

Boggabri Coal Operations Pty Ltd

Mining Operations Plan (MOP)

March 2020

IDEMITSU
BOGGABRI COAL

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Mining Operations Plan (MOP)

Name of Mine	Boggabri Coal Mine
MOP Commencement Date	1 January 2020
MOP Completion Date	31 December 2024
Mining Authorisations (Lease/Licence No.)	CL 368
Name of Authorisation/Title Holder	Boggabri Coal Pty Limited; NS Boggabri Pty Limited; Chugoku Electric Power Australia Resources Pty Ltd
Name of Mine Operator	Boggabri Coal Operations Pty Ltd
Contact Details of Mine Manager	Anthony Margetts ph. 02 6749 6021
Contact Details of Health, Safety, Environment Manager	Peter Forbes ph. 02 6749 6038
Name of Representative(s) of the Authorisation Holder(s)	Anthony Margetts
Title	General Manager
Signature	
Date	25/3/2020

Revision Control Chart

Rev No	Original	A	
Revision Date	19 December 2019	20 March 2020	
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Approved by	Anthony Margetts	Anthony Margetts	

Red text represents MOP Amendment A

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BCOPL	Health Safety and Environment Manager
BCOPL	General Manager
Resources Regulator	Inspector Environment
~~BGC~~NRW Contracting	Project Manager

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Appendices

Acronyms

AEMR	Annual Environmental Management Report
AHCS	Aboriginal Heritage Conservation Strategy
ANC	Acid Neutralising Capacity
AQGHGMP	Air Quality and Greenhouse Gas Management Plan
ARI	Average Recurrence Interval
AS	Australian Standard
ASCF	Aboriginal Stakeholder Consultation Forum
BCM	Boggabri Coal Mine
bcm	Bank cubic metres
BCOPL	Boggabri Coal Operations Pty Ltd
BCT	Boggabri Coal Terminal
BLMP	Blast Management Plan
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Areas
BTM	Boggabri, Tarrawonga, Maules Creek
CCC	Community Consultative Committee
CEMP	Construction Environmental Management Plan
CFMP	Clearing and Fauna Management Protocol
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant, including By-pass crusher
CPP	Coal Processing Plant
CL	Coal Lease
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DPI	NSW Department of Primary Industries
DP&E	Department of Planning and Environment
DRE	NSW Department of Trade and Investment - Division of Resources and Energy
DRG	Department of Planning and Environment – Division of Resources and Geoscience
DTIRIS	NSW Department of Trade and Investments, Regional Infrastructure and Services
EA	Environment Assessment
EAT	Emerson Aggregate Test
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMPs	Environment Management Plans
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act, 1999*
EPL	Environmental Protection Licence
ESP	Exchangeable Sodium Percentage
FTE	Full Time Equivalent
GDA	Geographic Datum of Australia
GMP	Groundwater Management Plan
GSC	Gunnedah Shire Council

HMMP	Hazardous Materials Management Plan
IAR	Idemitsu Australia Resources
IBC	Idemitsu Boggabri Coal Pty Limited
IKC	Idemitsu Kosan Co. Ltd
JV	Joint Venture
Km	Kilometre
kV	Kilovolts
LOX	Limit of Oxidation
MCA	Minerals Council of Australia
MIA	Mine Infrastructure Area
ML	Mining Lease
MOP	Mining Operations Plan
Mt	Million Tonnes
Mtpa	Million Tonnes Per Annum
m^3	Cubic metres
NMP	Noise Management Plan
NOW	NSW Office of Water
NSC	Narrabri Shire Council
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
CBIMP	Common Boundary Integration Management Plan
PAC	NSW Planning and Assessment Commission
PAF	Potentially Acid Forming
PAF – HC	Potentially Acid Forming – High Capacity
POEO Act	*Protection of the Environment (Operations) Act, 1997*
RAPs	Registered Aboriginal Parties
RMP	Rehabilitation Management Plan
RL	Relative Level
RMS	NSW Roads and Maritime Services
ROM	Run of Mine
SCMP	Spontaneous Combustion Management Plan
SD	Sediment Dam
SIMP	Social Impact Management Plan
SWB	Site Water Balance
SMP	Soil Management Protocol
SWC	State Water Corporation
SWMP	Surface Water Management Plan
t	Tonne
TARP	Trigger Action Response Plan
TCPL	Tarrawonga Coal Pty Limited
TSS	Total Suspended Solids
TMP	Traffic Management Plan
WHC	Whitehaven Coal Pty Ltd
WMP	Water Management Plan
WMS	Water Management Strategy

1. Introduction

Boggabri Coal Mine (BCM) is an open cut coal mine located 15 km north-east of the township of Boggabri in north-western New South Wales (NSW). BCM is managed by Boggabri Coal Operations Pty Ltd (BCOPL), which is majority owned by Idemitsu Australia Resources Group (IAR), a subsidiary of Japanese company Idemitsu Kosan Pty Ltd.

Truck and excavator operations produce a crushed and screened export quality thermal coal and pulverised coal injection product. Following extraction, Run of Mine (ROM) coal is processed in a Coal Handling and Preparation Plant (CHPP) and the resultant product is stockpiled prior to being conveyed to an on-site train load out facility, where it is dispatched via rail to the Port of Newcastle and exported for overseas consumption. The train load out facility and associated rail spur have been operating since early 2015, replacing road transport of product coal between the Mine Infrastructure Area (MIA) and former train loading facility located 17 km to the west of the mining lease, which was previously referred to as the Boggabri Coal Terminal (BCT). The CHPP has also been operating since 2015 and runs in conjunction with crushing and grinding facilities commissioned at the site in 2006.

In NSW, mining operations must be carried out in accordance with a Mining Operations Plan (MOP) that has been approved by the Department of Planning, Industry and Environment – Resources Regulator (Resources Regulator). This obligation derives from a condition of authorisation issued under the Mining Act 1992. This MOP has been developed to meet the requirements of the Mining Act 1992. It has been prepared in accordance with the ESG3 Mining Operations Plan Guidelines (DRE, 2013) and applies to activities undertaken at the BCM between 1 January 2020 to 31 December 2024 (the MOP term). All activities described in this MOP are considered in accordance with the activities approved under relevant State and Federal approvals for the BCM (as summarised in Section 1.2).

This MOP has also been prepared to satisfy the requirements for a Rehabilitation Management Plan (RMP) outlined in Project Approval 09_0182 (the Project Approval). Specific conditions within the Project Approval that relate to the development of an RMP and associated rehabilitation management activities are presented in Section 1.2.2.

1.1 History of operations

1.1.1 Site history

In December 1991, Idemitsu Boggabri Coal Pty Limited (IBC) became the sole owner of the BCM. IBC was then 100 % owned by Idemitsu Kosan Co. Ltd (IKC), a privately owned Japanese resource company whose main business consists of importing crude oil, refining oil and the retail sale of fuel products in Japan.

IKC has been involved in the Australian coal mining industry for over 25 years, currently operating the Ensham Mine in central Queensland, Muswellbrook Mine in the Hunter Valley, NSW and the BCM in the Gunnedah Basin. In January 2007, the Idemitsu Australia Resources Group (IAR) underwent an internal reorganisation. As part of the reorganisation, the assets and undertaking of IBC were transferred to Boggabri Coal Pty Ltd, a newly constituted wholly owned subsidiary of IAR. In December of 2014 the BCM became an unincorporated joint venture in the form of BCOPL.

Development of the BCM commenced in 1976, and in the early 1980s numerous environmental and engineering studies were conducted. In the mid-1980s these studies were reviewed and in 1988 an Environmental Impact Statement (EIS) was submitted to the NSW government seeking development approval for the project. The BCM was granted development consent on 25 August 1989. Coal Lease 368 (CL368) was subsequently granted on 15 November 1990.

Between May and July 1979, a box cut pit (approximately 150 metres long and 35 metres wide) was developed to the Merriown seam in the south west of the lease area near the Merriown seam Limit of Oxidation (LOX) line. A total of 100 tonnes of Merriown seam bulk sample coal was extracted. In November 1981 a further 10 tonne sample was excavated from the box cut. In November 1993 a bulk sample of approximately 2,000 tonnes of Merriown seam coal was extracted by auguring operations at the box cut.

Following confirmation of consent validity in late 2005, a MOP and Environment Protection Licence (EPL) were approved for the BCM and construction of ancillary infrastructure commenced. This included:

- A 17 km bitumen sealed private coal haul road from BCM to the rail loading facility including bridges over the Namoi River and Kamilaroi Highway.
- ROM pad.
- Coal crusher.
- Conveyor and truck load out facility.
- 3 km rail loop and turnout.
- A product stockpile and precision train loading facility.
- MIA including workshop and offices.

These construction activities were completed in early November 2006. Forest clearing began in February 2006 and Stage 1 clearing, including timber recovery, was completed in August 2006. Topsoil stripping activities commenced in May 2006 and the first coal was mined and delivered to the ROM pad in October 2006.

Mining commenced from the south of the open cut area utilising hydraulic excavators and rear dump trucks. The first two years of mining concentrated on two separate, progressively developed pits (the “Merriown“ and “Jeralong” pits) which were then joined to form the ”Bollol Creek” pit. The rehabilitation of in-pit and ex-pit emplacement areas has been undertaken progressively. The initial rehabilitation objective was to achieve a similar structure to existing native forest composition surrounding BCM.

Initially, coal was mined and transported to the ROM crushing facility located in the south western corner of CL368, crushed and blended (without further beneficiation) to produce an export quality steaming coal and a product suitable for pulverised coal injection applications. Product coal was then hauled 17 km via a bitumen sealed private coal haul road to the BCT facility for loading and rail transport to the Port of Newcastle.

In 2009, BCOPL lodged a major project application under the now-repealed Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). In the project application, BCOPL sought to extend its mining operations for a further 21 years (until the end of 2033), and increase its production rate to 7 Million tonnes per annum (Mtpa) of product coal (the project). The project application also proposed the following activities:

- Overburden emplacement area to a maximum height of RL 395 metres.
- Construction of the new CHPP and operation of associated ancillary equipment.
- Closure of a section of Leard Forest Road and widening of the existing private coal haulage road.

- Construction of a 17 km rail spur and loop, including a bridge over the Namoi River, Therribri Road and Kamilaroi Highway.
- Upgrade and modification of existing infrastructure, including workshops, bathhouse etc.
- Construction of additional ROM hoppers and the extension of existing coal stockpiles.
- A total workforce of approximately 500 employees.
- Construction of a 132 kV transmission line from near the existing BCT to the MIA.

The project application was approved by the NSW Planning Assessment Commission (PAC), under delegation by the (then) Minister for Planning and Infrastructure. The Project Approval was received in July 2012. The new infrastructure for the Project was constructed and commissioned during late 2014 and early 2015. This eliminated routine road transport of product coal between the mine infrastructure area (MIA) and Boggabri Coal Terminal (BCT).

BCOPL has modified the Project Approval on six occasions since it was issued in 2012. These are summarised in Table 1-1.

Table 1-1 Summary of modifications to Project Approval 09_0182

Modification	Approval Date	Activities
MOD1	Application Withdrawn	Emergency trucking operations.
MOD 2	17 February 2015	▪ Processing of up to 3.5. Mtpa of ROM coal in the CHPP in any calendar year. ▪ Infrastructure , processing, and associated transport of up to 3 Mtpa of ROM coal from Tarrawonga Coal Mine.
MOD 3	17 March 2014	▪ Construction of permanent mine access roads from the Kamilaroi Highway. ▪ Temporary storage of processed mine overburden material at the existing Rock Quarry and the reuse of this material during the construction of the rail spur embankments. ▪ The reuse of the existing Daisymede laydown compound. ▪ The use of temporary in-pit fuel storage facilities.
MOD 4	23 March 2015	▪ Project boundary adjustments to include infrastructure and borrow pits built prior to the Project Approval. ▪ Alterations to existing infrastructure within the BCM, including the extension of two dirty water dams (SD12 & SD3). ▪ Realignment of a haul road, extension of the ROM coal stockpile and construction of new hardstand areas within the MIA. ▪ Construction of a security fence and firebreak along the approved disturbance boundary. ▪ Use of additional portable fuel storages within operational areas.
MOD 5	30 August 2016	▪ Construction of additional groundwater production bores and supporting infrastructure including pumps, access roads, water tanks and power lines.
MOD 6	7 July 2017	▪ Approval to transport a maximum of 10 Mtpa of product coal from site via the Boggabri Rail Spur, of which up to 8.6 million tonnes may be from the BCM and up to 3 million tonnes may be from the neighbouring Tarrawonga Coal Mine.

Modification	Approval Date	Activities
MOD 7	27 May 2019	▪ Amend the available security mechanisms and timing to secure biodiversity offsets. ▪ Use of an approved stockpile area for BCM's product coal. ▪ Undertake exploration and associated activities within the approved disturbance area. ▪ Transport small tonnages of coal by road for testing and marketing purposes. ▪ Realign a small section of the project boundary.

The volumes of product coal produced to date at the BCM are listed in Table 1-2.

Table 1-2 Product coal produced to date

Mining operations	Product coal produced
2006 calendar year	235,000 t
2007 calendar year	1.488 Mt
2008 calendar year	1.472 Mt
2009 calendar year	1.557 Mt
2010 calendar year	2.105 Mt
2011 calendar year	2.653 Mt
2012 calendar year	3.342 Mt
2013 calendar year	4.656 Mt
2014 calendar year	5.493 Mt
2015 calendar year	6.635 Mt
2016 calendar year	6.929 Mt
2017 calendar year	6.9 Mt
2018 calendar year	6.6 Mt

1.2 Statutory requirements

1.2.1 Commonwealth legislation

The following Commonwealth statutory requirements associated with rehabilitation and mine closure management at the BCM have been considered during the development of the MOP.

Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act protects Matters of National Environmental Significance (MNES), including migratory species and threat-listed species/ecological communities. Previous surveys and assessments have identified that the project will impact upon EPBC Act listed ecological communities and native vegetation which provides potential habitat for threat-listed and migratory species.

Based on the known and potential impacts on MNES, the project constitutes a controlled action under the EPBC Act, with impact assessment and regulatory approval provided through a bilateral process (Part 3A of the EP&A Act), requiring approval from the Commonwealth Minister for the Environment.

BCOPL obtained approval from the (then) Commonwealth Minister for the Department of the Environment under the EPBC Act in February 2013.

A full copy of the approval conditions is available at: http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=referral_detail&proposal_id=5256.

The various conditions of the EPBC Approval relevant to rehabilitation management are addressed in the Boggabri Coal Mine Rehabilitation Management Plan (RMP). Notwithstanding, this MOP has also been developed to reflect the requirements of the relevant conditions of the EPBC Approval. As such, the conditions of the EPBC Approval relevant to rehabilitation management, and a reference indicating how each has been considered in this MOP, are presented in Table 1-3.

Table 1-3 EPBC Approval 2009/5256 Conditions

Applicable condition	Requirement	MOP Reference
Condition 21	*To mitigate the impacts to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and derived Native Grassland and the habitat of the regent honeyeater, swift parrot and greater long-eared bat, the person taking the action must, within 12 months of commencement of the new mining activities, submit to the Minister for approval a Mine site rehabilitation plan for the progressive rehabilitation and revegetation of no less than 650ha (less the portion included in the biodiversity corridor identified in condition 2) in the Boggabri extension mine site using species consistent with a White Box-Yellow Box-Blakely's red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This approved Mine site rehabilitation plan must be implemented.*	RMP and Section 8.3.7
Condition 22	*The person taking the action must:* *a. Rehabilitate the site to be consistent with the proposed rehabilitation strategy as provided in the Environment Assessment and, as required under the NSW state government Project Approval dated 18 July 2012 (application number 09_0182); and* *b. Not replace top soil and sub soil layers at a depth less than the minimum depths determined through pre-stripping soil surveys as described in condition 23c.* *Note: the NSW state government Project Approval dated 18 July 2012 (application number 09_0182) conditions require pre-stripping soil surveys and inventories to inform the availability, rehandling, stockpiling and management of soils, and maximising the salvaging of soil to be used, in the rehabilitation of the site.*	Section 8
Condition 23	*The Mine site rehabilitation plan must include, at a minimum, the following information:* *a. Targets and performance indicators to achieve effective restoration of native forest and woodlands.* *b. Details of the vegetation communities to be rehabilitated and the timing of progressive rehabilitation (commencing as soon as practicable following disturbance).* *c. Detailed soil depth surveys and analysis to inform the effective placement and restoration of soils underlying the proposed rehabilitation sites; including mapping of soils across the disturbance sites and soil sampling at no less than one sample point per 20ha of each soil types identified. Sampling must identify; type, depth, water holding capacity, structure and physio-chemical properties of each of the soil and subsoil layers.* *d. Processes and methodologies for the removal, storage and re-layering of the top soil and sub soil layers underlying the disturbed sites being prepared for rehabilitation. These processes and methodologies must ensure the replacement of top soil and sub soil layers:* *i Meet the minimum depth requirements determined from sampling outcomes as identified in condition 23c; and* *ii Replicates the other existing soil parameters including,, but not limited to, soil type, water holding capacity, structure and physio-chemical properties.* *e. Criteria to determine success of rehabilitation of native vegetation.*	Section 5 Section 7 Section 8 SMP SMP Section 7 and Appendix D Section 11

Applicable condition	Requirement	MOP Reference
	f. A process to progressively report to the department the rehabilitation management actions undertaken and the outcomes of those actions, and the mechanisms to be used to identify the need for improved management *g. A description of the potential risks to successful management and rehabilitation on the project site, and a description of the contingency measures that would be implemented to mitigate these risks* *h. Details of long-term management and protection of the mine site.* *Note: for consistency, the person taking the action may develop a single mine rehabilitation plan to align with the requirements including timing of reports of the NSW state government Project Approval dated 18 July 2012 (application number 09_0182) requirements and this approval. The Offset management plan and the Mine site rehabilitation plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.*	Section 4.2.1, Section 5 and Section 10
Condition 24	*The person taking the action must rehabilitate the site consistent with the proposed Rehabilitation Strategy as required under conditions 69, 70, 71 and 72 of the NSW state government Project Approval dated 18 July 2012 (application 09_0182) such that the final landform provides the optimum opportunity for the successful restoration of native forest and woodland including the critically endangered White Box-Yellow Box-Blakely's Red gum Grassy Woodland and Derived Native Grassland Ecological Community.*	Section 5, Section 8.3 and Appendix D
Condition 25	*The person taking the action must undertake rehabilitation to ensure the final landform minimises the extent of any resulting pit lake, avoids salt scalding and ensures that drained waters do not adversely affect the downstream environment and avoids any impacts on matters of national environmental significance.* *Note: the NSW state government Project Approval dated 18 July 2012 (application 09_0182) approval conditions require the preparation and implementation of an updated Final Void and Mine Closure Plan that considers interactions with the adjoining mines, including interaction between final voids, opportunities for integrated mine planning with adjoining mines to minimise environmental impacts, all reasonable and feasible landform options for the final void (including filling) and predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality).*	Section 8.3

1.2.2 State legislation

The following State statutory requirements associated with rehabilitation and mine closure management at the BCM have been considered during the development of the MOP.

Environmental Planning and Assessment Act 1979

In summary, the *Environmental Planning and Assessment Act 1979* (EP&A Act) facilitates mechanisms to encourage:

- Proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.
- Promotion and co-ordination of the orderly and economic use and development of land.

- Protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.
- Sharing of the responsibility for environment planning between the different levels of government in the State.

BCOPL has obtained Project Approval from the (then) Department of Planning and Environment (DPE) Minister under Section 75J of the EP&A Act. A full copy of the Project Approval conditions is available at: https://majorprojects.affinitylive.com/public/b3e160fc839a913e2be52be049c9181e/Project%20Approval.pdf.

The various conditions of the Project Approval relevant to rehabilitation management are detailed in Table 1-4, together with a reference to where each condition is addressed in this MOP. Also listed in Table 1-4 are the commitments made by BCOPL in the EA (Hansen Bailey, 2010) relevant to rehabilitation activities at the BCM.

