed completion criteria for the Landform Establishment Phase are documented in **Table 11**.

Reject Emplacement Area Capping

Two rejects emplacement areas (**Plan 2** and **3**) have been rehabilitated at Canyon. Rejects emplacement area rehabilitation was undertaken in accordance with the methodology proposed in the approved 2007 Section 100 Application for the establishment of coarse rejects emplacement area at Canyon.

All coarse rejects have been capped beneath a minimum cover of 3 m of inert material including select crushed overburden, subsoil and topsoil. The final landform has been shaped to be a free draining landform to minimise the potential for any ponding. Monthly surveys provide a record of the rejects emplacement development and capping works. During the term of this MOP WHC will undertake works (such as core samples) to verify that capping meets the minimum requirements for depth and material properties to demonstrate that completion criteria are met.

Overburden Emplacement Areas

In order to blend with the surrounding (predominantly agricultural) landscapes, emplacements have been constructed to a maximum height of approximately 285 m to be compatible with surrounding topography (i.e. Red Hill). Generally batter slopes have been constructed less than 1:10 (V:H) (6 degrees) and no more than 1:5 (11 degrees).

Initially after commencement of mining in 2000 overburden was emplaced at an out of pit dump in the north of ML 1471. Since 2001 all overburden emplacement has occurred in-pit, with dump sequencing developed to optimise progressive rehabilitation of the open cut pit. Overburden emplacements have generally been shaped with irregular surfaces to create a landform that compares with the pre-mining landform. Depressions have been constructed to encourage minor ponding (where appropriate) to provide long term variation in vegetation assemblages and habitat.

Overburden at Canyon was typically highly friable up to 8 m deep below subsoils. Friable and weathered overburden was selectively handled and stockpiled for emplacement near the surface of overburden dumps to minimise occurrence of large rocks near the final landform surface.

Final Landform Drainage Structures

Final landform drainage structures including contour banks and rock lined drains have been constructed to convey flows from rehabilitation areas at sub-erosive velocities, and to convey flows to sediment dams. Rock lined channels, contour banks and diversion drains have been constructed in accordance with design principles recommended by the (former) NSW Department of Lands Soil Services (Soil Services).

Contour banks have been constructed on slopes in accordance with the recommendations of Soil Services. Contour bank spacing is based on catchment size and slope. Banks on steeper slopes (including the final void) are generally spaced at 20 to 25 m to service a catchment of approximately 10 to 12 ha. Longitudinal grades for contour banks are constructed in accordance with the Blue Book.

Rock lined waterways have been constructed to convey flows from overburden dumps by boxing out a 10 m strip from the surface overburden layers and placing selected blast rock (non-weathered).

Monitoring following significant rainfall events in 2009 and 2010 identified erosion associated with contour bank failure in the southern void batters, as well as dam embankment failure for the eastern dam in the lower void that acts as a flow velocity regulator for flows reporting from the eastern slopes to the void lake in the west of the void. Remediation was completed in 2010 including regrading and seeding contour banks, and enlarging the eastern lower void dam wall and construction of a rock lined spillway.

Erosion monitoring undertaken since 2010 indicates further minor rilling and gullying in the void. Should rilling not be stabilised with minor repairs and re-seeding WHC will investigate engaging a soil conservationist in this MOP term to assess erosion and will undertake further remedial works in accordance with the soil conservationist recommendations.

Final Void Shaping

The final void has been constructed as a water storage accepting surface runoff from the void batters and eastern portion of the backfilled pit. Prior to receiving surface flows the floor of the void was raised above the height of the extracted coal seam to create a barrier between the void surface waters and ground water associated with the coal seam. Raising the floor of the void was achieved by a combination of backfilling with overburden and pushing down the void highwall and low walls.

The resultant final void has a total depth of approximately 25 metres, with slopes ranging from less than 6 degrees in the east to 14 degrees at the northern, western and southern edges. Batter slopes were determined to achieve sufficient material to raise the void floor, and optimise the post mining land use opportunities.

As described in **Section 3.2.2** surface water quality monitoring indicates that there is no upward trend in EC, indicating that there is no groundwater interaction within the void. If, however, monitoring indicates groundwater inflows (through elevated EC levels) WHC will undertake investigations to identify appropriate remedial actions.

7.2.3 Growth Media Development

In the context of this MOP, growth media development encompasses activities to reinstate soils with the initial physical, chemical and biological characteristics required to establish the desired vegetation community. Methodologies are summarised in the sections below. Completion criteria for Growth Media Development are listed in **Table 12.**

Soil Replacement

As described in **Section 0** GCNRC undertook a soil resource assessment for the 2005 SEE that included a soil balance for the project and identified suitable soil resources for both pasture and native vegetation rehabilitation areas, and recommended soil replacement depths.

Soils stripped from pasture areas and remnant native vegetation areas were stockpiled separately in accordance with the recommendations of GCNRC so soils from remnant vegetation areas that held a native seed bank would be used in native vegetation rehabilitation areas. Stockpiled clearing debris was mulched mixed into stripped topsoils to act as a soil conditioner and improve moisture retention and soil organic content.

Following shaping of the final landform soils have been reinstated at rehabilitation areas in the reverse stripping order. Prior to applying soils the substrate was ripped to produce a roughened surface to minimise erosion by enhancing infiltration and keying soils in.

Generally soils were spread at a depth of 15 – 20 cm of subsoil and 20 cm of topsoil at pasture rehabilitation areas, and 50cm subsoils or friable overburden and 7cm topsoil at native vegetation rehabilitation areas. Rehabilitation monitoring undertaken in 2012 (ELA, 2013) included soil test pits to verify soil depths in pasture and native vegetation rehabilitation areas. Test pits indicate that soil depths on average meet the proposed requirements for pasture and native vegetation soil depths.

Habitat Augmentation

Native vegetation rehabilitation areas include features to promote the colonisation by native fauna, including felled hollow bearing logs and other coarse woody debris. Most logs and timber debris salvaged during clearing operations have been reinstated in woodland rehabilitation areas. Those that remain stockpiled can be utilised in future rehabilitation.

7.2.4 Ecosystem Establishment Phase

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

- Seeding and tubestock planting; and
- Land management activities to promote ecosystem establishment such as weed and feral animal management, erosion control and bushfire mitigation.

General revegetation methodologies are discussed in the sections below. Proposed completion criteria for each domain are listed in **Table 13.**

Cover Crops and Pasture Establishment

All rehabilitation areas have been stabilised immediately following topsoil emplacement with seed mixes including perennial exotic and native pasture species and a fast growing cover crop. Depending on the timing of rehabilitation warm and cool season cover crops have been applied at the rates documented in **Table 17** below. Historically Rhodes Grass had been incorporated into cover crop mixes to assist rapidly stabilise areas identified as a high erosion risk. Due to its pervasive nature Rhodes Grass will not be used in any further revegetation works.

Future pasture establishment that will be undertaken prior to relinquishment is associated with rehabilitation of the infrastructure areas and topsoil stockpile locations, predominantly on the eastern side of the Tarrawonga Haul Road (**Plan 3**).

Table 17 Typical Species Used for Cover Crop and Pasture Establishment

Species	Rate (kg/Ha)
Warm Season Grasses	
Bombastic Panic	1-2
Green Panic**	2-4
Purple Pigeon Grass	1-2
Annual Legumes*	
Subterranean Clover	4-5
Cool Season Legumes	
Barrel (Sephi) Medic	2-4
Snail (Sava) Medic**	3-5
Woolly Pod Vetch	4-6
Serradella (Elgara)	1-2
Lucerne	0.5
Cool Season Legumes*	
Phalaris (Sirolon or Holdfast)	1-2
Wallaby Grass	0.3-1

* Inoculated with appropriate rhizobia ** Specific soil conservation applications

Native Vegetation

Native vegetation has been established predominantly with tubestock propagated from locally collected seed, as well as passively using the native vegetation seedbank in salvaged topsoils. Tubestock has generally been planted at approximately 400 stems per hectare along rip lines at 4 to 5 m spacing.

Tubestock has been planted at rehabilitation areas and enrichment zones over a succession of campaigns to develop native vegetation communities analogous to the composition of analogue sites. In particular, infill plantings have been undertaken to establish mid-storey and understorey vegetation species representative of native vegetation analogue sites. Domain C – Pasture Rehabilitation Areas also include clumps (group plantings of tree and shrub species) across pasture areas to provide stock shade for a grazing final landuse. Tubestock has been planted in rip lines established at approximately 4 to 5 m spacing in 0.1 m areas.

Further revegetation to be undertaken prior to relinquishment is associated with rehabilitation of infrastructure areas including access roads and the explosives magazine, and topsoil stockpile areas in the located around the toe of overburden emplacements. Typical species used for native vegetation planting is listed in **Table 18**.