Table 1-4 Project Approval 09_0182 Conditions and EA Commitments for Rehabilitation

Applicable condition	Requirement	MOP Reference
Project Approval 09_0182		
Schedule 3 Condition 36	*The Proponent shall:* *a. Develop a detailed soil management protocol that identifies procedures for* ▪ *Comprehensive soil surveys prior to soil stripping;* ▪ *Assessment of top-soil and sub-soil suitability for mine rehabilitation; and* ▪ *Annual soil balances to manage soil handling including direct respreading and stockpiling;* *b. Maximise the salvage of suitable top-soils and sub-soils and biodiversity habitat components such a bush rocks, tree hollows and fallen timber for rehabilitation of disturbed areas within the site and for enhancement of biodiversity offset areas;* *c. Ensure that coal reject or any potentially acid forming Interburden materials must not be emplaced at elevations within the Boggabri pit shell where they may promote acid or sulphate species generation and migration beyond the pit shell;* *d. Ensure that any coal barrier between the final void and any future surrounding mining operations must remain intact in order to impede exchange of any contaminated groundwaters in the Boggabri pit shell.*	SMP Section 8.3 Section 4.2.1 Section 6.1.1 and Section 8.3.3
Schedule 3 Condition 44	*For the White Box - Yellow Box - Blakeley's Red Gum Grassy Woodland Endangered Ecological Community the Proponent shall:* *a. Ensure that the Biodiversity Offset Strategy and Rehabilitation Strategy are focused on protection, rehabilitation, re-establishment and long-term maintenance of viable stands of this community* *b. Investigate in consultation with OEH and the North West LLS, all factors likely to enhance or impede the effective long-term restoration of degraded remnants of this EEC in offset areas or regeneration of this EEC on disturbed areas (both offset areas and the site)* *c. Within 24 months of the date of this approval (and if possible in conjunction with Stage 2 of the Leard Forest Mining Precinct regional Biodiversity Strategy), submit a report of this investigation and provide an implementation plan to maximise the prospects for rehabilitation and regeneration of this EEC on the offset areas and the site, for approval by the Secretary, and* *d. Incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 50.*	Section 5, Section 8 and Appendix B

Applicable condition	Requirement	MOP Reference
Schedule 3 Condition 45	*For all threatened species on site, the proponent shall ensure that the Biodiversity Offset Strategy and Rehabilitation Strategy are focussed on protection, rehabilitation and long-term maintenance of viable stands of suitable habitat for these species.*	Appendix B
Schedule 3 Condition 46	*The Proponent shall:* *a. Investigate, in consultation with OEH and the North West LLS, all factors likely to enhance or impede the effective long-term provision of suitable habitat(s) for the following species: Brown Treecreeper, Hooded Robin, Black-chinned Honeyeater, Painted Honeyeater, Pied Honeyeater, Grey-crowned Babbler, Speckled Warbler, Diamond Firetail, Varied Sittella, Regent Honeyeater, Eastern False Pipistrelle, Greater Long-eared Bat, Yellow-bellied Sheath Tail Bat* *b. Within 24 months of the date of this approval (and if possible, in conjunction with Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy), submit a report of this investigation and provide an implementation plan to ensure delivery of suitable areas of viable habitat for the species included in (a) above, for approval by the Secretary, and* *c. Incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 50.*	Appendix B
Schedule 3 Condition 69	*The Proponent shall rehabilitate the site to the satisfaction of the Resources Regulator. This rehabilitation must be generally consistent with the proposed Rehabilitation Strategy described in the EA (and depicted conceptually in Appendix 9) and comply with the objectives in Table 16.*	Section 5 and Section 8
Schedule 3 Condition 70	*The Proponent shall rehabilitate the site progressively, that is, as soon is reasonably practical following disturbance.* *All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies shall be employed when areas prone to dust generation cannot yet be permanently rehabilitated.*	Section 8
Schedule 3 Condition 71	*The Proponent shall prepare and implement a Rehabilitation Management Plan to the satisfaction of the Resources Regulator.* *This plan must:* *a. Be prepared in consultation with the Department, Forestry Corporation of NSW, DoI Lands & Water, OEH, North West LLS, Council and the CCC;* *b. Be submitted to the Resources Regulator within 6 months from the date of this approval;* *c. Be prepared in accordance with any relevant Resources Regulator guideline;* *d. Describe how the rehabilitation of the site would be integrated with the implementation the biodiversity offset strategy;* *e. Include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);* *f. Describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, and address all aspects of rehabilitation including mine closure, final landform, and final land use;* *g. Include interim rehabilitation where necessary to minimise the area exposed for dust generation;* *h. Include a program to monitor and report on the effectiveness of the measures, and progress against the detailed performance and completion criteria; and* *i. Build to the maximum extent practicable on the other management plans required under this approval.* *Note: In particular the Biodiversity Management Plan and Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.*	Whole document Section 1.4 Section 1 Section 8.3 Section 7 Section 8 Section 0 Section 9 and Section 11 Whole document

Applicable condition	Requirement	MOP Reference
Schedule 3 Condition 72	*The Proponent shall prepare and implement an updated Final Void and Mine Closure Plan (as a component of the overall Rehabilitation Management Plan required under Condition 71 of Schedule 3) to the satisfaction of the Resources Regulator. This plan must:* *a. Be submitted to the Resources Regulator by the end of December 2025;* *b. Address future stability of the proposed landforms, long term groundwater recovery and void groundwater quality characteristics;* *c. Include a detailed assessment of the hydrochemistry, hydrogeology and hydrology components of the final void and landform design that has been subject to independent review and verification by suitably qualified, experienced and independent person/s whose appointment has been approved by the Secretary.* *d. Demonstrate that:* ▪ *The long term landform will not generate a pit lake;* ▪ *Emplaced spoil has the capacity to drain to the natural environment;* ▪ *Drained waters do not adversely affect the downstream environment; and* *e. Identify opportunities for integrated mine planning with adjoining mines to minimise environmental impacts of the final landform.*	Section 13.3
EA Commitments (Hansen Bailey, 2010)		
Section 8.16.3, p.164	*It is proposed that the final land use of the rehabilitated site will include those similar to pre-mining land uses including biodiversity, pastoral, forestry and recreational opportunities.*	Section 5
Section 8.16.3, p.165	*The Mine Disturbance Area: The final land use of this area will comprise a mixture of the native vegetation communities including, grassy woodland (70%), shrubby woodland / open forest (25%) and riparian forest (5%) for conservation and forestry.*	Section 5 and Section 8
Section 8.16.3, p.165	*The Mine Infrastructure Area and Haul Route / Rail Spur: final land use will incorporate a mixture of land capability classes III, IV and V for agricultural lands. The rehabilitation strategy will, where practical, revegetate the haul route and rail spur corridor to maximise its ecological contribution to the east-west wildlife corridor.*	Section 5 and Section 8
Section 8.16.3, p.167	*The final void will be reshaped to ensure the land form is safe, stable, non-erosive and revegetated as is practical.*	Section 5 and Section 8.3

Mining Act 1992

The *Mining Act 1992* provides mechanisms to encourage and facilitate the discovery and development of mineral resources in NSW. BCOPL holds Coal Lease (CL) 368 under this Act. Table 1-5 identifies applicable coal lease conditions and their corresponding requirements relevant to BCOPL in relation to rehabilitation and preparation of a MOP.

Table 1-5 Coal Lease 368 Conditions

Applicable condition	Requirement	MOP reference
2	*Environmental Harm* *a. The lease holder must implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of any activities under this lease.* *b. For the purposes of this condition:* *i Environment means components of the earth, including:* *(A) land, air and water, and* *(B) any layer of the atmosphere, and* *(C) any organic or inorganic matter and any living organism* *(D) human-made or modified structures and areas and includes interacting natural ecosystems that include components referred to in paragraphs (A)-(C).* *ii Harm to the environment includes any direct or indirect alteration of the environment that has the effect of degrading the environment and, without limiting the generality of the above, includes any act or omission that results in pollution, contributes to the extinction or degradation of any threatened species, populations or ecological communities and their habitats and causes impacts to places, objects and features of significance to Aboriginal people.*	Whole MOP document
3	*Mining Operations Plan* *a. Mining operations must not be carried out otherwise than in accordance with a Mining Operations Plan (MOP) which has been approved by the Secretary.* *b. The MOP must:* *i Identify areas that will be disturbed by mining operations;* *ii Detail the staging of specific mining operations;* *iii Identify how the mine will be managed to allow mine closure;* *iv Identify how mining operations will be carried out in order to prevent and or minimise harm to the environment;* *v Reflect the conditions of approval under:* ▪ *The Environmental Planning and Assessment Act 1979* ▪ *The Protection of the Environment Operations Act 1997* ▪ *And any other approvals relevant to the development including the conditions of this lease; and* ▪ *Have regard to any relevant guidelines adopted by the Secretary* *c. The leaseholder may apply to the Secretary to amend an approved MOP at any time.* *d. It is not a breach of this condition if:* *i The operations constituting the breach were necessary to comply with a lawful order or direction given under the Mining Act 19925, the Environmental Planning and Assessment Act 1979, Protection of the Environment Operations Act 1997, Mine Health and Safety Act 2004 / Coal mine Health and Safety Act 2002 and Mine Health and Safety Regulations 2006 or the Occupational Health and Safety Act 2000; and* *ii The Secretary had been notified in writing of the terms of the order or direction prior to the operations constituting the breach being carried out.*	Whole document

Applicable condition	Requirement	MOP reference
	e. A MOP ceases to have effect 7 years after date of approval or other such period as identified by the Secretary.	
7	*Rehabilitation* *Any disturbance as a result of activities under this lease must be rehabilitated to the satisfaction of the Secretary.*	Whole document

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation, which aims to protect, restore and enhance the quality of the environment in New South Wales by rationalising, simplifying and strengthening the regulatory framework for environment protection.

This Act ensures that during construction and operations, the operation of any plant or equipment is undertaken in a manner that does not cause pollution from those premises and operations are also carried out in a competent manner.

Under the POEO Act, certain industrial activities (including the project) require an (EPL. Each EPL limits lawful pollution emissions to air, land and water to specific thresholds.

BCOPL holds EPL No: 12407 (the EPL) under this Act.

There are currently no specific EPL conditions relating to rehabilitation or mine closure activities specified in the EPL, though issues such as noise, water and air quality criteria in the EPL are potentially impacted via rehabilitation and mine closure activities. Monitoring requirements of the EPL apply during closure and rehabilitation activities until surrender of the licence.

Brigalow and Nandewar Community Conservation Area Act, 2005

This Act provides the mechanisms to reserve forested land in the Brigalow and Nandewar area to create a Community Conservation Area, which provides for permanent conservation of land, protection of areas of natural and cultural heritage significance to Aboriginal people and sustainable forestry, mining and other appropriate uses.

The Brigalow and Nandewar Conservation Area Agreement was made pursuant to this Act.

The Leard State Forest is currently listed under the Brigalow and Nandewar Conservation Area (2005) for ongoing forestry, recreation and mining activities. Consultation with Resources Regulator, OEH, Forestry Corporation of NSW and the Brigalow and Nandewar Community Conservation Area committees is required to consider the post mining zoning of the Leard State Forest.

Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future. The BC Act lists threatened species, populations and ecological communities as well as critical habitat and key threatening processes that must be considered when assessing the effects of an activity.

Following the repeal of the *Threatened Species Conservation Act 1995* (TSC Act) and *Native Vegetation Act 2003* (NV Act) in 2017, the BC Act is now the key State legislation for the protection of biodiversity values in NSW. Threatened ecological communities and species previously listed under the TSC Act are now listed under the BC Act.

The EA identified one threatened ecological community and thirteen species listed under the TSC Act that are likely to be significant impacted by the project.

Mitigation measures associated with the provisions of the BC Act (as per the repealed TSC Act) will apply during the rehabilitation phase of the project.

Biosecurity Act 2015

The *Biosecurity Act 2015* guides the management of weeds at the regional level throughout NSW. Under the Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risks they may pose. Any person who deals with any plant who knows or ought to know of any biosecurity risk, has the duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Individual landholders and managers are required under the Act to control priority weeds for their area according to the relevant biosecurity toolset.

BCOPL has a requirement to manage weeds on BCOPL owned and managed land in accordance with the requirements of the Act.

Local Land Services Act 2013

This Act repealed the *Rural Lands Protection Act the Rural Lands Protection Amendment Act 2008* and the *Catchment Management Authorities Act 2003*. It provides the mechanisms to ensure responsibility for management and delivery of local land services in the social, economic and environmental interests of the State in accordance with any State priorities for local land services.

This Act specifies a number of obligations of owners and occupiers of private land, including:

- An occupier of any private land on whom a general destruction obligation in relation to a pest is imposed by a pest control order must eradicate any pest on the land by any lawful method (or, if the order specifies a method to be used, by the method specified).
- An owner or occupier of land who is served with an individual eradication order by a board must comply with the individual eradication order.

Under this Act, BCOPL has a requirement to comply with pest control and eradication orders served by the Local Land Services (LLS).

1.2.3 Current consents, authorisations and licences

BCM is a Level 1 mine under the ESG3: Mining Operations Plan Guidelines (DRE, 2013) as the mine was approved under the former Part 3A of the EP&A Act. Table 1-6 summarises the current consents, authorisations and licences that have been granted for BCM.

Table 1-6 Summary of current consents, authorisations and licences

Lease/licence/approval	Date granted	Expiry/duration
Exploration licences		
Exploration Permit Tender Area no. 1	22 December 1975	-
Coal leases		
CL368	15 November 1990	14 November 2032
Mining leases		
ML A355	19 July 1984	11 April 2018[1]
ML A339	11 April 1984	11 April 2022
ML 1755	30 June 2017	30 June 2038
Project Approvals		
Development Consent DA36-88 MOD 1 MOD 2	22 August 1989 22 July 2009 19 October 2011	15 November 2011 15 November 2011 31 December 2013
75J Project Approval 09_0182 MOD1 MOD2 MOD3 MOD4 MOD5 MOD6 MOD7	18 July 2012 Withdrawn 17 February 2015 17 March 2014 23 March 2015 30 August 2016 7 July 2017 27 May 2019	31 December 2033 N/a 31 December 2033 31 December 2033 31 December 2033 31 December 2033 31 December 2033 31 December 2033
EPBC Act Approval 2009/5256	11 February 2013	31 December 2053
Other licences		
EPL 12407 (as currently modified)	4 April 2016	-
Approval of Controlled Works Part 8 of the Water Act 1912 – Floodplain construction works for rail loop	01 October 2013	-
Approval of Controlled Works Part 8 of the Water Act 1912 – Floodplain construction works for Kamilaroi Highway access road	5 June 2014	-
Water Access Licence (WAL) 12691	27 July 2012	Perpetuity
WAL 12767	8 April 2014	Perpetuity
WAL 15037	12 December 2013	Perpetuity
WAL 24103	1 September 2011	Perpetuity
WAL 12691	12 May 2015	Perpetuity
WAL 37519	14 June 2016	Perpetuity
WAL 37067	26 April 2016	Perpetuity
WAL 29473	26 July 2012	Perpetuity
WAL 29562	26 July 2012	Perpetuity
WAL 2571	12 December 2013	Perpetuity
WAL 2572	25 September 2013	Perpetuity

[1] *An application to renew A355 was lodged with the Resources Regulator prior to the expiry date. The application is currently being processed. Whilst the renewal application is being processed, A355 remains 'current'.*

Lease/licence/approval	Date granted	Expiry/duration
WAL 2595	12 December 2013	Perpetuity
WAL 2596	25 September 2013	Perpetuity
WAL 31084	22 August 2013	Perpetuity
WAL 36547	6 February 2014	Perpetuity

1.3 Land ownership and land use

The BCM lies wholly within the Narrabri Shire Council (NSC) local government area. Land ownership is identified on Map 1C (refer to Section 12). Table 1-7 provides a schedule of land ownership and occupancy over the lease area for the BCM. Properties shown as 'bold' are owned or leased by BCOPL.

Table 1-7 Schedule of land ownership and occupancy

Property	Occupancy	Parish	County	Description
Authorisation Area 355	Unoccupied	Leard	Nandewar	Non designated crown land to the north and east of Lots 30 and 38 DP 754940
Coal Lease 368	Unoccupied	Leard	Nandewar	Lots 30, 38 and 56 DP 754940
Closed road	Unoccupied	Baan Baa	Pottinger	Between Parish 191 and PT 156
Leard State Forest	Unoccupied			State Forest – Leard 420
"Merriown" – Farm and Cottage	Unoccupied	Leard	Nandewar	Lots 5, 12, 17, and 37 DP 754940
"Nagero" – Farm and Cottage	Occupied	Leard	Nandewar	Lots 24, 25, and Lot 44 DP 754940. Lot 279 DP 1196626
Crown controlled public roads	Unoccupied	Leard	Nandewar	Road that runs East West through the Southern portion of MLA 355. Road in the South East corner of MLA 339
"Greenhills"	Occupied	Leard	Nandewar	Lots 86, 87 and 88 DP 754953
Local Government controlled public roads	Unoccupied	Leard	Nandewar	Leard Forest Road path through the Leard State Forest and Road in the South East corner of MLA 339
"Forest View" Farm only	Unoccupied	Wean	Nandewar	Lot 83 DP 754953
Whitehaven Coal owned freehold	Unoccupied	Leard	Nandewar	Lot 60 DP 754940

1.3.1 Historic, current and proposed land use

The BCM is bounded by Willowtree Range, which encloses the catchment of an ephemeral drainage line (known as Nagero Creek), forming a broad south-facing basin. The BCM site existed pre-mining as cleared agricultural land and an area within the Leard State Forest.

The majority of the BCM's ancillary infrastructure, such as the rail spur and mine access road, is located within areas previously disturbed and cleared for agricultural land use. Coal extraction, waste emplacement and some water management infrastructure is located within the Leard State Forest.

The area between the Leard State Forest and the point at which the rail spur connects with the main north-west railway line consists of level cleared pastures established on the alluvial soils of the Namoi River floodplain interspersed with volcanic rock outcrops. The rail spur and former private haul road, part of which now forms the mine access road, pass through this area and over the Namoi River. The western extent of the rail spur and former private haul road extend up a small rocky valley containing more established native vegetation.

Proposed post-mining land uses for the mine are biodiversity conservation and agriculture. Areas within the BCM will be used for biodiversity conservation and agricultural purposes following rehabilitation and areas adjacent to Biodiversity Offset Areas will be rehabilitated to appropriate vegetation communities to enhance biodiversity and corridor establishment.

1.4 Stakeholder consultation

Extensive consultation has been undertaken throughout development of the BCM, including liaison with government agencies, the community and Aboriginal community groups, as detailed in the following subsections. Specific consultation undertaken by BCOPL for the preparation of this MOP is summarised in Section 1.4.4.

1.4.1 Agency consultation

BCOPL has undertaken ongoing consultation with the agencies listed in Table 1-8 throughout the approvals process for the BCM. A comprehensive stakeholder engagement program was undertaken as part of the process for obtaining the 2012 Project Approval, details of which are provided in the 2010 Environmental Assessment (EA) (Hansen Bailey, 2010).

Table 1-8 Summary of agency consultation undertaken over the life of the project

Agency	Issues
DPIE (formerly DP&E)	Consultation in relation to the 1989 Development Consent (DA 36/88), the current Project Approval and various compliance issues.
DoI – Lands & Water (formerly DPI Water)	Consultation in relation to licences required under the *Water Act 1912*, consent under the *Water Management Act 2000*, associated Water Environmental Management Plans (EMPs) and water modelling undertaken.
	Consultation in relation to Part 3A licence applications.
ENSIS	Consultation with ENSIS, a joint venture of CSIRO and SCION in relation to the development of the Rehabilitation Management Plan* (RMP).
SWC	State Water Corporation (SWC) in relation to licence details under the *Water Act 1912* and the *Water Management Act 2000.*
DoI	Former Department of Lands (now DoI – Lands & Water) (Soil Conservation Service) in relation to the assessment of Rural Land Capability and development of the RMP.
	NSW Department of Industry, DoI (Fisheries) in relation to Part 3A licence applications.
	NSW Department of Industry, DoI (Agriculture) in relation to the RMP.
(former) OEH (now part of DPIE)	NSW Office of Environment and Heritage (OEH) in relation to flora and fauna, archaeology, EPL application, mine rehabilitation and green offsets.
Forests NSW	Forestry Corporation of NSW (Forests NSW) in relation to the Project property management and the RMP.
Resources Regulator (formerly DRE, DRG)	Resources Regulator within the DPIE in relation to EMP requirements, MOP requirements and lease issues.

Agency	Issues
RMS	NSW Roads and Maritime Services (RMS) in relation to traffic and transport requirements, particularly with regard to the intersections and bridges over the Kamilaroi Highway.
NSC	Narrabri Shire Council (NSC). Presentation to the NSC Development Committee and on-site field days. Various planning and engineering staff have been consulted with respect to roads and planning issues. A member of NSC is also a member of the BCM Community Consultative Committee (CCC).
GSC	Gunnedah Shire Council (GSC) in relation to planning and transport issues.
North West LLS (formerly Namoi CMA)	North West Local Land Services (LLS) in relation to the development of the previous version of the RMP (which has now been incorporated into this MOP).

*Note: *following consultation with DPE and Resources Regulator (formerly DRE) in February 2017, the RMP has been incorporated into the MOP document and is no longer a separate management document. All elements of rehabilitation management previously addressed in the RMP are now addressed solely in this MOP.*

A summary of key stakeholder expectations and agreements in relation to post mining land use, rehabilitation objectives and completion criteria is presented in Table 1-9. These include submissions to the PAC in relation to the Project Approval and comments received from the (then) DPE in response to the RMP (which now forms part of the MOP). Other detailed stakeholder feedback received from the DPIE has been considered, where relevant, in preparation of this MOP.