Table 18 Typical Species Used for Native Vegetation Establishment

Species	Upper Slopes / Crests (%)	Mid-Slopes (%)	Lower Slopes / Drainage Flats (%)
Trees			
Eucalyptus melanophloia Silver-leaf Ironbark	15	4	
Eucalyptus crebra Narrow-leaf Ironbark	30	15	
Callitris glaucophylla White Cypress Pine	25	22	10
Geijera parviflora Wilga	5		
Eucalyptus albens White Box	10	40	
Eucalyptus melliodora Yellow Box	30		
Eucalyptus pilligaensis Pilliga Grey Box		10	25
Eucalyptus populnea Bimble Box			25
Allocasuarina luehmannii Bull Oak			10
Shrubs			
Eremophila debilis Amulla	3	2	2
Alectryon oleifolius Rosewood			2
Acacia homalophylla Yarran			5
Capparis mitchellii Wild Orange			1
Notelaea microcarpa Native Olive	8	2	
Maireana microphylla Eastern Cotton bush	4	2	
Eremophila mitchellii Budda	5		

Land Management

WHC undertakes land management practices on all land within ML 1471 to enhance the success of ecosystem establishment at rehabilitation areas including:

Weed and feral animal control is undertaken in accordance with the management measures described in **Section 3.2.6**; Erosion and sediment controls are inspected and maintained in accordance with the *Erosion and Sediment Control Plan* (refer to **Section 3.2.3**); and

Bushfire management, undertaken in accordance with the approved *Bushfire Management Plan* (refer to **Section 3.2.13**).

7.2.5 Ecosystem Sustainability Phase

The (former) Commonwealth Department of Industry, Tourism and Resources (DITR) publication Leading Practice Sustainable Development Program for the Mining Industry (DITR 2006) defines a functional ecosystem as one that is:

- Stable (not subject to high rates of erosion);
- Effective in retaining water and nutrients; and
- Self-sustaining (DITR 2006).

For the purposes of this MOP the Ecosystem Sustainability phase represents those activities required to develop sustainable ecosystems that have characteristics analogous to similar undisturbed vegetation associations in the area.

Key activities in the Ecosystem Sustainability phase are:

- Rehabilitation monitoring (refer to **Section 8.2**);
- Rehabilitation maintenance including ongoing:
    - Weed and feral animal control;
    - Erosion control work maintenance;
    - Maintenance fertilizing and re-seeding or re-planting (where required); and
    - Repair of fence lines, access tracks and other general related land management activities.
- Intervention and adaptive management (**Section 9**).

Proposed completion criteria for the Ecosystem Sustainability phase are included in **Table 14.**

7.3 Rehabilitation Summary this MOP Period

Through the MOP period rehabilitation maintenance will continue and WHC will undertake necessary activities to demonstrate achievement of completion criteria such as rehabilitation monitoring and surface and ground water monitoring. No additional areas are proposed to be rehabilitated until completion criteria for existing rehabilitation areas are met. When rehabilitated catchments are considered to have met requirements for relinquishment, WHC will undertake works to decommission sediment basins, rehabilitate access tracks not required in the final landform and commence processes required to transfer statutory responsibility for infrastructure areas to be retained in the final landform.

Table 19 below summarises the rehabilitation status for each domain at the start of the MOP and anticipated status at the end of the MOP period.

Table 19 Summary of Rehabilitation Proposed during the MOP Term

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the MOP (ha)	Area at the end of the MOP (ha)
Infrastructure (1)	Rehabilitation Area – Native Vegetation (B)	1B	Active	10.2	10.2
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	12.3	12.3
			Land Relinquishment	0	0
			Total	22.5	22.5
Infrastructure (1)	Rehabilitation Area – Pasture (C)	1C	Active	5.2	5.2
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	19.7	19.7
			Land Relinquishment	0	0
			Total	24.9	24.9
Infrastructure (1)	Retained Infrastructure (F)	1F	Active	2.9	2.9
			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	2.9	2.9
Infrastructure Total:				**50.3**	**50.3**
Final Void (2)	Final Void (A)	2A	Active	0	0
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	21.6	21.6
			Land Relinquishment	0	0
			Total	21.6	21.6
Final Void Total:				**21.6**	**21.6**
Water Management Area (3)	Water Management Area (E)	3E	Active	7.8	7.8
			Decommissioning	0	0
			Landform Establishment	0	0