Table 1-9 Stakeholder expectations

Stakeholder / source	Concern	Comment
PAC Submissions (various) (2011)	The extent of the final void should be minimised as much as possible to reduce the long term impacts on the landscape.	The nature and extent of the final void is addressed in the MOP.
	The proponent should work with adjoining mines to minimise final landscape/ biodiversity impacts and enhance biodiversity and environmental management outcomes.	BCOPL and Whitehaven Coal have developed draft regional strategies for environmental management, required as part of the Project Approval. These include strategies for the sharing of environmental monitoring networks. A dump integration management plan is being developed by BCM and Tarrawonga Coal Mine.
	The ability to rehabilitate the forest to its pre-mining conditions is doubtful; Concern that soil depths suggested are insufficient for establishment of rehabilitation.	The MOP outlines the approach that will be taken to rehabilitation, including topsoil management and placement. Topsoil depths have been researched as part of this and are believed adequate for sustaining proposed vegetation.
(then) DPE comments on the RMP (received 2013)	The final mix and areas of natural vegetation communities will need to be in accordance with the approved Biodiversity Management Plan.	The final mix and areas of vegetation have been established based upon conditions of the Project Approval, commitments in the EA and other requirements. This is addressed and documented in the BMP and RMPs.
	Investigations into proposed final landforms should be considered to start earlier to allow for alternative landform designs to be considered.	BCOPL will consider accelerating studies into final landform designs.
	Land zoning post closure will need to be considered and addressed.	A strategy for final land uses is included in the RMP. A rezoning application may be required to achieve final land uses.
	Need to ensure consistency between the RMP, the MOP and mine closure planning.	The MOP and mine closure planning are being continually reviewed and revised. As part of the revision process, cross checks are made between documents and when required, plans are updated.

Stakeholder / source	Concern	Comment
	Final landforms should provide information on land capability and agricultural suitability.	Land capability and agricultural suitability is addressed in Section 3 and Section 5.
	Need to consider Commonwealth approval conditions in preparation of management plans.	The Commonwealth approval has been considered in the preparation of management plans. In particular, extensive changes have been made to the Biodiversity Management Plan, Site Water Balance, Surface Water Management Plan, Water Management Plan and Groundwater Management Plan in response to the Commonwealth approval.
(then) DPE comments on the RMP (received February 2015)	Update references to approval conditions following granting of MOD 5. Update Soil Management Protocol (SMP) with domains consistent with target vegetation communities in RMP.	The previous version of the RMP (including SMP) (which has now been incorporated into this MOP) was updated to address DPE review comments and issued to relevant agencies for consultation. Subsequent feedback from agencies has been addressed in this MOP.

The above feedback has been considered and incorporated into this MOP.

1.4.2 Community consultation

BCOPL has undertaken extensive community consultation as part of the development and operation of the BCM. This has included the establishment of the BCM Community Consultative Committee (CCC). BCOPL also maintains ongoing communication with residents immediately neighbouring the BCM through direct correspondence. Where possible, BCOPL has utilised local residents and contractors throughout the development and operation of the BCM.

Land Access Agreements for environmental studies and monitoring have been established with the residents of the following mine owned properties:

- Oakleigh
- Goonbri
- Tarrawonga
- Cooboobindi

BCOPL also maintains a community enquiry and complaints hotline **1800 BOGGABRI** (1800 2644 2274) along with a CCC consultation forum at BoggabriCCC@boggabricoal.com.au .

1.4.3 Aboriginal consultation

Consultation with Aboriginal stakeholders has been undertaken on an ongoing basis as part of previous approvals processes and development of the site's Cultural Heritage Management Plan (CHMP). A representative of the Aboriginal stakeholder group is also part of BCOPL's CCC.

To facilitate ongoing Aboriginal stakeholder consultation, an Aboriginal Stakeholder Consultative Forum (ASCF) has been initiated. The ASCF is open to all stakeholders involved in the various BCOPL projects. The ASCF provides a platform for information exchange between BCOPL, stakeholders and is a method of efficiently disseminating information to the Aboriginal community.

Key concerns from the ASCF have been mostly related to preservation of cultural heritage, access to land and employment opportunities.

1.4.4 MOP consultation

The proposed mining and rehabilitation activities for the MOP term were presented to the Resources Regulator during a meeting held at the Boggabri Coal Mine on Tuesday 17 December 2019. The presentation was followed by tour of the mine. No specific issues regarding the proposed mining and rehabilitation set out in the MOP were raised during the consultation.

In early March 2020 BCOPL discussed with the Resources Regulator its proposed MOP amendment 'A'. During this consultation it was suggested to BCOPL that the concurrence of DPIE should be sought in relation to the approval pathway for proposed exploration boreholes located outside of BCM's approved mine disturbance boundary.

BCOPL has consulted with the DPIE and DAWE regarding the appropriate approval pathway for the proposed exploration boreholes located outside BCM's approved mine disturbance boundary (correspondence is attached in Appendix H). In accordance with advice received from DPIE and DAWE an assessment and determination under Part 5 of the EP&A Act is required and has been prepared as part of the MOP (refer to Section 5).

2. Proposed mining activities

2.1 Project description

The BCM is located predominantly within the Leard State Forest. General access to the site is via Rangari Road and Leard Forest Road. Heavy vehicle access is via the mine access road off the Kamilaroi Highway. The area lies immediately to the north of Tarrawonga Coal Mine, a joint venture between BCOPL and Whitehaven Coal Mining Pty Limited, and southeast of the Maules Creek Coal Mine.

The BCM extracts coal resources down to the Merriown coal seam using a truck and excavator method. Mine plans for the duration of the MOP term are shown on Plan No's 3A to 3E (refer to Section 12). A conceptual final landform design for the BCM has been developed and is discussed further in Section 6.1.1.

The BCM operates up to 24 hours a day, 7 days a week. BCM currently operates within CL 368.

Key aspects of the BCM are outlined in Table 2-1.

Table 2-1 Overview of the Boggabri Coal Mine

Key aspect	Approved operations
Extraction limit	▪ Up to 8.6 Mtpa ROM coal
Product coal to be mined	▪ Approximately 145 Mt
Mine life	▪ 21 years
Operating hours	▪ 24 hours per day, 7 days per week
Number of employees	▪ Approximately 650 full time equivalents (FTEs)
Mining methods	▪ Open cut using truck and shovel with the option of a dragline
Mine footprint	▪ Approximately 1,954 ha
Coal processing	▪ CHPP with approximately 500 t per hour capacity and associated ultra-fines plant
Product coal transport	▪ Rail spur from Main North-West Rail Line to new loading facilities adjacent to CHPP
Infrastructure	▪ Mine Infrastructure Area (MIA) located to the south-west of the mine ▪ Power/water/communications systems ▪ Service roads
Waste management	▪ Coarse rejects and tailings co-disposed with overburden or within in-pit tailings emplacement areas
Water management	▪ Clean water diversions to divert run-off from surrounding areas around disturbance areas ▪ Dirty water management system to capture and treat water from disturbed (non-mining) areas ▪ Contaminated water management system to capture water from coal mining and storage areas
Other features	▪ Closure of a section of Leard State Forest Road to allow for mining

During the MOP term (from the date of approval until 31 December 2024), mining and transport operations at the BCM will remain relatively constant. The production rate over this period is expected to remain at full production (between 7.3 and 7.9 Mtpa product coal). In early 2015, the rail spur commenced operation, transporting product coal directly from the MIA. This has removed the need for haulage of product coal between the mine and the BCT on the private haul road. The CHPP also commenced operation in 2015, which has enabled further processing of ROM coal required for the mine to reach the full production rate.

A conceptual production schedule for the life of the BCM is provided in Table 2-2.

Table 2-2 Production schedule for the BCM

Project year	Total overburden (Mbcm)	ROM coal total (Mt)	Product coal (Mt)	Reject (Mt)
Year 1	35.5	4.7	4.9	0.0
Year 5	54.0	8.0	7.0	1.5
Year 10 (2023)	60.2	8.6	7.5	0.8
Year 21 (2033)	29.3	4.1	3.8	0.3

2.2 Asset register

Table 2-3 outlines the domains for the BCM that are referred to in this MOP. The table also outlines major assets within each domain and the activities required to demolish, remove and rehabilitate each domain following the completion of mining.

Table 2-3 Asset register

Domain	Major assets	MOP disturbance area[1] (km²) and year	Indicative closure requirements[2,3]
Domain 1 – Overburden emplacement areas	▪ None	4.1 (2023)	▪ Stabilisation and shaping of final landform ▪ Construction of drainage structures ▪ Spreading of topsoil ▪ Revegetation (see domain 3)
Domain 2 – Active mining areas	▪ None	4.1 (2020)	▪ Safety works for final void
Domain 3 – Rehabilitation	▪ None	5.2 (2024)	▪ Planting, establishment and maintenance of revegetation (up to 5 years)
Domain 4 – Clean water management systems	▪ Clean water dams	0.02 (2020 – 2024)	▪ Stabilisation and safety works ▪ Planting, establishment and maintenance of revegetation (up to 5 years)
Domain 5 – Dirty/contaminated water management systems	▪ Dirty water dams ▪ Tailings dams	0.3 (2020 – 2024)	▪ Stabilisation and safety works ▪ Planting, establishment and maintenance of revegetation (up to 5 years)
Domain 6 – Administration buildings, car parks, access roads	▪ Offices and buildings ▪ Services (power and water) ▪ Paved and hardstand areas	0.2 (2020 - 2024)	▪ Demolish and remove buildings and services ▪ Demolish and remove paved areas and footings ▪ Rehabilitate disturbed areas
Domain 7 – Potentially contaminated areas	▪ Workshops and stores ▪ Services (power and water) ▪ Refuelling stations ▪ Sewage treatment plant	0.1 (2020 – 2024)	▪ Demolish and remove buildings and services ▪ Demolish and remove paved areas and footings ▪ Treat suspected contaminated areas, as required ▪ Rehabilitate disturbed areas
Domain 8 – Coal handling areas	▪ Rail loop and spur ▪ Services (power and water) ▪ Chpp ▪ Conveyors and gantries	1.3 (2024)	▪ Demolish and remove rail infrastructure ▪ Demolish and remove buildings and services ▪ Demolish and remove paved areas and footings ▪ Treat suspected contaminated areas, as required ▪ Rehabilitate disturbed areas
Domain 9 – Haul road, buffer zones and hardstand areas	▪ Paved and hardstand areas ▪ Haul roads	1.1 (2020)	▪ Demolish and remove paved areas ▪ Address compaction issues ▪ Treat suspected contaminated areas, as required ▪ Rehabilitate disturbed areas
Domain 10 – Stockpiled material	▪ Topsoil stockpiles	1.1 (2021)	▪ Utilise topsoil in rehabilitation and revegetation ▪ Rehabilitate disturbed areas.
Total		**17.52**	

(1) Maximum disturbance that would occur within the MOP term
(2) Resources Regulator approval is required for all closure activities
(3) Indicative closure requirements have been determined. Detailed closure requirements would be prepared as part of a mine closure plan that would be developed by the end of December 2025, as required under PA 09_0182.

2.3 Activities over the MOP term

This MOP addresses ongoing mining activities at BCM, including the construction, operation and rehabilitation works planned for the mine site during the MOP term. The MOP term commences from the date of Resources Regulator approval of this document up to 31 December 2024.

2.3.1 Drilling activities

Boggabri Coal's 2020-24 drilling program will be undertaken to further define the coal resource and to establish further environmental monitoring locations. The proposed drilling is considered ancillary to mining as it is ~~entirely~~ either within the approved mining disturbance boundary and exploration drilling and associated activities have been specifically described in the Boggabri Coal Mine Environmental Assessment (Modification 7, 2019), and approved under PA 09_0182~~.~~, or subject to assessment under Part 5 of the EP&A Act, the details of which are included in Section 5 of this MOP. Impacts from surface disturbance activities are consistent with those previously assessed and approved. The Merriown seam represents the current approved vertical limit of mining (refer to Figure 2-1), however exploration drilling is undertaken down to the basement of the coal basin ~~(i.e. the base of the Templemore seam) as described within Boggabri Coal Mine Environmental Assessment (Modification 7, 2019).~~

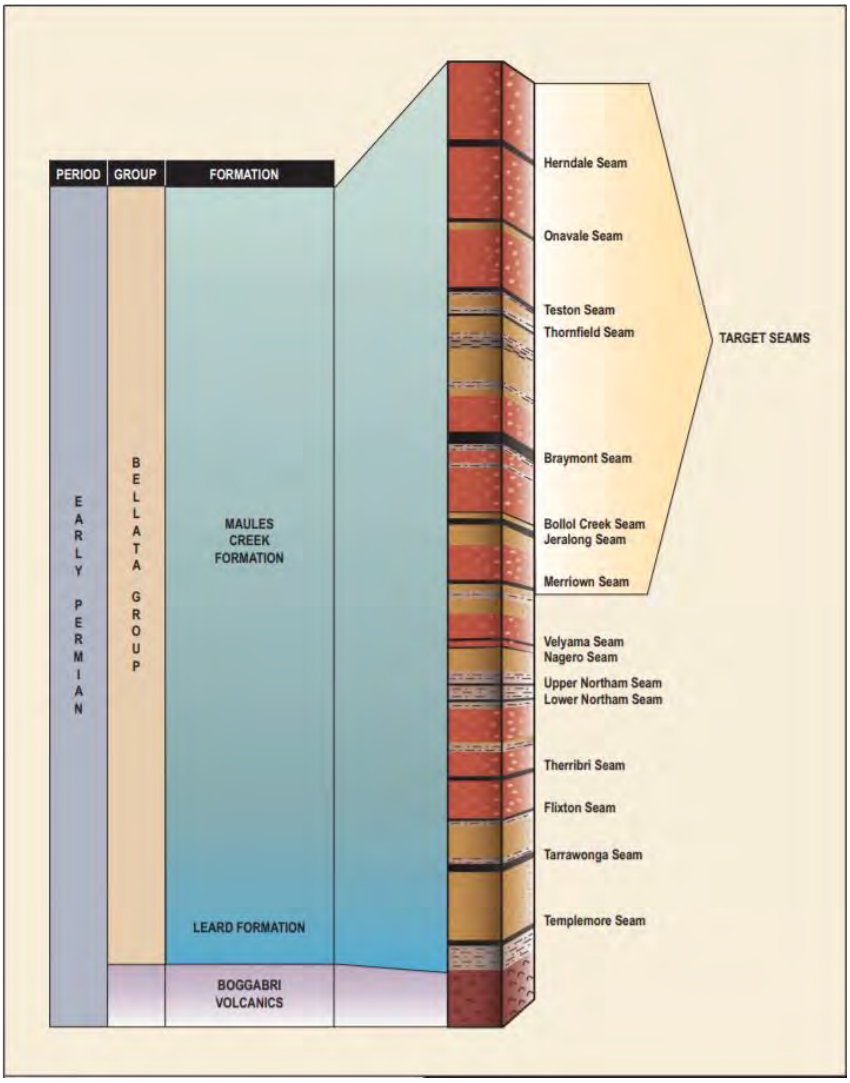


Figure 2-1 Approved vertical limit of mining (Hansen Bailey, 2010)

Drilling activities during the MOP term will be undertaken mostly within an area which can be defined as follows:

- Inside the project disturbance footprint approved under PA 09_0812.
- Inside the disturbance footprint approved under EPBC 2009/51.
- Inside CL368.
- Outside of the 250 m wide vegetated barrier between the BCM and the Maules Creek Coal Project.

Note: Approximately 13 exploration holes are planned to be drilled during the MOP term that are located outside of the PA 09_0812 and EPBC 2009/51 disturbance footprints. The impact of undertaking these activities has been assessed in accordance with Part 5 of the EP&A Act, as detailed in Section 5 of this MOP.

Drilling will be undertaken to understand the limit of oxidation, coal quality and structure, and will occur as both open hole and fully cored drill holes. It will also be undertaken for fugitive emissions assessment. ~~The program will include structure and quality holes for proving-up the immediate progression, typically but not always in the cleared area ahead of mining. Some holes will be drilled to secure data (coal quality and structure tracking) for future studies.~~ Drill holes will be sumped and~~,~~ geophysically logged~~,~~ after completion. ~~cemented and rehabilitated after completion.~~

Holes within the operational clearing boundary down to pit floor will be backfilled in advance of blasting. Holes below pit floor and ahead of the operational clearing area will be cemented and rehabilitated.

Following the completion of the required exploration investigations, some holes will be subjected to further hydro-geological testing (e.g. Packer Testing, slug tests, etc.) and/or established as new groundwater monitoring locations. These new locations will supplement the existing groundwater monitoring program or will replace bores which have been or will be mined through by the advancing open cut mining operations.

Small areas of vegetation in the forest ~~may~~ will need to be cleared prior to drilling.~~, however generally the drilling activities will be located within the cleared area ahead of mining. There may also be some minimal impact drilling within forested areas using existing access tracks.~~ Where possible, existing access tracks will be used for accessing sites to minimise impact. Drill pads will typically have a maximum size of 40 m x 40 m. The management of Aboriginal heritage and flora and fauna impacts will be undertaken in accordance with the CHMP and the CFMP (Appendix B of the BMP).

Drilling activities will be ongoing throughout the MOP term. They will generally be undertaken between 6:00 am and 7:00 pm seven days per week.

Boreholes will be drilled to the base of the coal basin. They will typically be between 100 mm and 260 mm in diameter and drilled using RC percussion and core methods. Cores will be logged for lithology and analysed for raw coal quality.

All drilling will be undertaken within the area indicated in Figure 2-2. The specific locations of boreholes will be confirmed progressively throughout the drilling program.

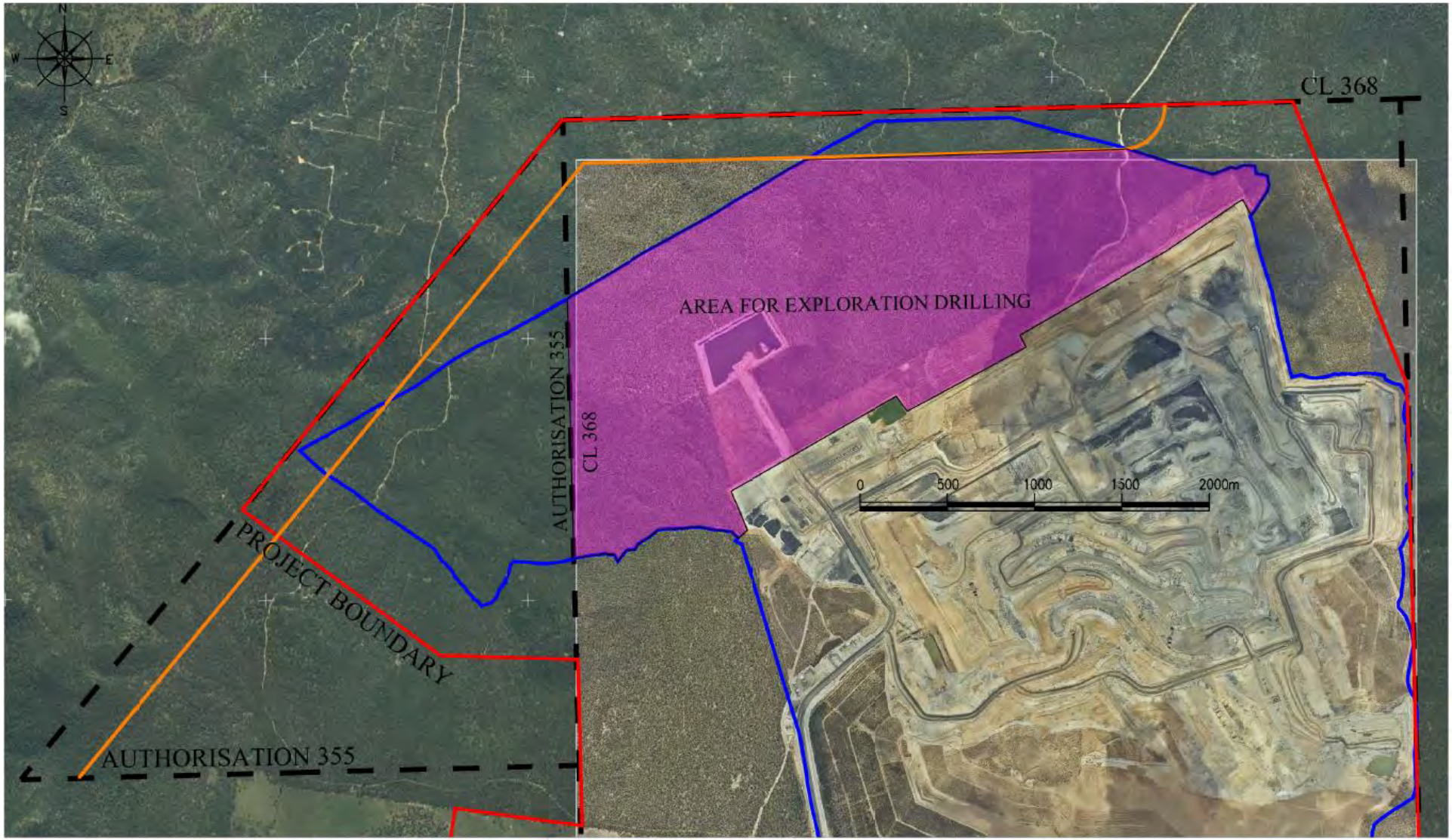


Figure 2-2 Area of drilling 2020-24

2.3.2 Construction activities

Construction activities that will be completed during the MOP term will include:

- Water management infrastructure including:
  - Dirty water drains.
  - Dams.
  - Pipelines and pumps associated with water transfers between storages.

If required, fill material will be stockpiled within existing stockpile areas within the MIA (refer to Plan No's 3A to 3E in Section 12). All stockpiled material will be stored within the approved project boundary.

2.3.3 Land preparation

Vegetation and soil stripping will be undertaken prior to the commencement of construction or mining activities in accordance with the following documents:

- Clearing and Fauna Management Protocol (CFMP), which forms part of the Biodiversity Management Plan (BMP).
- Soil Management Protocol (SMP).

Prior to and during vegetation stripping, the following activities will be undertaken (where applicable):

- Pre-clearing surveys.
- Clearing.
- Seed collection.
- Mulching of debris.
- Removal of larger diameter material.

Following the removal of vegetation, topsoil will be stripped in accordance with the SMP. Once stripped, it will be loaded in to rear dump trucks by hydraulic excavator. The SMP outlines required planning, sampling, equipment to be used, processes for removing topsoil, relocation methods, topsoil shaping activities, dump specifications and the inspections required. Where possible, topsoil will be stripped ahead of mining and hauled and dumped directly onto areas of reshaped overburden.

Land within CL368 that is subject to tree and vegetation removal is either owned by BCOPL or The State of NSW (Crown land). The felling of trees, stripping of bark, and cutting and removal of timber on Crown land within CL368 is approved under a compensation agreement between BCOPL and Forests NSW.

2.3.4 Mining operations

Mining activity during the MOP term will involve a continuation of extraction within the A, C and E Pits. The development will continue in an eastern direction completing A Pit whilst also progressing in a northerly direction into C Pit and easterly direction into E Pit. Mining will continue along 100 metre wide mining strips for the duration of the MOP term. Backfilling will continue progressively to the south.

Coal will be mined from six seams during the MOP term; the Teston, Thornfield, Braymont, Bollol Creek, Jeralong and basal Merriown.

The progression of mining activities for the duration of the MOP term is shown in Plan No's 3A to 3E in Section 12.

The 'Federal Approval Limit' identified in Map 1A is an accurate reflection of the mine progression disturbance limit approved under the Project Approval.

Project Approval modification received on the 23rd of March 2015 (MOD 4) allows for additional disturbance for expanding SD3, SD12 and the new ROM Haul Road. No changes to mining operations were proposed under Boggabri Coal's latest Project Approval modifications (MOD 5, MOD 6 and MOD 7).

Truck and excavator operations will continue to be undertaken to handle a ROM coal product which will be transported by truck to the onsite coal processing and rail transport facilities. A number of in-pit ROM stockpile areas will also be utilised within the active mining areas to provide temporary storage of ROM coal prior to processing and rail transport. The Project Approval permits the use of a dragline, although there are no immediate plans to utilise such plant.

2.3.5 Overburden emplacement

Out-of-pit dumping will continue on the western and southern overburden emplacement areas to a maximum RL of 395 m. The A and C Pit will continue to be progressively backfilled to the south.

The continuation of dumping within the western and southern overburden emplacement area will minimise haulage distances and contribute to the establishment of a landform that is generally consistent with the approved conceptual final landform.

2.3.6 Coal handling

The method of coal handling at BCM during the MOP term will involve utilisation of the coal handling infrastructure including the CHPP, product stockpile, expanded ROM pad, train load out (TLO) facility, and rail spur.

The CHPP comprises a 1500 tonne per hour capacity bypass crusher and a 500 tonne per hour capacity Coal Processing Plant (CPP) feed crusher. Product coal is transferred to the product stockpile utilising two slewing and luffing stackers. Product coal is then loaded onto trains via valves to a reclaim tunnel and TLO facility. The reclaim valves feed a conveyor with approximately 5,000 t of coal per hour. A section of the product stockpile is also utilised as a temporary storage area, to allow for coal stacking and rehandling. MOD 7 provided BCM with approval to use a coal stockpile area previously designated for Tarrawonga coal (subject to the relevant commercial agreement).

Product coal is railed to the Port of Newcastle for export to international markets.

2.3.7 Coarse reject and tailings disposal

Processing infrastructure

Reject material from the CPP is comprised of coarse and fine tailings. Fines are processed through a belt press filter system to reduce moisture content before being added back to the coarse reject and transferred to a load out bin. Trucks take the reject material from the bin to the operational pit for co-disposal with overburden material in the mining void.

A temporary reject transfer area adjacent to the ROM pad is also utilised to manage the relocation of coarse reject from the CPP to the mining void. The temporary transfer area is located entirely within the contaminated water management system and is only utilised for the temporary storage of rejects until permanent emplacement within the mining void can be undertaken.

Tailings facilities

An Emergency Tailings Facility (ETF) is available as a short term storage facility for temporary fine reject emplacement. It will be utilised as a last resort in the event of either a system failure or unscheduled maintenance within the CHPP, whereby it is necessary for the contents of the thickening circuit to be disposed temporarily to the facility. The CHPP operator would recover fine rejects disposed to the ETF by pumping the fines back through the CHPP as soon as practicable after the release, or by other means assessed as suitable should pumping not be achievable.

Procedures relating to the management of the ETF and emplacement of reject material have been the subject of consultation between BCOPL and Resources Regulator since September 2014. Final submission of the Boggabri Coal Emplacement Area High Risk Activity (HRA) Notification was received by the Resources Regulator in February 2015.

Disposal methods

Reject material is co-disposed of in the pit void with waste rock material. Reject material is placed in the spoil in planned locations to ensure that a minimum of five metres of non-carbonaceous material covers any tailings deposit beneath the final rehabilitation surface. Methods for disposal may include the construction of small cells within the spoil, mixing of reject material at an active dump or any other method assessed as suitable.

Reject material from the CPP identified as potentially acid forming (PAF) will be co-disposed in the pit void in a manner that reduces the risk of uncontrolled acid drainage to the lowest possible level. PAF reject material will be co-disposed with overburden conglomerate sourced from above the Merriown and Jeralong seams, at a level between the basal Merriown seam pit floor and pit floor +20 metres. During the MOP term PAF reject material will indicatively be co-disposed at depths no less than 80 metres below existing natural ground level. The current program of testing of PAF reject material will continue through the MOP term to ensure any PAF material is identified and managed appropriately.

Resources Regulator Mine Safety Operations Branch has been notified of the proposed co-disposal of CPP reject material with waste rock material in-pit.

Locations

All reject material is disposed of in the pit void in a planned manner to ensure that a minimum of five metres of non-carbonaceous material covers any reject deposit. The location of the tailings within the waste pile is dependent on the mining and dumping sequence.

2.3.8 Waste management

BCOPL undertakes waste management in accordance with the objectives of the *Waste Avoidance and Resource Recovery Act 2007* and the waste management hierarchy of avoid, reduce, reuse, recycle and dispose. The waste management measures that will be employed on site during the MOP term are summarised as follows:

- General putrescible waste will be collected on site and disposed of at an appropriate licensed waste management facility.
- Loose green waste will be mulched and used on site for landscaping and rehabilitation.
- All plant and equipment wash down areas will have oil/water separating devices. Water from these areas will be collected onsite; sediment, oils and grease will be separated and water will be reused onsite for haul road dust suppression. Any sediment collected during wash down activities will be placed into the in-pit bioremediation area for further treatment. Oily waste recovered from the oil/water separators will be stored appropriately and transported offsite by a licensed waste contractor for disposal.
- Scrap metal materials will separated onsite and collected by a recycling contractor for off-site recycling.
- Sewerage from site facilities will be collected onsite in an aerated septic sewer system and reused on site for irrigation
- All waste oils and greases will be segregated and stored appropriately for collection by a licensed waste contractor and appropriate offsite recycling/disposal.
- Heavy earthmoving tyres will be re-treaded and reused where possible; otherwise, they will be buried in pit in accordance with site guidelines.
- Other recyclable wastes such as timber pallets, plastic, glass, and paper will be segregated on site and collected for off-site recycling
- Waste chemicals (including solvents) will be segregated, stored appropriately and transported offsite by a licensed waste contractor for appropriate disposal.
- Contaminated soil will be collected and transported to the on-site bioremediation area for treatment and eventual on-site disposal. This will be undertaken in accordance with the site's bioremediation pad management procedure.

BCOPL will report on waste statistics annually in the Annual Review. The data collected will be used by BCOPL to identify areas for improvement and to track performance against targets.

2.3.9 Decommissioning activities

A 6 km section of Leard Forest Road was closed during 2014. Only the southern and northern sections of the road will remain open for public use. These sections will also be closed on a temporary basis when blasting and other mining-related activities are being undertaken in close proximity. These closures will vary depending on the mining schedule.

The former product coal haul road has been commissioned into the main access road for the BCM. The road provides heavy vehicle access, general access to the mine and ongoing access to the former BCT for property and infrastructure maintenance purposes.

The BCT will be retained and subject to a remediation program that allows for its ongoing care and maintenance. BCOPL is currently entertaining proposals from other industries interested in utilising the BCT infrastructure. The side dumping b-double trucks that were used to haul product coal from the MIA to the BCT prior to commissioning of the TLO and rail spur in 2015 will be retained on site for possible emergency coal haulage in the event of unforeseen operational issues with the Boggabri rail spur.

2.3.10 Temporary stabilisation

Temporary stabilisation works during the MOP term will be limited to the stabilisation of batters, windrows, drains and stockpiles associated with ongoing mining activities. These temporarily exposed areas will be seeded with fast growing, sterile cover crops using pasture species such as Rye Corn and Japanese Millet. This will help to minimise soil loss through wind and water erosion. Permanent batters, windrows, drains and stockpiles will be seeded with native pastures species consistent with the targeted post-mining land use vegetation communities outlined in section 8.3.7.

2.3.11 Progressive rehabilitation and completion

Rehabilitation during the MOP term will focus on the establishment of native vegetation on sections of the western and southern overburden emplacement areas, to progressively join the two areas and eventually create a continuous east-west vegetated corridor. Species used for rehabilitation will be consistent with the target post-mining ecological communities outlined in Project Approval 09_0182 (the Project Approval) and section 8.3.7.

Rehabilitation activities are shown on Plan No's 3A-3E (refer to Section 12) and discussed further in Sections 5 to 9. A detailed description of rehabilitation methodologies that will be implemented during the MOP term is provided in section 8.3.

2.3.12 Material production schedule during the MOP Term

The material production schedule for the MOP Term is listed below in Table 2-4.

Table 2-4 Material production for MOP term

Material	Unit	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)
Stripped topsoil	kbcm^3	350	360	230	180	80
Overburden	Mbcm^3	62.7	58.3	57.1	60.2	57.6
ROM coal	Mt	8.6	8.6	8.6	8.6	8.6
Product coal	Mt	7.3	7.4	7.5	7.5	7.9
Reject material*	Mt	1.6	1.1	1.5	0.8	0.9

Note * = unadjusted for moisture

3. Baseline data

3.1 Climate

Climatic conditions in the North West Region of NSW are influenced by its latitude, inland location and relative proximity to the Nandewar Range. The region is frequently influenced by periods of low precipitation often resulting in droughts, with the extent and severity increasing towards the west.

Seasonal climatic conditions vary throughout the year, summer months are predominantly hot and winter periods are relatively short with frequent frosts.

Temperature records from the Gunnedah Pool (BOM monitoring station) indicate summer months are warm with January reaching a mean daily high of 34^0C. July was the coolest month recorded, with a mean daily low temperature of 3^0C.

Rainfall in the North West Region is summer dominant as a result of high intensity summer storms, with falls peaking in summer and declining in winter. The annual mean rainfall recorded at the Gunnedah pool is 617 mm falling over 72 days.

BCM predominantly receives wind from the south-east in summer and the north-west in winter. Autumn and spring months experience a combination of these wind conditions.

3.2 Natural features and surrounding land uses

BCM is bounded by Willowtree Range, which encloses the catchment of an unnamed ephemeral creek, forming a broad south facing basin. The BCM site existed pre mining as cleared agricultural land and an area within the Leard State Forest.

The topography away from the Willowtree Range ridge is generally undulating, most slopes being from 1 to 10%. Small sections near the ridge do contain gradients greater than 15%. The BCM site ranges in elevation between 204m along the Namoi River floodplains to 430 m in the upper hills of Leard State Forest.

The majority of the activities associated with the BCM are located within areas previously disturbed and cleared for agricultural land use. Coal extraction, waste emplacement and some water management infrastructure are located within the Leard State Forest.

The area between the Leard State Forest and the western extent of the rail spur mainly consists of level cleared pastures established on the alluvial soils of the Namoi River. The private coal haul road passes through this area and over the Namoi River.

The site contains four main Land Management Units (LMU), as described by the North West LLS including:

- Sedimentary Slopes.
- Central Mixed Soil Floodplains.
- Central Black Earth Floodplains.
- Riparian Corridor.

3.3 Leard State Forest

Prior to commencement of mining operations at BCM, the site was predominately managed by the Forestry Corporation of NSW for forestry operations as part of the Leard State Forest. The Leard State Forest has been intensively logged for its timber resource on a regular basis up until the early 1980s. The surrounding landscape has been extensively cleared for agricultural activities. It is currently listed under the Brigalow and *Nandewar Community Conservation Area Act 2005* for ongoing forestry, recreation and mining activities.

Evidence of previous land use within the Leard State Forest includes extensive logging tracks for timber harvesting purposes, the prominence of stumps and fallen timber and land clearing from forestry activities. These activities have affected the quality and diversity of habitats for locally occurring threatened species and it is likely in the absence of future mining projects, these activities would continue throughout the forest as productive timber develops.

Vegetation in the region surrounding BCM is generally highly fragmented, with large expanses of cleared land. However, the remnant vegetation within the project boundary is significantly connected with the surrounding vegetation of Leard State Forest to the north east and west. There are a number of local corridors with partial connectivity to the Leard State Conservation Area and Namoi riverine corridor in the west and the Nandewar Range in the east.

Given the width and condition of the vegetation within BCM and Leard State Forest, these areas are likely used by a range of species as part of a wider corridor network.

The majority of BCM site is dominated by vegetation communities of the Leard State Forest with high natural species diversity and relatively few exotic species. However, these vegetation communities have often been structurally simplified, reflecting a history of disturbances consistent with commercial timber harvesting and regular thinning.

Four broad vegetation groups have been identified within the project boundary:

- Grassy Woodlands on Fertile Soils
- Shrubby Woodland/ Open Forest on Skeletal Soils
- Riverine Woodlands
- Grasslands

The areas of the project boundary outside of the Leard State Forest are characterised by highly disturbed vegetation communities affected by intensive agricultural land uses.

In accordance with previous approvals, the rehabilitation strategy for BCM has focused on the establishment of commercial timbers for future forestry activities based on best practices research into growth rates of various canopy tree species under agreement with the land manager (Forestry Corporation of NSW). However, the focus of rehabilitation at the BCM is now the re-establishment of pre-mining native vegetation communities for biodiversity conservation final land use objective.

3.4 Soil types

Summary details of the soils occurring within the primary mine disturbance area (ML A355 and CL 368) are shown in Table 3-1 below.

Table 3-1 Soils occurring within the primary mine disturbance area

Soil types	Description	Key features
Maules Gravelly Sands (Shallow Depth & Moderate Depth Phases)	Gravelly to very gravelly sands formed on the sedimentary Maules Creek Formation. Shallow depth phase is predominant and on hill crests and upper slopes. Deeper profiles (Moderate Depth Phase) are typically found at mid-slopes, lower-slope, and foot slope locations.	Uniform textured soils of loamy sand or clayey sand. Typical depths of Shallow Phase are 0.3–0.5 m and Moderate Depth Phase 0.6–1.1 m. Topsoil fertility rating is moderate to high. Total N: moderate; Available P: high; Available K: high; Organic Carbon: very high. Subsoil pH is neutral to low acidity, non-saline and marginally sodic, and sometimes dispersive. Effective rooting depth: Shallow Phase, 0.3–0.5 m; Moderate Depth Phase, 0.6–1.0 m. Water holding capacity: Shallow Depth Phase, 50–75 mm; Moderate Depth Phase, 75–150 mm. Estimated soil erodibility (K–factor): Topsoil: low–moderate; Subsoil: moderate.
Maules Gravelly Loams (Shallow Depth &Moderate Depth Phases)	Gravelly to very gravelly loams formed on the sedimentary Maules Creek Formation. Shallow depth phase is found on hill crests and upper slopes. Deeper profiles (Moderate Depth Phase) are typically found at mid-slopes, lower-slope, and foot slope locations.	Uniform or gradational soils that are gravelly to moderately gravelly (< 50% gravel). Clay content tends to increase with depth with loamy sand or clayey sand topsoil and sandy clay loam to clay loam subsoils. Typical depths of Shallow Phase are 0.3–0.5 m and Deep Phase 0.6–1.1 m. Topsoil fertility rating is moderate to high. Total N: moderate; Available P: high; Available K: high; Organic Carbon: very high. Subsoil is highly acidic, non-saline, marginally sodic and non-dispersive. Effective rooting depth: Shallow Phase, 0.3–0.4 m; Moderate Depth Phase, 0.6–1.0 m. Water holding capacity: Shallow Depth Phase, 25–75 mm; Moderate Depth Phase, 75–150 mm. Estimated soil erodibility (K–factor) – Topsoil: low–moderate; Subsoil: moderate.

Soil types	Description	Key features
Maules Gravelly Duplex	Gravelly moderately deep texture contrast soils on slopes formed on the sedimentary Maules Creek Formation, and includes both sodic and non-sodic subsoils.	Texture contrast soils that are slightly to moderately gravelly (< 50 % gravel). Depth to weathered rock is generally less than 1.5 m. Topsoil fertility rating is moderate to high. Total N: moderate; Available P: moderate; Available K: high; Organic Carbon: high to very high. Subsoil pH ranges from low acidity to highly alkaline with low to moderate salinity; and is sometimes sodic and generally dispersive. Effective rooting depth: 1.0 m. Water holding capacity: 150-175 mm. Estimated soil erodibility (K–factor) – Topsoil: low–moderate; Subsoil: moderate.
Maules Sodic Duplex	Moderately deep to deep, texture contrast soils with sodic subsoils on foot slopes and valley flats formed over colluvium.	Texture contrast soils with sodic subsoils underlain with colluvium at ~ 1.5 m. Topsoil fertility rating is moderate. Total N: moderate; Available P: low to moderate; Available K: high; Organic Carbon: high to very high. Subsoil pH ranges from highly acidic to highly alkaline with salinity increasing with depth from low to high. It is sodic to highly sodic and dispersive. Effective rooting depth: 1.0 m. Water holding capacity: 25-175 mm. Estimated soil erodibility (K–factor) – Topsoil: low–moderate; Subsoil: moderate.

3.5 Soil landscapes

Soil landscapes reflect variations in soil type, geology, landform, drainage and vegetation. All soil landscape units have some soil variation, and generally include more than one soil profile class.

Details of the soil landscapes and corresponding soil profile classes identified in the primary mine disturbance area are shown in Table 3-2. The soil landscapes for the BCM have been identified with reference to the soil landscapes presented in the Soil and Land Resources of the Liverpool Plains Catchment Interactive DVD (Office of Environment and Heritage, 2012).