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the MOP (ha)	Area at the end of the MOP (ha)
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	2.2	2.2
			Land Relinquishment	0	0
			Total	10.0	10.0
Water Management Area Total:				**10.0**	**10.0**
Overburden Emplacement Area (4)	Rehabilitation Area – Native Vegetation (B)	4B	Active	0	0
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	98.3	98.3
			Land Relinquishment	0	0
			Total	98.3	98.3
Overburden Emplacement Area (4)	Rehabilitation Area – Pasture (C)	4C	Active	0	0
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	21.9	21.9
			Land Relinquishment	0	0
			Total	21.9	21.9
Overburden Emplacement Area Total:				**120.2**	**120.2**
Reject Emplacement Area (5)	Rehabilitation Area – Pasture (C)	5C	Active	0	0
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	3.1	3.1
			Land Relinquishment	0	0
			Total	3.1	3.1
Reject Emplacement Area Total:				**3.1**	**3.1**
Topsoil Stockpile Area (6)	Native Vegetation Area (B)	6B	Active	4.7	4.7
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	9.3	9.3

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Area at the start of the MOP (ha)	Area at the end of the MOP (ha)
			Land Relinquishment	0	0
			Total	14.0	14.0
Topsoil Stockpile Area (6)	Rehabilitation Area – Pasture (C)	6C	Active	4.1	4.1
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	3.0	3.0
			Land Relinquishment	0	0
			Total	7.1	7.1
Soil Stockpile Area Total:				**21.1**	**21.1**
Other Lands (7)	Enrichment Area (D)	7D	Active	172.9	172.9
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Sustainability	19.2	19.2
			Land Relinquishment	0	0
			Total	192.1	192.1
Other Lands Total:				**192.1**	**192.1**
Overall Total				**418.4**	**418.4**

7.4 Relinquishment Phase Achieved During MOP Period

WHC may pursue relinquishment for areas within ML 1471 through the MOP period based on:

- Achievement of all completion criteria for rehabilitation areas to the satisfaction of the DRE; and
- Determination of the development of the Vickery Coal Project which is approved to utilise the south west portion of ML1471 for waste rock emplacement.

8 REHABILITATION MONITORING, TRIALS AND RESEARCH

8.1 Rehabilitation Monitoring

Annual rehabilitation monitoring campaigns at Canyon Mine is undertaken in accordance with the *Rehabilitation Monitoring Program for Canyon Mine* (ELA 2011).

A multi-scale, multi-data source monitoring approach has been used, incorporating remote sensing to monitor the entire target area as well as targeted field work. Monitoring has been directed into control and impact areas for both grazing and native vegetation environments.

Rehabilitation monitoring reports are prepared annually and include:

- Remote-sensing based landscape assessment (multi-spectral imagery);
- Monitoring of grazing areas (using a combination of pasture attributes);
- Native vegetation surveys;
- Terrestrial fauna and habitat surveys; and
- Analysis of results including statistical analysis (where appropriate).

The aim of the rehabilitation monitoring reports is to document the annual spring monitoring results and provide a quantitative assessment of rehabilitation performance against nearby unmined (i.e. control) landscapes.

Specific monitoring objectives include:

- Quantitative tracking of rehabilitation performance;
- Assess key aspects of flora (upper, mid and lower strata) in woodland areas;
- Compare data with previous monitoring;
- Evaluate monitoring results against monitoring triggers and rehabilitation objectives as outlined in the RMP; and
- Provide recommendations to assist with the improvement of rehabilitation or monitoring methods and mine closure for WHC.

8.1.1 Remote Sensing

Multi-spectral imagery provides information relating to land cover and condition across the entire site, including rehabilitated areas and control zones.

Multi-spectral imagery is captured across rehabilitation and control areas then processed into a normalised difference vegetation index (NDVI).The combination of true colour, false colour and NDVI image visualisation products gives an indication of the extent and condition of each land cover type in the area.

Significant changes identified via analysis of remote sensing data (> +/-2 standard deviations from average) instigates further investigation including targeted rapid on ground assessments. If changes are confirmed or discovered on-ground site specific management responses and remedial actions are developed and implemented.

8.1.2 Pasture Areas

Monitoring for Domain C – Pasture provides quantitative data on key pasture and soil attributes as they relate to land agricultural capability. Pasture species, weed species, biomass, groundcover composition as well as parameters related to soil erosion and soil nutrient status (pH, EC, OM, N or P) are assessed in surveys of grazing areas.