Table 3-2 Soil landscapes within the primary mine disturbance area

Soil landscapes	Landform and Geology	Soil types	Associated vegetation
Leard	Crests and upper slopes of low hills on the Maule's Creek Formation, sometimes extending to mid slopes. Moderately inclined slopes with to 8–30% gradient.	Complex of Maules Gravelly Sands-Shallow Depth Phase, and Maules Gravelly Loams-Shallow Depth Phase.	Narrow-leaved Ironbark and White Cypress Pine Open Forest. Dominant tree and shrub species include *Callitris glaucophylla* (white cypress pine), *Callitris endlicheri* (black cypress pine), *Eucalyptus crebra* (narrow-leaved ironbark), *E. melanophloia* (silver-leaved ironbark), *E. sideroxylon* (mugga ironbark), localised *E. albens* (white box), *Acacia cheelii* (motherumbah), *Notelaea microcarpa* (native olive).
Blue Vale Slopes	Mid to lower slopes of low hills on the Maule's Creek Formation. Gently inclined slopes of 3–10 % gradient.	Complex of Maules Gravelly Duplex (70–90 %), Maules Gravelly Sands-Moderate Depth Phase (10–20%), and Maules Gravelly Loams-Moderate Depth Phase (10–20 %).	White Box, Narrow-leaved Ironbark, and White Cypress Pine open forest Dominant tree species including *E. albens*, *E. sideroxylon*, *E. melanophloia*, *E. crebra*, *E. populnea* (bimble box), *E. pilligaensis* (narrow-leaved grey box), *E. dealbata* (tumbledowngum), *Allocasuarina distyla* (scrub she-oak), *Notelaea microcarpa*, *Beyeria viscosa* (sticky wallaby-bush), *Olearia elliptica* (sticky daisy bush), *Ehretia membranifolia* (peach bush), *Geijera parviflora* (wilga), *Alectryon oleifolius* (rosewood), *Callitris glaucophylla*, and *Callitris endlicheri*.
Blue Vale Footslopes	Drainage fans and plains derived from the Maule's Creek Formation. Footslopes of < 4 % gradient.	Complex of Maules Sodic Duplex Soils (80–90 %), Maules Gravelly Loams-Moderate Depth Phase (5–15 %), and Maules Gravelly Sands-Moderate Depth Phase (5–15 %).	
Brentry	Drainage plains and fans formed on Quaternary alluvium derived from the Maule's Creek Formation. Footslopes of < 4 % gradient.	Maules Sodic Duplex Soils.	Pilliga Box, Poplar Box, and White Cypress Pine open woodland. Major tree and shrub species are *Eucalyptus populnea* (bimble box), *E. sideroxylon, E. moluccana* (grey box), *E. macrocarpa* (western grey box), *E. pilligaensis* (pilliga grey box), *E. crebra*, *E. melanophloia*, localised *E. albens*, *E. dealbata, E. blakelyi* (Blakely's red gum), *E. conica* (fuzzy box), *Allocasuarina luehmannii* (bull oak), *Callitris glaucophylla, Notelaea macrocarpa, Beyeria viscosa* (sticky wallaby-bush), *Olearia elliptica* (sticky daisy bush) and occasional examples of *Cadellia pentastylis* (ooline), a vulnerable tree species. *E. melliodora* (yellow box), *E. blakelyi* (Blakely's red gum), *Angophora floribunda* (rough-barked apple) and *Melaleuca bracteata* (white cloud tree) occur along drainage lines.

**Associated Vegetation is based on that described by Soil and Land Resources of the Liverpool Plains Catchment Interactive DVD (Office of Environment and Heritage, 2012) to be associated with the Soil Landscapes of the region. Listed are the dominant tree species. The publication also includes lists of the groundcover spp.*

In general, the soils supported healthy ecosystems of locally-adapted vegetation prior to mining. For rehabilitation to achieve the same mix of vegetation groups and communities, the post mining growth media properties will aim to have soil characteristics similar to those of the associated undisturbed areas as described in detail in the SMP. This does not mean direct replication of soil layers; but rather, replication of the key soil and landscape properties that are required for sustainable growth of target vegetation communities.

3.6 Hydrology and flooding

BCM is contained within the catchments of an unnamed waterway, locally referred to as 'Nagero Creek', which is a small ephemeral tributary of the Namoi River.

The regional groundwater system consists broadly of three aquifer systems:

- The extensive and productive Cainozoic Namoi Valley alluvial aquifer system.
- A thin veneer of weathered bedrock near the ground surface.
- Permian bedrock aquifers, in particular the coal seams of the Permian Maules Creek Formation.

The mining area, mine area and administration area are not located within the floodplain. The product coal haul road and rail spur cross the Namoi River and floodplain however; do not interact with groundwater due to their location on the surface.

4. Environmental issues management

4.1 Environmental risk assessment

BCOPL completed an environmental broad-brush risk assessment workshop in November 2015 to identify the risks for mining operations and processes that will occur during the MOP term. Attendees of the risk assessment included the BCOPL Mining Manager, Technical Services Superintendent, Environment Superintendent, Environment Coordinator, the Mining Contractor's Environmental Representative and a third party risk assessment facilitator.

The risk assessment workshop was undertaken in accordance with BCOPL's Risk Management Standard, which follows the general principles outlined in *Australian Standard (AS) AS/NZ ISO 31000:2009 Risk Management – Principles & Guidelines*. The methodology used to identify and review each risk included the following key steps:

1. Identify and establish the context for the risk assessment process.
2. Identify risks.
3. Identify potential impacts.
4. Analyse and review risks.
5. Evaluation of risks and identification of appropriate mitigation measures/controls.
6. Re-assessment of all risks taking into consideration any additional mitigation measures/ controls.

The results of this risk assessment are presented in Appendix C. Measures used at the site to manage risks during operation are discussed in the following sections. Specific risks associated with rehabilitation activities are discussed in Section 9.

4.2 Environmental risk management

The majority of environmental issues identified from the risk assessment will be managed in accordance with the BCOPL Environmental Management Plans (EMPs) and Boggabri, Tarrawonga, Maules Creek (BTM) Complex Management Strategies, which have been prepared in accordance with the requirements of the Project Approval. These documents are at various stages of DPIE review and approval. Plans approved prior to the current Project Approval having been received are still implemented, where not superseded by an approved plan associated with the Project Approval.

EMPs implemented or under development, that are used by BCOPL to manage environmental risks at the BCM, are outlined in Appendix B.

These plans will be progressively updated and the most current versions made available on the BCOPL website (www.idemitsu.com.au).

Strategies for the management of risks specific to rehabilitation that are outlined in each of the documents listed above are summarised in the following subsections. Strategies for the management of additional issues identified during the risk assessment that are not covered by a management plan or are not required under the Project Approval are also summarised.

4.2.1 Specific risks to rehabilitation

Geology and geochemistry

The EA (Hansen Bailey, 2010) included an assessment of waste rock geology and geochemistry. The outcomes of that assessment, with regard to its potential to pose a risk to rehabilitation success, are summarised as follows:

- The concentration of total metals in overburden solids is well below applied guideline criteria for soils and is unlikely to present any environmental issues associated with revegetation and rehabilitation.
- Most overburden materials will generate slightly alkaline and relatively low-salinity run-off and seepage following surface exposure. The major ion chemistry of initial surface run-off and seepage from overburden materials is likely to be dominated by sodium, bicarbonate, chloride and sulphate.
- The concentration of dissolved metals in initial run-off and seepage from overburden materials is unlikely to present any significant environmental issues associated with surface and groundwater quality.
- Most overburden materials are sodic and likely to have structural stability problems related to potential dispersion. Some near surface and conglomerate overburden materials are likely to be less sodic and may be the most suitable materials for revegetation and rehabilitation activities (as a growth medium). For all other sodic overburden materials, it is likely that treatment would be required if these were to be considered for use as vegetation growth medium.

In light of these assessment outcomes, the following management strategies will be implemented for the duration of the MOP term:

- Placement of overburden at the emplacement area will be undertaken in a manner that limits the risk of exposure of highly sodic material and subsequent run-off and erosion.
- Surface water will be monitored for pH, electrical conductivity (EC), total suspended solids (TSS) and dissolved metals to ensure that concentrations remain within the criteria listed in the SWMP.
- Out-of-pit dumping will only occur to a maximum RL of 395 m.

Should surface water monitoring indicate that seepage from overburden is outside the appropriate criteria, a review of overburden emplacement practices will be undertaken.

Mineral processing residues and tailings

The following paragraphs provide a summary of the potential geochemical risks to rehabilitation from coarse and fine rejects emplacement and an overview of the management strategies that will be implemented to manage the identified risks. The summary is based on the geochemistry assessment completed in the EA (Hansen Bailey, 2010) and the results of a PAF testing program completed at the BCM during 2016.

The concentration of total metals in potential coal reject solids is well below applied guideline criteria for soils and is unlikely to present any environmental issues associated with revegetation and rehabilitation.

Most potential coal reject materials will generate slightly alkaline and relatively low-salinity run-off and seepage following surface exposure. The exception is potential coal reject material from the Braymont seam where PAF materials may generate acidic and more saline run-off and seepage. However, geochemical analysis undertaken during 2016 indicates that the vast majority of reject from the Braymont seam is non-acid forming (NAF).

The major ion chemistry of initial surface run-off seepage from potential coal reject materials is likely to be dominated by sodium bicarbonate, chloride and sulfate. The initial concentration of soluble sulfate in run-off and seepage is expected to remain within the water quality guideline criterion that was applied during the EA, although further exposure to oxidising conditions could lead to increased soluble sulphate concentrations. The concentration of dissolved metals in initial run-off and seepage from potential coal reject materials is unlikely to present any significant environmental issues associated with surface and groundwater quality.

Most potential coal reject materials are sodic and likely to have structural stability problems related to potential dispersion. These materials are unlikely to be suitable for use as a vegetation growth medium.

The coarse reject and tailings disposal strategy that will continue to be implemented during the MOP term will provide adequate disposal options and capacity for all coal waste produced throughout the life of the project whilst contributing to the mine rehabilitation outcomes.

The ongoing management of potential coal rejects material will consider the geochemistry of materials with respect to their potential for environmental impacts and suitability for use in rehabilitation. BCOPL will implement the following management strategies during the MOP term:

- Placement of reject materials in-pit and/or co-disposal with overburden.
- In pit burial of PAF potential coal reject materials will be in accordance with management measure outlined in section 2.3.7.
- For the co-disposal option, placement of NAF potential coal reject material in a manner that limits the risk of surface exposure of highly sodic materials and subsequent run-off and erosion (i.e. inward side of overburden emplacement area and at least 5 m below final RL).
- Continued confirmation of the geochemical and physical characteristics of coal rejects material when bulk samples become available from the CHPP.

Slopes and slope management

Risk assessments undertaken for all mine activities, processes and facilities as part of previous MOP preparations have identified the following risks associated with the management of rehabilitation slopes:

- Erosion and sedimentation.
- Surface water pollution.
- Vegetation management.
- Stable drainage system/landform.

Rehabilitated landforms will be free draining and integrate with surrounding catchments. Slope design typically incorporates a lineal batter gradient of 10° (17.5%) and lifts to a height of 20 m. Slopes are initially constructed with diversion banks (berms) that are subsequently removed once target vegetation cover is achieved.

Batter slopes will be sheeted with a topsoil mulch mix to a minimum depth of 150 mm. Topsoil will be subject to amelioration as necessary in accordance with the SMP.

BCOPL will identify opportunities for integrated mine planning with adjoining mines to minimise environmental impacts of final landforms. BCOPL will implement the requirements of the Common Boundary Integrated Management Plan (CBIMP), which details the planning and integration of the final rehabilitated landform of the Tarrawonga northern emplacement and southern extent of the BCM overburden emplacement area.

The final landform will be shaped in a manner consistent with the final landform design. Additional erosion and geotechnical assessment of the highwall will be undertaken to determine a design that provides a geotechnically stable highwall. Assessments will be undertaken and included in the Final Void and Mine Closure Plan, which will be prepared by the end of December 2025.

Air quality and greenhouse gas

Air quality issues at BCM will be managed in accordance with the Air Quality and Greenhouse Gas Management Plan (AQGHGMP). The document outlines air quality and greenhouse gas mitigation measures to be implemented for the various activities within the BCM project boundary.

BCOPL is responsible for undertaking all air quality monitoring for the BCM as required by the Project Approval and EPL (No. 12407). All monitoring will be undertaken in accordance with the document '*Approved Methods for Sampling and Analysis of Ambient Air Pollutants in NSW*' (EPA, 2006). Air quality monitoring results are documented in monthly reports and the Annual Review. Refer to the AQGHGMP for details of the BCM air quality management system.

While BCOPL is ultimately responsible for mitigating air quality and greenhouse gas impacts from the BCM, this responsibility is shared by all personnel undertaking works within the project boundary.

Erosion and sediment control

The Soil and Land Resource Assessment (GSS Environmental, 2010) completed for the EA (Hansen Bailey, 2010) included laboratory analysis of soils at the BCM. All samples were tested for dispersion using the Emerson Aggregate Test (EAT) and sodicity using the Exchangeable Sodium Percentage (ESP). These tests provided an indication of the susceptibility of the soils at BCM to lose their structure and binding capacity when wet and therefore their erosion potential. The results showed a similar pattern across the site, with the upper soil layers generally identified as being non-dispersive and non-sodic whilst the subsoils tended to exhibit moderate to high dispersion potential and high sodicity with depth. The risk of erosion was considered low for upper layers of the soil profile and high for subsoils. As such, minimising surface exposure of subsoils and overburden material will continue to form a key strategy for reducing the risk of erosion within rehabilitation areas.

Other potential risks to rehabilitation from erosion and sedimentation are summarised as follows:

- Slope slumping and/or failure due to poor landform establishment and incorrect surface preparation.
- Rill and gully erosion due to poor drainage design or slope instability.
- Loss of topsoil on stockpiles and rehabilitation areas from wind and water erosion due to poor groundcover.

The erosion and sediment control measures listed in Section 8.3.6 will be implemented, as a minimum, for all rehabilitation works. The implementation of these mitigation measures renders erosion and sedimentation a low risk to rehabilitation. Some of the measures listed are recommended by the Blue Book – Managing Urban Stormwater; Mines and Quarries (DECC, 2008) and others are recommendations from the soils study undertaken for the EA (GSS Environmental, 2010).

Erosion and sedimentation impacts are managed in accordance with the SWMP. All construction and mining contractors will be required to establish and implement a monitoring and inspection programme to ensure appropriate installation and operational control of erosion and sediment controls.

Soil type(s) and suitability

BCOPL will be mining through vegetation communities, which are part of the Leard State Forest. Translocation of the topsoil and vegetative material containing an appropriate seed bank, plant nutrients and organic carbon sources will be used to rehabilitate areas to assist in the recreation of understorey species consistent with the target post-mining vegetation communities. The appropriate management of this topsoil resource is a fundamental component of rehabilitation success.

Soil survey is undertaken prior to disturbance in accordance with the processes described in the SMP to identify the minimum topsoil and subsoil depths for respreading. Topsoil requirements for rehabilitation areas will be balanced against stored stockpile inventories, target vegetation communities and proposed stripping volumes.

Soil stripping will be undertaken with consideration of the characteristics of the materials to be salvaged (depths, quality, stoniness, terrain), the design to which the materials are reinstated, and the limitations of machinery and terrain. Depending on practicability, subsoil may be preferentially stripped, ameliorated and stockpiled to be used as a growth medium. One of two potential methods will be adopted during topsoil stripping; ‘Double Stripping’ or ‘Single Stripping’.

Double stripping involves the removal of topsoil and upper subsoil materials in separate operations. It provides the opportunity to reinstate profiles in a layered manner comparable to the original condition. This method is better suited to broad acre areas of low frequency relief with topsoils of moderate depth or greater (>150 mm). It produces a salvaged topsoil with minimal dilution of the fertile surface layer and associated seedbank. This method however is impractical in situations where topsoil depths are thin (<150 mm), stony, and/or where the terrain undulation has a high frequency. Double stripping in such situations can result in salvaging considerably less topsoil than what is available, and may result in a deficit in surface growth media for rehabilitation.

Single Stripping involves removal of topsoil and the upper subsoil materials in one operation. It is a viable option for soils with upper subsoil layers that only have minor limitations to plant growth, or limitations that can be readily amended. In such scenarios, single stripping results in dilution of topsoil fertility by mixing the more fertile topsoil with less fertile subsoil materials. This fertility decline may be mitigated with additional of ameliorants (fertiliser, gypsum, etc.). Another substantial impact of single stripping is the decline in quantity of viable seed in the upper surface of reinstatement topsoil; because – when placed for rehabilitation - much of the seed is buried too deep in the material for emergence to occur (i.e. > 50 mm).

Mitigation of this impact requires introduction of target species by alternative methods such as supplementary seeding, tube stock, or natural recruitment from adjoining areas as outlined in the BMP.

Some site soils and mine spoils are low in plant available nutrients, have low organic carbon, are sodic and are dispersive. The soil testing described in the SMP will be undertaken to determine amelioration requirements and rates.

Mine soil and spoils are typically ameliorated with agricultural gypsum to treat dispersion, and improve the calcium to magnesium ratio, structure, water holding capacity, compost to increase organic carbon levels (mulch can be used but is less desirable), water holding capacity, soil biota, fertiliser to improve nutrients levels and wetting agents for hydro-phobicity.

Ameliorants will be mixed in with the topsoil prior to stripping. Application of ameliorants as part of the topsoil stripping process is more cost effective, and also gives the ameliorants additional time to react and modify the soil and to assist in the maintenance of soil conditions suitable for plant development. Where topsoil is unavailable or of insufficient quality, subsoil also may be ameliorated to form a suitable growing media.

During the removal of soils from stockpiles, care will be taken to minimise structural degradation of the soils. Material will be spread in even layers at an appropriate thickness to meet the rehabilitation goals of the area being rehabilitated. Soil will not be replaced at a depth less than the minimum depth identified during soil sampling.

Water

Water management at the BCM is guided by the Water Management Plan (WMP), which provides a framework for water management requirements listed under Section 75J of the EP&A Act (Schedule 3, Condition 38). The WMP also meets the standard requirements for management plans (outlined in Schedule 5, Condition 3 of the Project Approval).

The WMP includes the following sub-plans:

- SWMP.
- Groundwater Management Plan (GMP).
- Site Water Balance (SWB).

In addition to the WMP and associated sub-plans, the BTM Complex Water Management Strategy (WMS) has been prepared by BCOPL in cooperation with the neighbouring mines ‘Tarrawonga’ and ‘Maules Creek’.

The following sections discuss specific aspects of the WMP and WMS that will be implemented to mitigate risks to rehabilitation during the term of the MOP.

Surface water

Surface water impacts from mining activities will be managed in accordance with the SWMP, a copy of which is available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/). The SWMP has been prepared to comply with the requirements of:

- BCOPL’s Project Approval.
- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 1 (Landcom, 2004).
- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 2E Mines and Quarries (Landcom, 2008).

The key objectives of the BCM surface water management system are to:

- Segregate clean runoff, dirty runoff and coal contact water generated from rainfall events and mining operations.
- Minimise the volume of coal contact water (surface runoff draining to pit and groundwater seepage that has been in contact with coal) generated by the BCM.
- Preferentially reuse coal contact water for dust suppression and coal washing.
- Provide sufficient on-site storage to avoid releases of coal contact water that could affect the quality of downstream watercourses.
- Treat all dirty runoff from non-rehabilitated overburden areas to settle coarse suspended solids.

Surface water monitoring requirements are documented in the SWMP. An annual surface water monitoring review will be prepared for each calendar year. The results of the annual surface water monitoring review will be presented as part of the Annual Review.

Clean water management

Existing and proposed clean water management structures for each year of the MOP term are shown on Plans 3A to 3E in Section 12.

Clean water diversion drains will be designed to convey the peak flow rate from a 100 year average recurrence interval (ARI) time of concentration storm event for the contributing catchment. Typical design features of diversion drains are as follows:

- Trapezoidal in section.
- 3H:1V side slopes, with a maximum depth of 1 metre.
- Vegetated to minimise the risk of erosion and deterioration in water quality due to turbidity.
- Base and sides of drains may require gypsum stabilisation where constructed in dispersive clay.
- Scour protection will be required where velocities exceed 2 m/s or diversion drains are constructed in highly erosive soil.

Clean water drains will be provided to capture clean water runoff from upstream undisturbed catchments wherever possible and will be directed around the site and returned to Nagero Creek. In some locations it is not feasible to provide diversion drains or highwall dams due to topographic conditions and advancing topsoil stripping and stockpiling. In these circumstances clean water will be allowed to enter the active mining areas and the dirty water diversion system. BCOPL will have to account for the additional captured clean water and hold adequate licences or harvestable water rights.

Dirty water management

Dirty water runoff will be captured in sediment dams to encourage the settling of suspended solids. Existing and proposed dirty water management dams and drains for each year of the MOP term are shown on Plans 3A to 3E in section 12. The sediment dams will be generally ‘wet basins’, comprising a ‘settling zone’ for temporary treatment storage and a ‘sediment zone’ for storage of sediment. Runoff from large storm events exceeding the design capacity will overtop sediment dams and discharge to ‘Nagero Creek’. Captured water will typically be released to the creek. However, during extended dry periods water may be pumped to mine water storage dams for storage and reuse. Generally captured water is suitable for release following settling of the suspended solids, however, spoil dump runoff will potentially have elevated acidity, salinity, dissolved metals and oils and greases. Sediment dams will therefore be provided with manually operated valves on the outlet pipes or alternatively consist of mobile pump out arrangements only, so that discharge to the creek can be prevented if water quality is not suitable (e.g. to allow for flocculation).

Dirty water diversion drains will be designed for the peak 100 year ARI time of concentration storm event for the contributing catchment. Dirty water sediment dams will be sized in accordance with the guidelines Managing Urban Stormwater – Soils and Construction – Volume 1 (Landcom, 2004) using a 90th percentile 5-day rainfall total of 38.4 mm and will be based on the 'Type F' design given the local soil conditions. The Managing Urban Stormwater guidelines recommend that the 'settling zone' be sized to capture the 90th percentile 5 day duration storm event, and the 'sediment zone' be sized at 50% of the 'settling zone' volume. This sizing is based on site disturbance duration of more than 3 years and a standard receiving environment, and results in an average sediment basin overflow frequency of 2 to 4 overflows per year. For sizing purposes, runoff coefficients of 0.75 to 0.85 and 0.4 have been adopted for disturbed and undisturbed areas, respectively.