Groundcover composition is recorded during surveys of pasture areas for all plots and takes into account the percentage cover of weeds, pasture, bare ground and litter. 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 is also recorded and any recommended weed treatments are documented in the annual monitoring report.

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

8.1.3 Native Vegetation Monitoring

Vegetation surveys are undertaken for all Domain B – Native Vegetation Areas, and Domain D – Enrichment Zones, and focus on the condition, composition and structure of woodland vegetation in rehabilitation areas and analogue sites. The monitoring protocol adopted in the *Rehabilitation Monitoring Program* (ELA 2011) aligns with the national protocol for monitoring vegetation condition change (and direction of change) developed for the Caring for our Country Program.

The native vegetation monitoring program provides quantitative data on woodland structure and composition, exotic fauna species and soil attributes. Surveys of native vegetation areas are used to detect any significant declines in each strata, specifically:

- Overstorey: cover, health, richness, recruitment;
- Mid storey: cover, richness; and
- Groundcover: total percent ground cover, native ground cover (cover and richness), weeds (percent cover, richness).

During native vegetation monitoring events native and exotic fauna observations, and soil erosion observations, are also recorded. Rehabilitation monitoring in Domain B will also assess the recovery of the area affected by the 2013 bushfire event (refer to **Section 3.2.13**), and document the progress of recovery.

The survey method adopted in the *Rehabilitation Monitoring Program* (ELA 2011) is framed within the following definition of vegetation condition:

> *"Vegetation condition is a measure of the structural and functional quality of vegetation, where quality is express as the difference between observed and expected values for a set of key ecological indicators".*

For the purposes of rehabilitation monitoring, change in vegetation condition for rehabilitated sites is measured against control sites; in this case control sites selected outside of the area of influence of the mine which are representative of the native vegetation communities (structure and floristics) in the surrounding landform.

8.1.4 Terrestrial Fauna and Habitat Monitoring

Terrestrial fauna and habitat monitoring focuses 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*), Neophema pulchella* (Turquoise Parrot) and *Pomatostomus temporalis* (Grey-crowned Babbler) since they are listed under either the TSC Act and/or the EPBC Act 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 AEMR.

8.2 Rehabilitation Monitoring Records

Annual rehabilitation monitoring campaign records are documented in a rehabilitation monitoring report which is appended to the AEMR. Rehabilitation monitoring records are supported by a range of operational records to assist verify achievement of rehabilitation completion criteria including:

- A register of contamination sites and records of the movement of contaminated materials to the bioremediation area or transport offsite to licenced waste facilities;
- Records of production wastes including coarse rejects transported from the Whitehaven CHPP and emplaced at Canyon;
- Topsoil resource records including the topsoil stockpile register; and
- Environmental monitoring records including surface and groundwater monitoring.

8.3 Analogue Sites

8.3.1 Rehabilitation Trials

There are no specific rehabilitation trials or research proposed or undertaken to date at Canyon. Rehabilitation monitoring and rehabilitation methodology records are, however, shared among WHC operations to inform decision making regarding future rehabilitation campaigns. For example, any further revegetation works that may be undertaken at Canyon will be informed by direct seeding trials and tubestock trials currently being undertaken at Tarrawonga.

8.3.2 Analogue Sites

WHC undertakes monitoring at appropriate representative (analogue) sites to assist quantify the key desirable qualities (indicators) of native vegetation and pasture rehabilitation areas. There are three pasture analogue sites (*Pasture Control 1 – 3) and two native vegetation analogue sites (Control Wood 1 and 2), located within the mine lease boundary in pasture areas and remnant woodland areas not disturbed by mining (refer to **Plan 2**).

Monitoring at pasture analogue sites is used to determine bench marks for indicators including percent pasture cover, total biomass, pasture species composition and weed species presence. Native vegetation analogue site monitoring is used to determine bench marks 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 are also monitored to compare utilisation of rehabilitation areas and undisturbed areas by target fauna species including the Grey-crowned Babbler.

9 INTERVENTION, ADAPTIVE MANAGEMENT AND CONTINUAL IMPROVEMENT

9.1 Threats to Rehabilitation

Risks associated with rehabilitation at Canyon are outlined in the Environmental Risk Assessment (**Section 3.1**). Risk management is described in **Section 3.2**. The scope of rehabilitation and environmental monitoring undertaken at Canyon assesses the effectiveness of management measures to control risks to rehabilitation. WHC has developed a Trigger Action Response Plan (TARP) to assess whether these key rehabilitation parameters are trending toward rehabilitation success or failure, and whether any intervention is required. The TARP is discussed in **Section 9.2** below.

9.2 Trigger Action Response Plan

This TARP has been developed to provide a framework to manage potential key risks to rehabilitation and has been developed based on the rehabilitation and closure risks identified in the Environmental Risk Assessment **(Section 3.1**). The 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 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 intervention or adaptive management, actions will be reported in the AEMR. WHC will notify DRE 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 in the predicted timeframes.

The TARP is provided as **Table 20**, and will be reviewed and may be revised as conditions at Canyon change or new risks to rehabilitation are identified.

Table 20 Rehabilitation TARP

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
Landform stability	Slope gradient	Trigger	Slopes >10° but <14°, unless assessed to be stable	Slopes >15°, unless assessed to be stable
		Response	Undertake stability enhancement works including revegetation if required.	Undertake a review of the landform design, and make 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.
	Erosion control	Trigger	Minor gully or tunnel erosion present and/or minor rilling.	Slumping and /or significant gully or tunnel erosion present and/or significant rilling.
		Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install (or augment existing) water management infrastructure to address erosion. Remediate as appropriate.	Remediate as appropriate If required, consult with a land management 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. Review the *Erosion and Sediment Control Plan* and update where required.
	Free Draining Landforms	Trigger	Landforms exhibiting minor ponding.	Landforms exhibiting significant drainage issues, threatening or causing material harm to the environment.
		Response	An inspection of the site will be undertaken by a suitably trained person. 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.	Remediate as appropriate. If required, consult a water management specialist to develop a site specific remediation plan and review water management structure design criteria.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
Soil Quality	Salinity	Trigger	Increasing trend in soil/ spoil salinity levels.	Presence of salt scalds.
		Response	Undertake soil/spoil testing to verify EC and recommend further soil / spoil amelioration.	Engage a specialist consultant to develop a site specific management report to be implemented to remediate salinity scalds.
	Soil ESP	Trigger	Exchangeable sodium percent (ESP) greater than 8 and less than 15%.	Exchangeable sodium percent (ESP) greater 15%.
		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 600us/cm.	Soil EC greater than 800us/cm.
		Response	Engage a consultant to recommend appropriate measures to reduce soil EC. Undertake consultant recommendations where possible and viable.	Engage a consultant to recommend appropriate measures to reduce soil EC. Undertake consultant recommendations to reduce EC to an appropriate level.
	Soil pH	Trigger	Soil pH <8.5 but >4.0	Soil pH is <4.0 or > 9.5.
		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 pH to within rehabilitation guidelines. Undertake evaluation recommendations to achieve soil pH within appropriate range.
Water Quality	Void Water Quality	Trigger	Monitoring detects void surface water EC is greater than adjacent storage dams	Monitoring detects ongoing increasing trend in void surface water EC.
		Response	Undertake additional monitoring to identify if there is an increasing EC trend that indicates groundwater interaction.	Engage specialist consultant to investigate groundwater interaction with void and develop remedial actions to ensure there is an impermeable barrier between surface and groundwater.
	Groundwater	Trigger	Monitoring detects decreasing groundwater depth.	Monitoring detects ongoing trend in decreasing groundwater levels.
		Response	Undertake additional monitoring to identify if there is a decreasing trend that indicates groundwater loss into the void.	Engage specialist consultant to investigate groundwater interaction with void and develop remedial actions to ensure there is an impermeable barrier between surface and groundwater.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
	Discharge Water Quality	Trigger	Sediment basin discharge exceeds EPL criteria for pH, TSS and oil/grease.	Long term upward trend outside ANZECC quality guideline limits
		Response	Repeat sampling to confirm results exceed limits, and investigate potential causes.	Review sediment basin maintenance and discharge procedures, and sediment basin capacity requirements
Land Management	Weeds	Trigger	Weeds represent > 10% but <25% of total ground cover in Ecosystem Establishment phase.	Weeds represent >25% cover of total groundcover in Ecosystem Establishment phase.
		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.
		Trigger	Isolated occurrences Class 4 or 5 noxious weeds (including Bathurst Burr and Prickly Pear) are identified.	Occurrences of Class 1, 2 or 3 noxious weeds, or infestations of Class 4 or 5 noxious weed infestations are identified.
		Response	Control using herbicides in accordance with legislation and the relevant Narrabri Shire Council Weed Management Plan.	Control using the appropriate control requirements stipulated for the noxious weed control class. Notify Narrabri Shire Council and NSW DPI of occurrences of Class 1, 2 or 5 noxious weeds.
	Pest animals	Trigger	Pest animal species presence and density increased in annual monitoring events.	Significant numbers of pest animals causing widespread damage to rehabilitation.
		Response	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign.	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign. Update to *Land Management Plan.*
		Trigger	Pest animal species are causing damage to rehabilitation.	Continued damage to rehabilitation from native fauna after tree guards and fencing has been installed.
		Response	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign.	Liaise with government agencies and consider a culling program in accordance with National Parks and Wildlife Service regulations.