Coal contact water management

Coal contact water will be captured in sediment dams or mine water dams for storage and reuse and will not be released to the receiving environment. Existing and proposed coal contact water management structures for the duration of the MOP term are shown on Plan No's 3A-3E in Section 12. The water management system will aim to reuse as much coal contact water as possible onsite, which will be used as a priority for dust suppression and coal washing. Surplus coal contact water will be stored in-pit or mine water dams.

Coal contact water diversion drains will be designed for the peak 100 year ARI time of concentration storm event for the contributing catchment. The volume of a coal contact water sediment dam will be sufficient to contain the volume from a 100 year ARI 72 hour storm event with freeboard for the local contributing catchment, and an additional 20% allowance for sediment storage. Mine water dams will be sized based on water balance modelling, so as not to overflow under recorded historical climate conditions.

Groundwater

The Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources (NOW, 2003) notes that 'there are no high priority groundwater dependent ecosystems identified and scheduled at the commencement of this Plan'. In addition significant stands of groundwater dependent vegetation in the area are unlikely as water tables in the Namoi Valley are typically deeper than 2 m and consequently direct groundwater evapotranspiration is not a significant part of the water balance (CSIRO, 2007). The creeks in the vicinity of BCM are ephemeral and not expected to support groundwater dependent ecosystems (GDEs).

Groundwater impacts from mining activities will be managed in accordance with the GMP. The GMP has been prepared as an integral part of the WMP, and should be read in conjunction with the SWMP, SWB and WMS.

A key aspect of managing groundwater impacts is the groundwater monitoring program, which will be implemented to identify any changes to the natural groundwater systems as a result of mining operations. Groundwater levels and quality monitoring will be undertaken in accordance with the Project Approval, EPL, this MOP, and associated EMPs.

Trends in the monitored groundwater levels, water quality, pore pressure and pit seepage will be assessed annually and documented in an Annual Groundwater Monitoring Report. The results of the Annual Groundwater Monitoring Report will be presented in the Annual Review. Where a sudden observable variation or trend change from baseline water quality, groundwater levels, pore pressure or pit seepage occurs in any monitored bore, any of the trigger levels listed in GMP are exceeded, or there is a significant deviation from model predictions, a review of groundwater monitoring information will be carried out by a suitably qualified hydrogeologist. The hydrogeologist will be commissioned to investigate trends in monitoring data, identify the potential cause(s) of the impact and provide options to remedy the cause. BCOPL will prepare an action plan to reduce the identified impact in consultation and agreement with DPI Water (or relevant regulator), and implement additional monitoring as necessary.

Additionally, an investigation will be undertaken where a loss of groundwater supply is reported by a registered user, or where water levels taken from private registered bores incorporated into the monitoring network show significant change from historical averages. The investigation will be undertaken by a suitably qualified hydrogeologist, to identify potential cause(s). Where mine activities are deemed to have potentially impacted the supply, an independent review of the impact will be undertaken, including an investigation of groundwater level and quality trends, rainfall data and mining activities.

BCOPL will provide a compensatory water supply to any landowner whose water supply is shown to be adversely and directly impacted by the mining operations. Compensatory works may include financial provisions, alternative water supply provisions or other ‘make good’ provisions.

Site water balance

BCM’s water resources and storage volumes are managed through the SWB. The SWB has been prepared as an integral part of, and should be read in conjunction with, the WMP, GMP, and WMS.

The aim of the SWB is to:

- Detail the sources and security of water supply, including contingency for future reporting periods.
- Detail water use and water management at BCM.
- Describe management of any off-site water discharges.
- Outline reporting procedures including the preparation of a SWB for each calendar year.
- Outline the program to validate the surface water model, including monitoring discharge volumes from the site and comparison of monitoring results with modelled predictions.
- Describe the measures that will be implemented to minimise clean water use on site.

The most recent water balance analysis was undertaken in May 2017. The purpose of the analysis was to quantify the water demands (e.g. dust suppression, CHPP process water) and supplies (e.g. groundwater seepage, surface runoff, recycled water) in order to identify the likely water deficits/surpluses and discharges from the BCM. The water balance analysis will be used as a strategic planning tool to assess the performance of the water management system for the BCM under a wide range of climate scenarios (including both historically dry and wet periods) that may occur over the life of the Project. The mine’s development over the life of the project was represented in the model through the Year 1, 2, 5, 10 and 21 ‘snapshot’ landforms.

The Annual SWB model predictions for each calendar year will be verified against site monitoring data, with the verification results reported in the Annual Review.

Material prone to generating acid mine drainage

The EA (Hansen Bailey, 2010) included an assessment of the potential for mining and overburden activities to cause acid mine drainage. The outcomes of that assessment, with regard to its potential to pose a risk to rehabilitation success, are summarised as follows:

- Most overburden is likely to have negligible (<0.1%) total sulphur content and is therefore classified as NAF. Overburden also has excess acid buffering capacity typical of a moderate Acid Neutralising Capacity (ANC) value, which will compensate for any acid that could potentially be generated from the small amount of overburden materials with uncertain acid generating classification.
- Most potential coal reject materials are likely to have negligible (<0.1%) total sulphur content and are therefore classified as NAF-barren. These materials have a high factor of safety with respect to potential acid generation.
- A small proportion of the potential coal reject materials located within siltstone near the roof of the Braymont Seam have a relatively high total sulphur content and negligible buffering capacity and are classified as Potentially Acid Forming – High Capacity (PAF – HC). However, geochemical analysis undertaken during 2016 indicates that the vast majority of reject from the Braymont seam is NAF. As most overburden materials are likely to be NAF and have a high factor of safety with respect to potential acid generation, the overburden can be regarded as a NAF unit. Management of PAF reject materials will be undertaken in accordance with the measures described in Section 2.3.7.

Based on these outcomes, the risk of acid mine drainage at BCM is considered low. BCOPL will manage PAF material through the following processes:

- Confirming the geochemical and physical characteristics of coal reject materials as bulk samples become available from the CHPP.
- Undertaking in-pit burial of identified PAF potential coal reject materials including materials from the Braymont and Jeralong seams in accordance with management measures detailed in Section 2.3.7.

Flora and fauna

Impacts to flora and fauna will be managed in accordance with the BMP. The BMP provides practical instruction for managing and controlling risks to biodiversity associated with the project and directs the implementation of the Biodiversity Offset Strategy (Parsons Brinckerhoff, 2010a).

The BMP aims to:

- Describe the measures (short, medium and long-term) to be implemented to manage remnant vegetation and habitat within the project boundary and Biodiversity Offset Areas (BOAs), including detailed performance and completion criteria.
- Describe the practical management strategies (including procedures) to be implemented to achieve the following objectives:
  - Revegetation and regeneration of all strata (canopy, sub-canopy, understorey, ground layer) within the disturbance areas.
  - Maximising salvage and beneficial use of resources in areas to be impacted (including vegetation, rocks, soil, and cultural heritage resources) for habitat enhancement.
  - Conserving and reusing topsoil and subsoils to meet rehabilitation objectives.
  - Protecting vegetation and soil outside of the disturbance areas (minimising vegetation clearing/disturbance).

  - Rehabilitating creeks and drainage lines to minimise net loss of stream length and aquatic habitat.
  - Managing salinity.
  - Undertaking pre-clearance surveys.
  - Managing impacts on native fauna and flora.
  - Collecting and propagating seed.
  - Controlling weeds and feral animal species (minimising their introduction and spread).
  - Managing grazing and agriculture on site.
  - Controlling access.
  - Integrating management with adjoining land managers.
  - Minimising human interferences to biodiversity.
  - Minimising impacts to biodiversity, particularly threat-listed species.
  - Bushfire management activities.
- Provide a seasonally based biodiversity monitoring program to monitor and report on the effectiveness of the biodiversity management measures and the progress made against specified performance and completion criteria.

Management measures and procedures contained in the BMP provide a framework for managing biodiversity values within the project boundary, BOAs and wider locality, throughout and beyond the operation of the project. Preparation of the BMP has been undertaken with reference to best practice environmental management standards in accordance with the Project Approval and other statutory requirements.

Procedures and strategies have been developed for activities and processes that pose a significant risk to biodiversity within the project boundary and for the management of BOAs. The following procedures/strategies form part of the BMP:

- CFMP (Appendix B of the BMP)
- Weed and Pest Management Strategy (WPMS) (Appendix C of the BMP).

All priority weeds within the project boundary will be controlled in accordance with the requirements of the *Biosecurity Act 2015*. The implementation of the monitoring, inspection and reporting program detailed within the BMP and section 9 of this MOP will reduce the potential for weed introduction and spread and allow continual monitoring and control. Pest animals will also be identified and controlled as part of the program. This program ensures both a proactive and reactive approach to weed and pest animal management.

Compliance with the BMP in accordance with the Project Approval, licences, permits and other legislative controls is maintained by a schedule of inspections, monitoring and reporting.

The monitoring, inspection and reporting program for the project and management of BOAs is set out in the BMP. Monitoring results are also reported in the Annual Review.

Contaminated land

As presented in the EA (Hansen Baily, 2010), potentially contaminated sites within the project boundary include pre-existing sheep dips, workshops/machinery sheds used for fuel, chemical and fertiliser storage and landfills. No contaminated lands have been identified within the Project boundary that will be disturbed for mining or mining related purposes.

Soil contaminated by hydrocarbons as a result of spills will be contained and transported to an in-pit bioremediation area for treatment and subsequent in-pit disposal.

Furthermore, each activity with the potential for a hydrocarbon spill will be identified through a risk management process. Management controls will be developed as required and will include:

- Locating spill kits in high risk areas around mine infrastructure and construction areas within the Project boundary.
- Ensuring all BCM personnel are trained in incident and emergency response procedures. Specific training will also be provided to those personnel required to handle hazardous materials.
- All workshop and vehicle wash down water shall be directed to a sump/separator for containment and subsequent treatment or appropriate disposal.
- Vehicles, plant and equipment leaking fuel, oil coolant or any other hydrocarbons will not be operated where practicable and repaired at the earliest opportunity.
- All hazardous materials facilities on site will be designed, constructed and operated in accordance with all relevant legislation, standards and guidelines, with particular reference to *AS 1940:2004 – The Storage and Handling of Flammable and Combustible Liquids.*
- Refuelling operations will be undertaken within areas specifically designated for that purpose, where practicable.

Blasting

There are inherent risks associated with blasting that, if managed poorly, may result in reduced safety, environmental and operational performance. These hazards include, but are not limited to:

- Excessive ground vibration.
- Overpressure exceedances.
- Flyrock exceeding blast exclusion zones.
- Fume events.
- Misfires.

When a confined explosive charge detonates, some of the energy is released as ground vibrations. The magnitude of ground vibrations depends on:

- The maximum instantaneous charge (MIC) of the blast.
- The distance between the blast and the sensitive receiver.
- The characteristics of the intervening material (rock, soils, geological structures, etc.) through which the ground vibration wave propagates.

If not managed appropriately, ground vibration has the potential to cause damage to buildings and other infrastructure.

Blasting generates airblast overpressure, a transient air pressure from the explosion that is greater than the surrounding atmospheric pressure. Airblast overpressure can be managed by ensuring that all or most of the explosion energy is consumed in fragmenting and displacing the overburden by the time the gases vent. Improper management of overpressure can result in noise exceedances.

Fly rock is any rock or stone that is propelled beyond defined blast limits by the force of the explosion. It can pose a serious safety hazard and cause damage to buildings and infrastructure if not managed appropriately.

The use of ammonium nitrate based explosives under variable conditions can lead to unwanted explosive reactions and the generation of nitric oxide (NO) and nitrogen dioxide (NO_2). Nitric oxide is unstable in air and readily oxidises to nitrogen dioxide. Nitrogen dioxide is identifiable as an orange or brown cloud which can be harmful if inhaled. Blast fume is a result of an explosive not reacting completely with the detonation.

There are a number of potential causes of blast fume including geological conditions, weather, blast design, explosive product selection, explosive quality, blast-hole contamination and bench preparation.

Misfires refer to the complete or partial failure of a blasting charge to explode as planned. The explosives that remain after the blast is detonated may be triggered to explode by mechanical means during post-blasting excavation activities, potentially leading to serious incidents.

Measures for the management of ground vibration, overpressure, flyrock, fume and misfires are detailed in the BCM Blast Management Plan (BLMP). Blasting impacts will be managed in accordance with the BLMP. All aspects of blast management will be undertaken in accordance with *AS 2187.2-2006 – Storage and Use of Explosives*.

All blasting activities at BCM will be subject to monitoring in accordance with Project Approval requirements. Monitoring results will also be reported annually in the Annual Review.

Noise

Noise impacts from the project will be managed in accordance with the Noise Management Plan (NMP), which aims to facilitate compliance with the Project Approval and EPL. A copy of the NMP is available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/).

Noise mitigation measures that will be applied during operational activities at BCM are outlined in the NMP. Ongoing real time noise monitoring and attended noise monitoring will be undertaken throughout the MOP term.

BCOPL's Environmental Superintendent and other nominated personnel will have access to real time meteorological data which will be used to make decisions on how mining activities will be modified or suspended based on the criteria outlined in the NMP. Management measures that will be undertaken during adverse weather conditions are also documented in the NMP.

In addition to the preventative noise management measures that are outlined in the NMP, a cumulative real time noise monitoring system will be operated during the MOP term. This will involve the operation of a series of real time noise monitors placed at strategic locations surrounding the BCM and its neighbouring mines (Tarrawonga Coal Mine and Maules Creek Coal Mine). Noise level triggers will be set for the monitors. Exceedance of a trigger level will initiate an alarm which will provide notification to relevant BCM personnel of the elevated noise levels. A response will then be initiated in accordance with the Trigger Action Response Plan (TARP) detailed in the NMP. The TARP will be refined as the cumulative network is progressively implemented, tested and improved.

Trigger level exceedance alarms will be communicated to environmental and mining personnel via SMS, email and/or other systems integrated into operating processes (depending on needs).

'Investigation' level criteria will be triggered initially when any of the real time monitors reach a level 3 dB below the project-specific noise criterion for the residence nearest to the monitor.

Investigation into the trend of increased noise levels will be conducted upon reaching this trigger level. This investigation will involve:

- Comparing the low-pass (initially 800 Hz) LAeq level with the total LAeq level to determine whether mine noise (predominantly lower-frequency) is a likely cause of elevated noise levels.
- Listening to audio files recorded from the monitors to see if the source(s) of the increasing noise can be identified.
- Reviewing meteorological data to determine whether increasing noise levels may be due to wind or temperature inversions. Low speed winds can affect noise levels due to the location of the monitor in relation to the noise source and high speed winds generally increase environmental noise levels.

'High' level criteria will be triggered when any of the real time monitors reach a level 1 dB below the project-specific noise criteria. After the contributing noise sources have been identified, implementation of appropriate noise mitigation actions will be instigated upon reaching this trigger level.

Trigger levels will be reviewed, updated and refined in response to the ongoing review of real-time monitoring data and calibration of the system.

BCM noise management performance, including progress on implementation of the real time noise management system will be reported annually in the Annual Review.

Visual and lighting

Lighting impacts are managed in accordance with the Project Approval (Schedule 3 Condition 65). External lighting for the Project is generally compliant with *Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting.*

Management measures that will be implemented at the BCM to mitigate adverse night lighting impacts include:

- Lighting will be strategically located for operational needs and safety, and directed so that no outdoor light shines above the horizontal wherever possible to minimise night glow.
- Lighting shields will be maintained on all mobile plant (where installed) to direct the light beam towards the area of interest.
- Where possible, lighting equipment will utilise the minimum wattage required to allow the safe operation and movement of equipment, and be directed so that no light shines above the horizontal to prevent unnecessary light emissions beyond the immediate work area.

Due to the natural screening of receivers and the existing mining operations in the vicinity of the project boundary, there will be no significant impacts from direct or diffuse lighting. Mitigation and management measures to reduce the visual impacts from the project include onsite treatments only.

Onsite mitigation measures will include designing and painting infrastructure in forest tones to blend in with the surrounding environment, progressive rehabilitation throughout the Project and the direction of lighting away from sensitive receivers.

Heritage

Aboriginal and historic heritage is managed in accordance with the approved CHMP. In addition to the CHMP, a regional Aboriginal Heritage Conservation Strategy (AHCS) has been prepared in consultation with Aboriginal stakeholders and neighbouring mines in the Boggabri, Tarrawonga and Maules Creek (BTM) Complex. Copies of the CHMP and ACHS are available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/).

Through the CHMP, BCOPL will implement a variety of management strategies to address impacts to the archaeological and cultural values at the BCM. BCOPL will utilise a project archaeologist to works with Registered Aboriginal Parties (RAPs) in undertaking field work prior to and during construction and operational phases in accordance with the management plan.

Spontaneous combustion

Spontaneous combustion is controlled by avoiding disposing of combustible material in waste emplacement areas and emplacing combustible materials in locations where oxygen ingress is minimised (i.e. deep in-pit burial, away from rehabilitation areas).

There will be four main components to the management on spontaneous combustion at BCM:

- Prevention.
- Detection.
- Control.
- Incident management.

BCOPL and its contractors currently employ these principles to minimise the occurrence of spontaneous combustion and have had significant success in reducing the area affected by spontaneous combustion. However, there are practical impediments to applications of these principles. Areas that are currently being mined cannot be capped and in some cases, it is not practical to cap areas which will need to be reworked in the near or medium future.

BCOPL and relevant contractors will monitor and manage spontaneous combustion throughout the life of the Project. Measures that will continue to be implemented for the duration of the MOP term include:

- Managing spontaneous combustion in accordance with the mining operator's Spontaneous Combustion Management Plan (SCMP).
- Capping all areas of spontaneous combustion with inert material.
- Emplacing any identified combustible materials deep within in-pit emplacement areas.
- Mnitoring of coal stockpiles for signs of spontaneous combustion and responding through action as required.

There have been minimal spontaneous combustion issues over the life of the mine to date. The EA (Hansen Bailey, 2010) reported that spontaneous combustion presents a low risk of causing environmental impacts at the BCM. It is therefore considered a low risk to rehabilitation at BCM. Whilst the risk of spontaneous combustion is considered low it is still required to be managed.

Bushfire

Bushfire management strategies to be undertaken during the MOP term will include:

- Monitoring and maintaining equipment and areas where bushfire hazards are present to prevent and minimise the potential outbreak of bushfire.
- Monitoring fuel loads adjacent to mining and within the mining lease area portion of Leard State Forest during routine environmental inspections.
- Monitoring the effects of the fire regime in Leard State Forest for effects on biodiversity.
- Storing and maintaining appropriate fire-fighting equipment in consultation with the Rural Fire Service (RFS).
- Establishing an appropriate fire regime for the maintenance of biodiversity in Leard State Forest.
- In the event that the RFS or an adjoining land manager identifies a significant fire risk within the Project boundary, completing a fuel load assessment and if applicable, assessing the feasibility of completing fuel load reduction burning or introducing a crash grazing regime.

Mine subsidence

The BCM is not within a mine subsidence district and no underground mining activities are proposed during the MOP term. As such, mine subsidence management is not considered relevant to this MOP and is not discussed further.

Integration with Tarrawonga Coal Mine

The Project Approval for the Tarrawonga Coal Mine (PA 11_0047) (located immediately adjacent to the south west of BCM's mine lease area CL368) approves a greater degree of integration with the BCM, namely:

- Continued development of mining operations in the Maules Creek Formation, including to the north within CL 368 (MLA 3) which adjoins ML 1579.
- Use of upgraded BCM MIA facilities for the handling and processing of up to 3 Mtpa ROM coal from Tarrawonga, and the loading of product coal to trains for transport on the BCM private rail spur to the port of Newcastle. Note: these activities are no longer proposed.
- Expanded emplacement of waste rock in the Northern Emplacement as mining develops, ultimately integrating with the southern extent of the BCM emplacement.

Common Boundary Integrated Management Plan

Integration of the Tarrawonga Northern Emplacement and the southern extent of the BCM waste rock emplacement presents an opportunity to enhance connectivity between the post mining landforms of both mines. Detailed planning to optimise integration of the final rehabilitated landform has been undertaken and documented in the CBIMP.

The CBIMP was prepared in consultation with Resources Regulator and was formally endorsed/signed-off by BCPL and TCPL in August 2015. It includes a definition of working areas and responsibilities, details of scheduling of emplacement area development, progressive rehabilitation activities, a nominal point of emplacement area integration and the conceptual integrated final landform. It also includes details on the integrated water management strategies for both the development and rehabilitation phases of the emplacement area integration and responsibilities for water management (including on-going maintenance). The CBIMP also outlines a process for the management of topsoil resources for placement on the final shaped emplacement area and identifies criteria and methodologies, consistent with those nominated in the approved BCPL and Tarrawonga MOPs, to establish native woodland/forest communities that integrate across the mine lease boundary and with Leard State Forest.