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
Biodiversity (Native Vegetation Rehabilitation Areas)	Ground cover percent	Trigger	Bare patches are > 30% (excluding rocks and logs). Bare patches present that are >20m^2 or >10m in length downslope are present.	Bare patches are > 50% (excluding rocks and logs). Bare patches present that are >30m^2 or >20m in length downslope are present.
		Response	Undertake a field survey to identify likely causes of unsatisfactory germination rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare.	Undertake analytical soil testing and evaluation, Where appropriate implement recommendations for amelioration Implement appropriate management actions including revising rehabilitation procedures if required.
	Vegetation Health	Trigger	<75% but >55% of shrubs and/or trees are 'healthy' when ranked 'healthy, sick or dead' in vegetation monitoring during the Ecosystem Sustainability phase.	<55% of shrubs and/or trees are 'healthy' when ranked 'healthy, sick or dead' in vegetation monitoring during the Ecosystem Sustainability phase.
		Response	Undertake a field survey to identify likely causes of vegetation sickness and/or death rates. Re-seed or re-plant areas with high sickness or death rates. Review seeding and/or planting procedures.	Engage a suitably qualified specialist to investigate causes for vegetation sickness and death. Implement appropriate management actions including revising rehabilitation procedures if required.
	Native Fauna Presence	Trigger	Decrease in the number of vertebrate species over successive seasons at rehabilitation areas that is not consistent with changes recorded at analogue sites.	Continued decline in trend in recorded vertebrate species numbers and/or presence and abundance (allowing for any variability observed at analogue sites).
		Response	Engage ecologist to undertake investigation to determine the cause of change.	Engage ecologist to undertake investigation to determine the cause of change. Liaise with relevant government agencies.
		Trigger	Loss or deterioration of nest boxes, or pest animal species usage of nest boxes.	Decline in trend in recorded fauna numbers and/or presence and abundance (allow for natural variation occurring in analogue sites).
		Response	Replace damaged / lost nest boxes. Relocate and replace boxes adopted by pests.	Engage ecologist to undertake investigation to determine the cause of change. A site specific management report may be prepared and implemented where necessary that aligns with the *Mine Closure Plan.*

Aspect/Category	Key Element	Trigger/Response	1st Level Trigger	2nd Level Trigger
Pasture areas	Pasture Composition	Trigger	Palatable, nutritious pasture grass species cover <70% but >50% during the Ecosystem Establishment phase.	Palatable, nutritious pasture grass species cover <50% Ecosystem Establishment phase.
		Response	Undertake a field survey to identify likely causes of unsatisfactory germination and/or growth rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. 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 70% ground cover is not present (or 50% if rocks, logs or other features of cover are present). Bare surfaces >20m^2 in area or >10m in length downslope are present.	During Ecosystem Establishment, vegetative cover is 50% or less. Bare surface > 30m^2 in area or >20m in length downslope are present.
		Response	Undertake a field survey to identify likely causes of unsatisfactory germination rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare.	Undertake analytical soil testing and evaluation, Where appropriate implement recommendations for amelioration Implement appropriate management actions including revising rehabilitation procedures if required.

9.3 Continual Improvement

Rehabilitation monitoring reports include an assessment of rehabilitation progress and recommended management actions to address any deficiencies. WHC is committed to actioning the recommendations of rehabilitation monitoring reports to improve rehabilitation processes at Canyon.

Should any of the triggers for remedial works nominated in the Rehabilitation TARP (**Section 9.2**) be met, WHC will undertake investigations to review the causes of poor rehabilitation outcomes and, where appropriate, amend rehabilitation procedures to achieve the aim of continually improving rehabilitation standards.

Continuous improvement drivers at Canyon also include:

- Outcomes of rehabilitation works undertaken at other WHC operations;
- Advances in industry best practice and technologies; and
- Advances in rehabilitation methodologies identified in the scientific literature.