Overburden emplacement integration – timing

A lease transfer in the area of MLA 3 has been agreed between BCOPL and TCPL to enable Tarrawonga to undertake open cut pit and overburden emplacement area development in the northern extension area. The lease transfer was completed in 2017.

Overburden emplacement integration – rehabilitation

The lease boundary defines the area of responsibility between BCOPL and TCPL. The CBIMP defines the rehabilitation goals for that area. The rehabilitation standard currently in place within the Leard Forest area, as demonstrated by BCOPL, has been be adopted for the lease transfer area to ensure the landform and rehabilitation of both operations is consistently applied and an integrated landform is achieved. Further information regarding rehabilitation of the overburden integration area is provided in the CBIMP.

Social impact

Social impacts will be managed in accordance with the Social Impact Management Plan (SIMP), a copy of which is available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/). A Social Impact Assessment was undertaken as part of the EA (Hansen Bailey, 2010). The most significant social impact issues were summarised into nine categories, including:

- Housing affordability and availability.
- Employment and training.
- Local business development.
- Social and community infrastructure.
- Community cohesion.
- Farming communities.
- Indigenous opportunities.
- Traffic management.
- Cumulative impacts.

BCOPL has developed mitigation and management strategies and actions for each of the key social benefits and impacts listed above. Commentary and justification for specific measures has been kept to a minimum in line with the key aspects of leading practice and guidance highlighted in the SIMP.

Social impact management and related monitoring actions are identified in the SIMP.

Traffic

All potential traffic impacts associated with the BCM will be managed in accordance with the approved Traffic Management Plan (TMP) for the project, a copy of which is available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/).

Generic management measures such as speed limits, approved hours of work, site inductions and traffic escorts will be implemented for the project to reduce the potential for traffic impacts. A full list of management measures is provided in the TMP.

Monitoring associated with traffic management will be undertaken during the MOP term and all monitoring results, including a discussion on traffic management issues and performance, will be reported in the Annual Review.

Drilling

Drilling activities proposed during the MOP term are described in section 2.3.1. Drilling boreholes located within active mining areas pose a low risk to rehabilitation. MOP term drilling boreholes drilled outside of the active mining area will be rehabilitated in accordance with the Exploration Code of Practice: Rehabilitation (DRG, July 2015).

Construction

Construction activities proposed during the MOP term are described in section 2.3.2. The key risk to rehabilitation from construction activities will be associated with erosion and sedimentation during temporary works, stockpiling, and rehabilitating construction related disturbance.

The focus for construction rehabilitation management will be the minimisation of erosion and sedimentation and the prompt rehabilitation of temporary disturbance areas as they become available. All construction rehabilitation will be undertaken in accordance with the methodology set out in section 8.3, where relevant.

Any topsoil that is stripped during construction activities will be stockpiled and managed in accordance with the MOP. Any topsoil that is not used for rehabilitation of construction areas (i.e. pad batters, drains, temporary areas, etc.) will remain stockpiled for the duration of the MOP term and be respread for site rehabilitation over infrastructure areas following decommissioning of that infrastructure during mine closure.

Mining method and features

The method of mining throughout the MOP term will continue as an open cut truck and shovel operation. Vegetation clearing and topsoil stripping will be undertaken by dozers ahead of mining activities to the north of the C Pit. Cleared vegetation and topsoil will be either directly placed onto areas ready for rehabilitation on overburden emplacement areas or stockpiled for later use in the rehabilitation process. This will be followed by drilling and blasting of the underlying overburden and ROM coal within the northern and eastern section of the C Pit. ROM coal will be loaded by hydraulic excavators and hauled to the existing ROM pad to the south-west of the mining area or an in-pit ROM stockpile.

Overburden will be loaded into dump trucks using hydraulic excavators and hauled to the existing out-of-pit overburden dump on the western side of the C Pit and the southern and eastern dumps (as shown on Plans 3A to 3E in section 12). Additionally, in-pit dumping will be undertaken to progressively backfill the A and C Pit. Emplacement of overburden will be undertaken until the dump reaches the planned RL consistent with the overburden emplacement sequence shown on Plans 3A to 3E in section 12. Once the desired RL is achieved, areas will be bulk shaped in preparation for rehabilitation.

MOP term areas will be progressively rehabilitated as they become available and in accordance with the sequence illustrated in Plans 3A to 3E in section 12. No areas of existing or proposed rehabilitation will be dumped over (or dehabilitated) during the MOP term. Management strategies that will be implemented during each stage of the mining and rehabilitation process are outlined in section 8.

A bund will be maintained at the crest of the existing rehabilitation area to minimise the potential for runoff from the growing overburden emplacement area. Once an area has been dumped out to its planned RL, it will be bulk shaped using dozers in readiness for installation of water management structures and surface preparation. Rock lined drop structures on existing rehabilitation will be extended over the new rehabilitation area. These will be tied into 5 m wide contours shaped with a 1% horizontal grade at 20 m intervals down the bulk shaped area. Surface preparation will involve contour ripping, topsoil spreading, amelioration (as required) and scarification prior to or during seeding. Following surface preparation, the area will be seeded with a cover crop and planted out with tubestock species required to achieve the post mining land uses, as detailed in section 8.3.7.

5. Assessment of drilling impacts outside approved mine disturbance boundary

As part of the 2020 Exploration Program, BCOPL is proposing to undertake large diameter exploration boreholes within CL368. However, 13 boreholes are proposed outside BCM's approved mine disturbance boundary. BCOPL has consulted with the DPIE and DAWE regarding the appropriate approval pathway for these activities (correspondence is attached in Appendix H). In accordance with advice received from DPIE and DAWE, an assessment and determination under Part 5 of the EP&A Act is required as part of the MOP.

The following subsections provide a description of the proposed drilling activities and an assessment of any potential impacts that are additional to those previously assessed (Hansen Bailey, 2010). Mitigation measures for the management of impacts from drilling activities are also outlined. This information has been provided to enable the Resources Regulator to make a determination under Part 5 of EP&A Act. The following subsections generally address the requirements set out in *ESG2: Guideline for preparing a Review of Environmental Factors* as relevant to the proposed works.

5.1 Proposed drilling activities

The proposed drilling will involve 13 large diameter exploration bore holes and the construction of associated new access tracks. These activities would generally be undertaken as described in Section 2.3.1.

Each borehole site will involve a drill pad (with a disturbance area of 40 metres by 40 metres in size) which includes set down, work areas, soil stockpile areas and in ground sumps (where physically possible). Minor excavation works may be required at some sites in order to develop a safe drilling location. Topsoil (generally between 0 to 300 mm depth) will be stripped prior to excavation. Stripped topsoil will be stockpiled separately to subsoil which will be subsequently used in rehabilitation activities. Each borehole will have a diameter of between 100 to 260 mm. All exploration bore holes will be rehabilitated in accordance with the borehole sealing guideline (DTI – Resources and Energy 2012) and the Exploration Code of Practice: Rehabilitation (DRG, July 2015).

Existing access tracks will be used wherever possible. Where sites require the construction of new access tracks, excavation and woodland vegetation removal will be avoided where practicable. Where excavation is required, a track of approximately 5 m wide will be cleared.

The 13 proposed exploration borehole sites (indicated by a red arrow pointing towards each site) along with the existing and proposed new access tracks are shown on Figure 5-1.

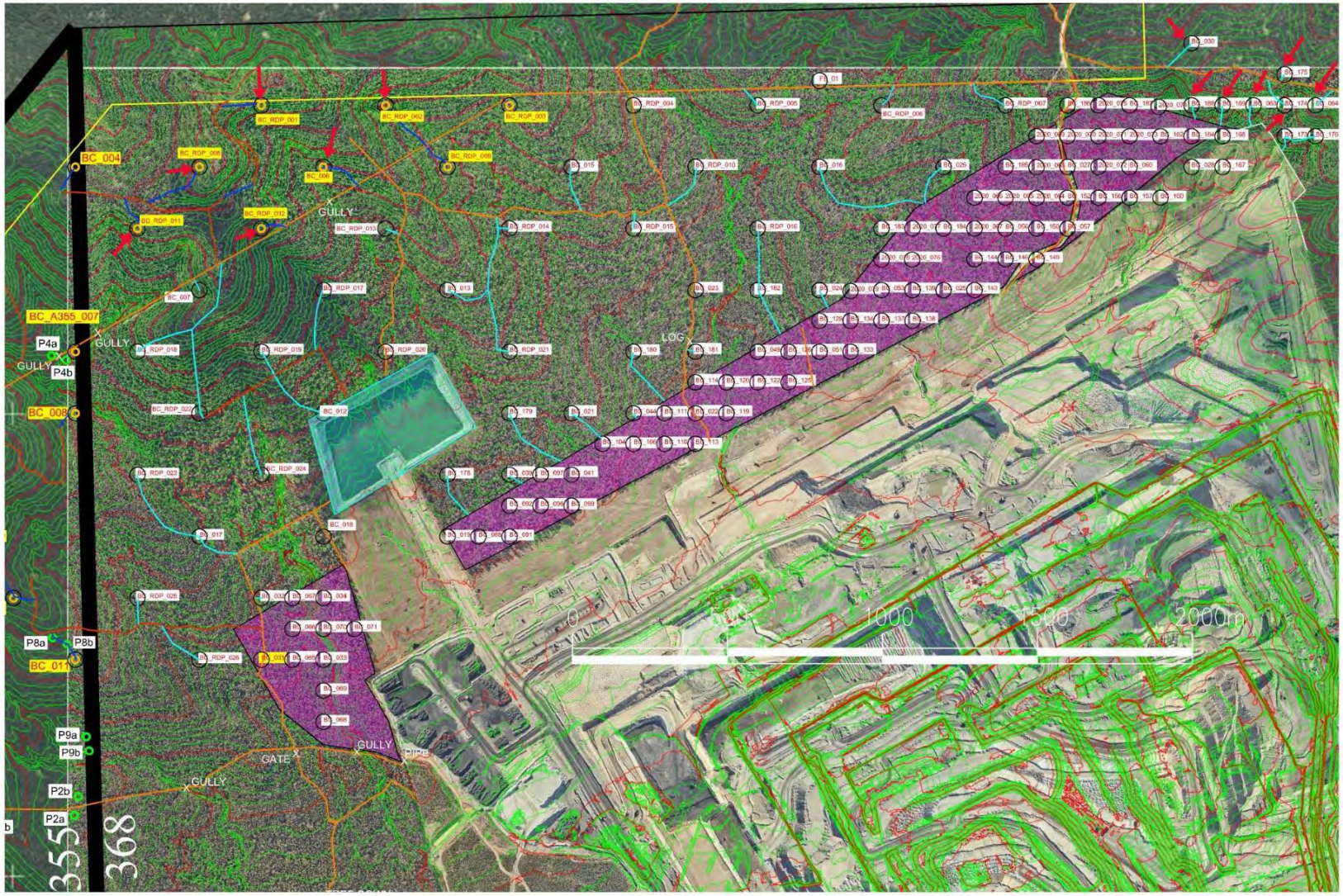


Figure 5-1 Proposed borehole locations

5.2 Stakeholder consultation

Extensive and ongoing consultation has been undertaken throughout development of the BCM, including liaison with government agencies, the community and Aboriginal community groups, as described in Section 1.4. This has included consultation specific to the proposed drilling activities.

5.3 Potential environmental impacts of drilling activities outside approved mine disturbance boundary

Potential impacts from the proposed boreholes located outside of the approved mining disturbance boundary are considered additional to those previously assessed (Hansen Bailey, 2010). Based on a review of the key environmental risks associated with these activities, BCOPL commissioned specialist impact assessment studies for:

- Biodiversity impacts.
- Aboriginal heritage impacts.
- Groundwater impacts.

The findings of the biodiversity, Aboriginal heritage, and groundwater impact assessments completed for the proposed exploration activities are summarised in the following subsections.

Impacts related to soils, surface water, traffic, air quality, noise and vibration, non-Aboriginal heritage, visual amenity, socio-economic, resource use, land use, waste and bushfires are not expected to significantly change as a result of the proposed drilling outside of the approved mining disturbance boundary. Potential impacts and mitigation measures for these environmental aspects are summarised in Table 5-1.

Table 5-1 Summary of potential environmental impacts

Environmental aspect	Potential impact	Mitigation measures
Noise and vibration	Due to the distance to sensitive receivers (greater than 3 km) and short-term, temporary nature of the works, potential noise and vibration impacts from the proposed drilling are not anticipated.	Potential noise and vibration impacts from the proposed drilling will be managed in accordance with the approved Noise Management Plan (NMP).
Air quality	Due to the distance to sensitive receivers (greater than 3 km) and short-term, temporary nature of the works, potential air quality impacts from the proposed drilling are not anticipated.	Potential air quality impacts from the proposed drilling will be managed in accordance with the approved Air Quality and Greenhouse Gas Management Plan (AQGHGMP).
Visual amenity	Due to the distance to sensitive receivers (greater than 3 km) and short-term, temporary nature of the works, visual amenity impacts from the proposed drilling are not anticipated. All works would be undertaken during standard construction hours and would therefore not require external lighting. Disturbed areas would be rehabilitated following completion of drilling.	All boreholes will be rehabilitated in accordance with the Exploration Code of Practice: Rehabilitation (DRG, July 2015).

Environmental aspect	Potential impact	Mitigation measures
Traffic	The proposed drilling would involve a small number of vehicles and drilling plant, which would access the proposed borehole locations via existing and newly constructed access tracks. Due to the minor nature of the works and minimal vehicle movements required, potential traffic impacts are not anticipated.	All potential traffic impacts associated with the proposed drilling will be managed in accordance with the approved Traffic Management Plan (TMP).
Surface water	The proposed drilling would require minor earthworks and stockpiling of soils, which could result in sedimentation of nearby waterways if not managed appropriately. Erosion and sediment controls would be implement to mitigate this potential impact.	Erosion and sediment controls would be implemented in accordance with the approved Surface Water Management Plan (SWMP). All boreholes will be rehabilitated in accordance with the Exploration Code of Practice: Rehabilitation (DRG, July 2015).
Groundwater	Refer to Section 5.3.3	
Soils	There is potential for accidental spillage or leaks of hydrocarbons or chemicals to result in soil contamination. The volumes of potential spillages would be relatively minor and would be managed through appropriate mitigation measures.	Potential soil contamination would be managed in accordance with the management controls identified in Section 4.2.
Biodiversity	Refer to Section 5.3.1	
Aboriginal heritage	Refer to Section 5.3.2	
Non-Aboriginal heritage	No non-Aboriginal heritage items are known to be located within the vicinity of the proposed borehole locations. Given the location of the proposed boreholes within generally undeveloped bushland, the potential to encounter previously unidentified non-Aboriginal heritage items is considered low. Impacts to non-Aboriginal heritage as a result of the proposed drilling are not anticipated.	If previously unidentified non-Aboriginal heritage items are encountered during the proposed drilling, these would be managed in accordance with the approved Cultural Heritage Management Plan (CHMP).
Socio-economic	Due to the minor nature of the works and distance to sensitive receivers, potential socio-economic impacts are considered to be negligible.	Any potential socio-economic impacts will be managed in accordance with the approved Social Impact Management Plan (SIMP)
Resource use	Due to the minor, short-term and temporary nature of the works, no impacts to community or natural resources are anticipated.	N/A
Land use	As the works would be minor, short-term and temporary, and all disturbed areas would be rehabilitated following completion of the borehole drilling activities, impacts to land use are not anticipated.	All boreholes will be rehabilitated in accordance with the Exploration Code of Practice: Rehabilitation (DRG, July 2015).

Environmental aspect	Potential impact	Mitigation measures
Waste	The proposed drilling would produce minor quantities of waste, including drilling fluid and general waste.	All waste would be management in accordance with the objectives of the *Waste Avoidance and Resource Recovery Act 2007* and the waste management hierarchy of avoid, reduce, reuse, recycle and dispose as described in Section 2.3.8 of the MOP.
Bushfires	There is potential for sparks generated from vehicles and actions of works to act as an ignition source. Additionally, bushfires may enter the proposed borehole locations from external sources. Given the minor nature and extent of the proposed works and with the implementation of appropriate bushfire risk management controls, the risk of bushfire either being generated by the proposed works or entering the proposed borehole locations from external sources is considered low.	Bushfire risk would be managed in accordance with the strategies identified in Section 4.2 of the MOP.

5.3.1 Biodiversity impacts

A Biodiversity Assessment Report (BAR) (WSP, 2020) has been prepared to assess the likely impacts of the proposed drilling on biodiversity values and to detail the management and mitigation measures to be implemented. The following section is summarised from the BAR, which is provided in full in Appendix I.

Methodology

This BAR was largely based on a series of field inspections within the study area and surrounding landscape, a desktop review of available information for the BCM and surrounding area, and a review of previous studies.

A desktop assessment was completed to inform the BAR. This involved a review of relevant and available background information to identify the presence of vegetation communities and flora and fauna species that may occur or use habitats within or adjacent to the proposal. The desktop assessment included a review from a range of databases, as detailed Appendix I.

Targeted ecological field surveys were conducted between 15-16 December 2019. These surveys sought primarily to:

- Assess the extent and condition of vegetation and fauna habitat at and immediately surrounding each site, especially for the threatened biodiversity.
- Identify biodiversity of concern (threatened biodiversity) to avoid and/or minimise impacts to biodiversity where possible during the works and for ongoing maintenance into the future.
- Identify areas with potential to be consistent with threatened ecological communities listed under the NSW BC Act, and Commonwealth EPBC Act.

Existing environment

Vegetation

Four native plant community types (PCTs) were identified during field surveys, including:

- PCT 1313 White Cypress Pine -Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion.
- PCT1381 Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion.
- PCT 1307 White Box – White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion.
- PCT 610 Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range.

No PCTs identified during field surveys are commensurate with a threatened ecological community (TEC) listed under the BC Act or EPBC Act.

Detailed summaries of these communities including structure and dominant species recorded and vegetation habitat assessments are provided in Appendix I.

Fauna habitat

The quality of vertebrate fauna habitats is typically correlated with the patch size, configuration, structure, species composition and connectivity of the vegetation communities present at a given site and the presence of habitat features such as tree canopy, hollow-bearing trees, woody debris, intact shrub layer and rock outcrops. The study area contained most of these fauna resources and was in moderate to good condition. Overall the study area provided moderate/good quality habitat for terrestrial fauna.

Threatened biodiversity

No threatened ecological communities, endangered populations or threatened species listed under the BC act or EPBC Act were identified within the study area.

However, desktop investigations identified 12 threatened flora species that have been previously recorded or have the potential to occur within the locality. Of the 12, a total of two species are considered to have a moderate to high likelihood to occur within the study area. Assessments of significance have been completed for these species (Appendix I).

Desktop investigations identified 57 threatened fauna that have been previously recorded or have the potential to occur within the locality. Of the 57 threatened fauna identified, a total of 25 have a moderate to high likelihood to occur within the study area. Significant impact assessments have been completed for these species (Appendix I).

No Migratory species were recorded during field surveys. However, potential habitat was observed for the Fork-tailed Swift and White-throated Needletail. While terrestrial Migratory species of bird may potentially use the area, the site would not be classed as 'important habitat' as defined *Matters of National Environmental Significance, Significant Impact Guidelines 1.1 EPBC Act* (Department of Environment, 2013). As such, it is unlikely that the proposed activity would significantly affect Migratory species.

No 'Critical Habitat' listed under the EPBC Act or 'Areas of Outstanding Biodiversity Value' (AOBV) listed under the BC Act were identified within the study area.

The EPBC Act Protected Matters Search Tool identified five wetlands of international importance (Ramsar) that may relate to the study area. These sites are all located in South Australia, Victoria and far central northern New South Wales in association with the Murray River and Macquarie River The proposed drilling is not located near these sites and is not considered likely to impact upon any of these wetlands of international importance.

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) does not apply to Part 5 activities. Despite this, an assessment against the SEPP has been included to demonstrate due diligence and reinforce that the proposed works will not have a significant impact on the Koala. Although koala feed trees species were below 15% of the total number of trees within the study area, there are recent sightings (≤10 years) of koalas in the wider Leard State Forest, which indicate that this may be considered core koala habitat. However, the relative low activity suggests occurrence of Koala in the area is likely to be intermittent and predominately roaming males with only limited resources within the study area to support a population of Koalas. Additionally, an assessment against the EPBC Act Referral Guidelines for Koalas (Department of the Environment, 2014) indicated that the study area is considered to contain habitat critical to the survival of the Koala, however, it is not expected that the proposed drilling will adversely affect this habitat. Therefore, a referral is not considered necessary. The proposed drilling would not be considered to substantially interfere with the recovery of the species.

Impact assessment

Loss of vegetation

The area of native vegetation to be impacted (2.86 ha) will be generally limited to ground cover, shrub layers and immature trees. Disturbance and clearing of hollow-bearing trees will be avoided and retained where possible. If the removal of hollow bearing trees is required, a staged clearing process would be adopted in accordance with the approved BMP.