10 REPORTING, REVIEW AND IMPLEMENTATION OF THE MOP

10.1 Independent Environmental Audit

In accordance with Schedule 5, Condition 6, Canyon has commissioned and payed the full cost for an Independent Environmental Audit every three years from 2006. The next Independent Environmental Audit is due in 2015.

10.2 Reporting

In accordance with Schedule 5, Condition 5, each year Canyon prepares an Annual Environmental Management Report to the satisfaction of the Director-General. The AEMR assesses rehabilitation progress against the rehabilitation schedule included in the MOP.

Copies of the AEMR, including past AEMRs, can be found on the Whitehaven website (http://www.whitehavencoal.com.au/environment/canyon_mine_environmental_management.cfm).

10.3 Periodic Review Protocol

This plan may be revised due to:

- Deficiencies being identified;
- Changes to environmental requirements due to (for example) changed legislation or regulatory requirements;
- Changes in the activities described in this MOP; and
- Where risk assessment identifies the requirement to alter the MOP.
- Any major amendments to the MOP that affect its application will be undertaken in consultation with the appropriate regulatory authorities and stakeholders. Any amendments would be completed in accordance with the latest MOP guidelines.

10.4 Implementation

Canyon personnel responsible for the monitoring, review and implementation of this plan are defined in **Table 21.**

Table 21 Responsibilities for Implementation of the MOP

Position	Responsibility
Executive General Manager - Operations	• Overall site-based responsibility for all activities and all personnel at the mine-site, including their compliance with all applicable laws, regulations, licences, approvals, the conditions of consent and achievement of the desired environmental outcomes, the responsibility of the General Manager.
General Manager	• Ensuring all contractors, sub-contractors and service-personnel are appropriately qualified and/or licenced to undertake the required work and have a good environmental performance record; • Ensuring all operations are undertaken in accordance with relevant environmental legislation; • Providing the final sign-off and/or authorizing distribution of, all environmental reports / management plans etc; • Workforce induction/training; and • Communication with statutory authorities and the community.
Group Environment Manager	• Assist and advise mine management with the requirements of the relevant environmental laws and regulations, consents, licences, approvals and environmental management systems and plans; • Implement, monitor and review programs and procedures associated with this plan; • Consult with regulatory authorities as required; • Undertake maintenance as required; • Provide environmental training and assess the competence of all relevant personnel (as required) to implement this plan; and • Report the progress of rehabilitation and biodiversity monitoring in the AEMR.
Environmental Superintendent	• Provide support to the Group Environment Manager for MOP implementation as required. • Undertake site based actions to implement this plan in cooperation with the General Manager

11 REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZECC). 1992. *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*.

Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia. 2000. *Strategic Framework for Mine Closure*.

Charman P.E.V., and Murphy.B.W. 2007. S*oils: Their Properties and Management, 3rd Edition*. Oxford University Press.

Elliot GL, Reynolds KC. 2007. *Soil rehabilitation for extractive industries. in Charman PEV, Murphy BW.*

Eco Logical Australia. 2013. Canyon Coal Mine – Rehabilitation Monitoring Report Spring 2012. Eco Logical Australia Pty Ltd Armidale.

Environment Protection Agency (EPA). 1998. *Managing Land Contamination – Planning Guideline.*

Landcom. 2004. *Managing Urban Stormwater: Soils and Construction – Volume 1 4th Ed.* NSW Government, Sydney.

New South Wales Department of Environment and Climate Change. 2008a. *Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries.* NSW Government, Sydney.

New South Wales Department of Environment and Climate Change. 2008b. *Waste Classification Guidelines Part 1: Classifying Waste.* NSW Government, Sydney.

New South Wales Department of Environment, Climate Change and Water. 2010. *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* NSW Government, Sydney.

New South Wales Department of Primary Industries. 1997. *MDG1010 Risk Management Handbook for the Mining Industry*. NSW Government, Sydney.

New South Wales Trade Investment Division of Resources and Energy. September 2013. *ESG3: Mining Operations Plan (MOP) Guidelines*. NSW Government, Sydney.

Standards Australia. 1995. *Australian Standard AS4282 (INT) 1995– Control of Obtrusive Effects of Outdoor Lighting.*

Standards Australia. 2006. *Handbook 203: 2006 Environmental Risk Management – Principles and Process*.

Standards Australia. 2009. *AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines.*

Appendix A MOP Plans