Drill pads will be positioned in the field to avoid sensitive ecological constraints as identified during due diligence field inspections. Vegetation clearing will initially be undertaken at each site in accordance with the procedures provided within the currently approved BMP.

The removal 2.86 ha of native vegetation will have a minimal impact on fauna habitats. The impact assessments confirm that the disturbance and/or removal of 2.86 ha of native vegetation, is unlikely to have a significant impact upon any threatened species, populations or communities.

Direct loss of animals and plants

Fauna injury or death could occur, but is unlikely, as a result of the proposed drilling. Specifically, the excavation and earthworks, would involve ground disturbance and the removal of vegetation. While some mobile species, such as birds, have the potential to move away from the path of clearing, other species that are less mobile may have difficulty moving. Species of animal that may be affected by the removal of understorey vegetation include small terrestrial mammals, and reptiles. Vehicle strike during construction, operation and maintenance works is considered unlikely to significantly increase as a result of the proposed drilling.

Weed invasion and dispersal

The disturbances of land will result in the potential for the dispersal of weeds into areas of remnant vegetation where weed species do not currently occur. The most likely causes of weed dispersal associated with the proposed drilling would include earthworks, movement of soil and attachment of seed to vehicles and machinery. Therefore, mitigation measures relating to weed control would be implemented.

Erosion and sedimentation

Excavation and earthworks would expose soils with the potential to enter surrounding areas of vegetation. Erosion and sediment controls will be established at each drilling site prior to excavation to manage the potential for impacts to the neighbouring environment. With the implementation of appropriate mitigation measures, the potential impacts associated with the proposed drilling are not considered significant.

Significant impact assessment

Assessments of significance have been completed in accordance BC Act and EPBC Act guidelines for the threatened biodiversity with potential to occur within the proposed works study area and are provided in full in Appendix I. The assessments of significance concluded that the removal of vegetation and habitat loss associated with the minimal disturbance resulting from the proposed works is not likely to significantly impact upon threatened biodiversity within the area. A Species Impact Statement is not required under the BC Act and a referral of this project for consideration as a controlled action under the EPBC Act is not considered a requirement.

Mitigation measures

BCOPL's approved Biodiversity Management Plan (2019) will be implemented when removing vegetation. Where the Biodiversity Management Plan does not apply, the additional mitigation measures provided below would be implemented:

- An ecologist will be present during the clearing of native vegetation to relocate any displaced fauna to nearby habitat.
- Limit disturbance of vegetation to the minimum necessary to construct works.
- Mark the limits of clearing and install fencing around the proposed impact area prior to construction activities commencing to avoid unnecessary vegetation and habitat removal.
- Hollow bearing trees will be preserved/avoided where possible.
- Implement clearing protocols, including:
  - Marking trees to be removed and preparing an inventory of trees and hollows to be removed.
  - Checking hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possum, gliders and bats, prior to felling.
  - Animals found to be occupying trees will be safely removed before the clearing of trees if possible and relocated into nearby woodlands.
  - Where practicable, displaced woody debris and bushrock will be relocated into adjacent bushland.
- Restrict equipment storage and stockpiling of resources to designated areas in cleared land.
- Implement where appropriate erosion and sediment controls in accordance with:
  - *Erosion and sediment control on unsealed roads* (OEH 2012).
  - *Managing Urban Stormwater – Soils and Construction, Vol 1* (Landcom 2004).
  - *Managing Urban Stormwater – Soils and Construction, Vol 2* (DECC 2008).
- Vehicles and other construction equipment (i.e. excavators, dozers, etcetera) are to be received free of soil, seeds and plant material before entering the proposed works area to prevent the spread of potential pathogens into the construction site.

- Implement where appropriate in general accordance with:
  - Arrive Clean, Leave Clean Guidelines (Department of Environment, 2015).
  - Hygiene Protocol for the control of disease in frogs (National Parks and Wildlife Service, 2008).
- Weed management actions will be developed to manage weeds during the proposed works.
- Any vegetation cleared that contains weeds will be bagged and disposed offsite at a suitable vegetation waste facility.
- Vehicles and other construction equipment are to be received completely free of soil, seeds and plant material before entering the proposed works area to prevent the introduction of further exotic plant species.
- Notify wildlife service if injured fauna is identified during construction.

5.3.2 Aboriginal heritage impacts

An Aboriginal Cultural Heritage Report (ACHR) (Insight Heritage, 2020) was prepared to assess potential impacts to Aboriginal heritage as a result of the proposed drilling. The following section is summarised from the ACHR, which is provided in full in Appendix J.

Methodology

The management of ground disturbing works within CL368 is covered by the approved CHMP. The CHMP allow for a due diligence style process which requires a review of known sites within the area of works, and then an inspection of areas of proposed ground disturbance with two Registered Aboriginal parties (RAPs). The CHMP also allows for the collection of any artefacts located that will be disturbed by mining activities. The artefacts are then stored in a locked facility at Boggabri Coal.

The proposed borehole sites and access tracks were inspected by two RAPs and Boggabri Coal staff in November and December 2019.

Existing environment

No previously identified objects of Aboriginal cultural heritage significance were identified within the area of proposed drilling.

During field inspection, one isolated artefact (indurated mudstone/tuff (IMT) flake) was located and collected. The isolated artefact was found on an existing track which will be utilised to access drill sites in the north east corner of CL368.

No potential archaeological deposits were identified.

Impact assessment

The isolated artefact has been added to the Boggabri Coal artefact storage facility and will be managed along with other salvaged materials, in accordance with decisions made by RAPs via the Aboriginal Stakeholder Community Forum (ASCF).

No further impacts to Aboriginal cultural heritage were identified as a result of the proposed drilling.

The clearing of the drill sites and the creation of access tracks will require ground disturbance, which has the potential to impact on previously unidentified Aboriginal heritage objects. Potential impacts will be managed in accordance with the management requirements of the approved CHMP.

Mitigation measures

Potential impacts to Aboriginal heritage as a result of the proposed drilling will be managed in accordance with the management requirements of the approved CHMP. No additional mitigation measures are required.

5.3.3 Groundwater impacts

A Groundwater Impact Assessment (GIA) (AGE, 2020) was prepared to assess potential impacts on groundwater resources as a result of the proposed drilling. The following section is summarised from the GIA, which is provided in full in Appendix K.

Methodology

The GIA draws from a substantial body of information on groundwater collected at the Boggabri mine since mining commenced in 2006. Much of this information is presented in Annual Reviews and groundwater assessments prepared for Environmental Impact Statements (EIS). Publicly available information including NSW government databases on water bores and bioregional assessment reports prepared by the Commonwealth government were also utilised.

Existing environment

Groundwater characteristics and quality

The geology within the locality of BCM can be broadly classified into three distinct hydrostratigraphic units, which include:

- A Quaternary alluvial groundwater system.
- A Permian groundwater system of the Maules Creek Formation.
- A late Carboniferous/early Permian groundwater system of the Boggabri Volcanics.

At a regional scale the alluvium is generally thickest within the main Namoi River alluvial plain (exceeding 90 m), thinning towards the edges of the plain and along the tributaries. The Namoi River alluvium is a high yield aquifer that is a regionally significant water supply aquifer with extraction bores mainly along the Namoi River and its major tributaries. In specific areas, this unit meets the definition of a highly productive groundwater resource, being capable of supplying groundwater at a rate greater than 5 L/s with a salinity less than 1,500 mg/L. Hydraulic conductivity within the alluvium is highly variable. Groundwater quality in the alluvial aquifer is generally brackish, with a median electrical conductivity over the entire Namoi region. The freshest alluvial groundwater is generally found in bores adjacent to the Namoi River, Barbers Lagoon and Maules Creek and more saline groundwater is found away from these recharge sources.

Groundwater use in the Permian is generally limited due to the low permeability of the bedrock units limiting the volumes of water that can be removed. Groundwater levels within the Permian units can be deep in the ridge areas, which further limits its use as a groundwater source. This is the case in the area where exploration boreholes are proposed with the high elevation above the surrounding flood plain meaning the water table is expected to occur at depths of greater than 100 metres below the land surface. Groundwater quality within the Permian strata range from brackish within the coal seams to moderately saline within the interburden. Locally, groundwater within the Permian coal seams is generally fresher than that of the alluvium,

The Boggabri Volcanics is a relatively impermeable rock mass and therefore hosts limited groundwater yields. The areas these yields generally occur in the shallower sections at the fringes of alluvium sediments, where the Boggabri Volcanics are likely to be weathered. Groundwater quality in the Boggabri Volcanics is moderately saline.

Groundwater connectivity

Coal seams do not form highly productive aquifers, however, they are relatively permeable compared to the impermeable non-coal Permian host rock. Consequently, where continuous coal seams are in direct connectivity to a shallow alluvium, the coal seams form the primary pathway of groundwater flow. The closest area where the coal seams subcrop and maybe in contact with the alluvial sediments is to the south under the Bollol Creek alluvium. The connectivity between the groundwater within the Permian and the alluvial groundwater is limited due to limited thickness of continuous coal seams and the slow groundwater movement within the Permian strata.

There are limited areas in the study area with the potential for groundwater-surface water (GW-SW) interactions. Under natural conditions the area with the highest potential for GW-SW interaction is the Namoi River located some 10 km to the west of the proposed exploration area.

Groundwater users

Bores and water users in the vicinity of the proposed exploration area include licenses allocated to:

- Basic access right for stock and/or domestic purposes – 59 sites.
- Water access right for larger volume use including irrigation and mining – 17 sites.

BCM and the surrounding mines have water access rights in the immediate area to allow groundwater to be extracted from the active open cut pits. There are no registered water bores near the proposed exploration drilling area within the coal measures. The majority of the bores are located on the flood plain areas to the south and west where water use is mainly for irrigation. Most water users with basic access rights are located within the alluvial plains associated with Bollol Creek and Namoi River.

Groundwater dependent ecosystems (GDEs)

The Bureau of Meterology (BoM) GDE Atlas identifies areas of high potential terrestrial GDEs along Back Creek and Bollol Creek. Moderate potential GDEs are also mapped within 2 km of the proposed exploration holes. Low potential GDEs were mapped over the majority of the landscape across the exploration program as well as the Namoi subregion. There are no potential GDEs within close proximity to the proposed exploration area.

Impact assessment

Exploration activities are defined as “minimal impact aquifer interference activities” under the NSW Government Aquifer Interference Policy (AIP). This classification is based on the minimal amount of groundwater uptake and loss associated with exploration drilling, the use of surface casing to isolate unconsolidated materials as well as the strict hole rehabilitation procedures for exploration holes detailed under the relevant guidelines for coal exploration. These surface casing requirements and rehabilitation procedures ensure the risk of impacts to groundwater quality and quantity are minimised.

The exploration drilling programme focuses on the Permian strata, which is largely an aquitard and drilling will not penetrate the highly productive alluvial aquifer in the region.

The use or interference of groundwater through the proposed drilling is not expected to significantly contaminate or deplete groundwater. Nevertheless in some circumstances, potential impacts on groundwater as a result of exploration drilling activities could include the following:

- Disturbance to other users.
- Superficial impacts from drilling processes.
- Inter-aquifer groundwater flow.
- Impacts on GDEs.
- Impacts to the catchment water quality.
- Disturbance of flow regimes.

These potential impacts are assessed below.

Disturbance to other users

No water supply bores are located within 200 m of the proposed boreholes. Furthermore, private bores further than 200 m away within the Permian are not anticipated that to be impacted by the exploration drilling, due to low hydraulic conductivities within the Permian and the minimal amount of groundwater that is displaced during exploration drilling.

The proposed boreholes are not anticipated to intersect any alluvial sediments. The degree of connectivity between the Permian strata and the alluvial aquifer is limited, so impacts to groundwater users tapping the alluvial aquifer would be negligible.

Superficial impacts from drilling processes

There is a very low possibility of localised contamination of groundwater from drilling fluids or contaminated groundwater expelled to the surface during drilling. Water will be circulated in the boreholes during drilling. It is possible that an amount of drilling fluid could invade the coal seams immediately surrounding the borehole. The drilling fluids will be comprised of biodegradable material and are not a potential source of persistent or pervasive regional organic contamination.

All proposed boreholes will mostly intersect low permeability interburden and overburden Permian strata and the thinner interbedded coal seams. Overall, this means there will be negligible influence from the drilling process and limited effective pathways of contaminant transport to potential receptors.

Inter-aquifer groundwater flow

When drilling is undertaken, the drilling apparatus penetrate and therefore connect subsurface layers. This can potentially cause inter-aquifer flow of groundwater and cross-contamination of aquifers, if water quality varies between units. However, the site-specific assessment of proposed drilling shows that due to the low hydraulic conductivity of the Permian strata, low connectivity between units and borehole rehabilitation procedures, there is very little potential for inter-aquifer connectivity impacts.

Impacts on GDEs

The mapped GDEs in the locality are unlikely to utilise groundwater from the Permian strata due to the significant depth to the water table. Impacts to GDEs are therefore considered unlikely.

Impacts to catchment water quality

The proposed exploration drilling is within areas categorised as “mainly forested areas” and “uncontrolled streams” by the Namoi River Water Quality and River Flow Objectives (NSW Environment, Energy and Science, 2006). Consideration has been given to the potential for the proposed drilling to impact on relevant Water Quality Objectives (WQOs) and River Flow Objectives (RFOs) for the Namoi River

No lasting or significant impacts on groundwater salinity or organic contaminants are anticipated from the proposed activities. Additionally, the activities have no relevance to other important WQOs related to mainly forested areas and uncontrolled streams, such as biological or nutrient contaminants (faecal coliforms, algae, phosphorous, nitrogen). Therefore, the exploration activities will not adversely impact the potential for fulfilling the WQOs, and environmental values of the groundwater will be maintained.

Disturbance of flow regimes

When groundwater is extracted, it causes a reduction in hydraulic head and induces flow from elsewhere, potentially redirecting flow or changing flow rates. As these induced changes are commensurate with the volume of water extracted, among other factors, there are no lasting impacts expected in relation to the groundwater flow regime from the small volumes extracted during drilling. Further, the extraction at each location would be short-lived, allowing for staged aquifer recovery in localised areas.

Mitigation measures

To ensure that groundwater levels are not adversely impacted, water level monitoring will be undertaken at existing BCOPL monitoring sites, both during and following exploration drilling.

All exploration bore holes will be rehabilitated in accordance with the borehole sealing guideline (DTI – Resources and Energy 2012) to prevent impacts to groundwater, such as cross-contamination between the coal seams. This will generally include:

- Surface casing (nominally 125 mm Class 9 PVC or steel as appropriate) will be installed into each bore hole for the penetrated section of weathered material.
- The casing will be sealed in place by either grout or an expanding foam sealant.
- The casing will remain in place at the completion of drilling and logging of the hole.
- The casing will be cut to a depth of about 1.0 m below ground level, and the upper section of casing will be removed.

- The hole will be filled with grout from total depth to 1.0 m below ground level. Grout will be pumped down the hole using a tremie line, filling the hole from the bottom up.
- Soil will be placed within the hole from 1.0 m below ground level up to the natural surface.

6. Rehabilitation planning and management

All rehabilitation works will be undertaken in accordance with the approved EMPs (refer to Appendix B), and this MOP. Rehabilitation will generally commence as soon as practical following the completion of mining related activities, however BCM will aim to have it completed by early September each year to allow sufficient time for appropriate levels of vegetation to establish before the period of high erosion hazard. In order to achieve this, BCM will aim to ensure topsoil is placed by November of each year in preparation for the forthcoming rehabilitation in the following year.

The proposed rehabilitation methodology is set out in Section 8.

6.1 Post mining land use

6.1.1 Final landform description

BCOPL propose to construct a final landform that will be free draining and integrate with the surrounding catchments. Initial batter slope modelling indicates that the current design of a linear batter gradient of 10° (17.5%) and lift to a height of 20 m initially constructed with diversion banks (berms), which are removed once target vegetation cover levels are achieved, are possible to provide a stable landform.

BCOPL will work with adjoining mines as required by Schedule 3 Condition 72 (e) of the Project Approval to identify opportunities for integrated mine planning to minimise environmental impacts of the final landform (see Section 4.2).

The final landform will be progressively formed in the overburden emplacement area and shaped in a manner consistent with the landform design. A water balance assessment will be undertaken during development of the Final Void and Mine Closure Plan (prior to the end of December 2025) to determine long-term water levels in the final void and any potential for overtopping or seepage from the final void.

6.1.2 Post-mining land use goal

The rehabilitation of mining activities in the active pit and emplacement area and, in the case of closure, the rehabilitation of remaining infrastructure will be undertaken in accordance with the methods described in this MOP. A separate BMP has been developed to guide the management of biodiversity resources for the site (excluding the active pit, and mine closure) during operations and for BOAs into perpetuity. Additionally, two overarching strategy documents have been prepared which consider rehabilitation and biodiversity matters. The Biodiversity Offset Strategy (BOS) contains the conservation and enhancement strategy described in the EA (Hansen Bailey, 2010), which is required by Schedule 3, Condition 39 of the Project Approval. The Leard Forest Regional Biodiversity Strategy (Stage 1 and Stage 2), as required under Schedule 3, Condition 40, describes the strategy for the management of biodiversity regionally between the three mines in the BTM Complex. These documents are available on the Boggabri Coal website (https://www.idemitsu.com.au/mining/operations/boggabri-coal/approvals-plans-reports/)

Prior to the granting of the Project Approval in 2012 and subsequent development of these documents, BCOPL had, under agreement with the land manager (Forests NSW), implemented a rehabilitation strategy which focused on the establishment of commercial timbers for future forestry activities based on best practice research into growth rates of various canopy tree species. As a consequence of the outcomes and commitments of the BOS and condition Schedule 3 Condition 39 of the Project Approval, the rehabilitation strategy has been revised to focus on biodiversity and the establishment of habitat for threatened species in appropriate areas.

Other areas within the BCM will be used for agricultural purposes following rehabilitation and areas adjacent to BOAs will be rehabilitated to appropriate vegetation communities to enhance biodiversity and corridor establishment.

The final land uses and rehabilitation strategy for the BCM will be undertaken to ensure consistency with the National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Grassy Woodland) (DECCW, 2010).

The rehabilitation strategy broadly includes:

- Rehabilitation of disturbed areas to form part of a regional east-west wildlife corridor created as part of the BOS. This will create a linkage to remnant vegetation between the Namoi River to the west through the Leard State Forest to the Nandewar Range to the east.
- Revegetation of the post mine landscape with native vegetation, comprising a mixture of native grassy woodland, shrubby woodland/ open forest, riparian forest vegetation types and Box-Gum Woodland with fauna habitat for Threatened species to encourage the re- establishment of pre-mining biodiversity values.
- Ensuring the sustainability of the post mining ecological values of the landscape.

The long term security and management of Leard State Forest will be subject to review and recommendations in the development of the BTM Complex Regional Biodiversity Strategy. Biodiversity is the focus of the final land uses.

6.2 Rehabilitation objectives

The principal objective for rehabilitation at BCM is to return the site to a condition where it's landforms, soils, hydrology, flora and fauna are self-sustaining, and compatible with the surrounding land fabric.

The proposed end land use for the site is predominately biodiversity with some areas having agricultural land and soil capability including Class 3 (high capability), Class 4 (moderate capability) and Class 5 (moderate-low capability). The stated land use combination is compatible with adjoining lands. BCOPL will consider the opportunities for a diverse post-mining landscape and land use where practical.

Rehabilitation strategies will focus on the establishment of the threatened Box-Gum Woodland community using native species common to the region. This includes the establishment of Box-Gum Woodland on mine rehabilitated areas and the restoration of Box-gum Woodland on extensive areas of derived native grassland. The rehabilitation will be integrated with the BOS to create the proposed regional east west wildlife corridor.

Re-grading of overburden dumps has and will be undertaken to produce slope angles, lengths and shapes are compatible with proposed land capability classifications suitable for the proposed land use and have a low potential to erode. The design profile and associated requirements are broadly consistent with rehabilitation techniques employed on parts of the existing rehabilitated overburden dumps. Integrated with this will be a drainage pattern which is capable of conveying runoff from the newly created catchments and integrates with surrounding catchments by sheeting water towards natural drainage lines of associated ephemeral creeks.

Rehabilitation objectives, management goals and key actions have been developed with consideration of all planning approval and statutory requirements. General rehabilitation objectives are summarised in Table 6-1.

Table 6-1 General rehabilitation objectives

Location	General rehabilitation objective
Mine site (as a whole), including the final void.	Safe, stable and non-polluting. Minimise the size and depth of the final void as far as is reasonable and feasible and ensure the void contains no retained surface water (i.e. no pit lake). Land degradation is minimised and vegetation removal is minimised.
Surface Infrastructure	Decommission and remove, unless the Executive Director, Mineral Resources in Resources Regulator agrees otherwise, and rehabilitate to a level equal or better to the original landscape.
Waterways	Water is managed to ensure that clean and dirty water systems are separated. No pollution of waterways.
Other land	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of: ■ local native plant species (unless the Executive Director Mineral Resources in Resources Regulator agrees otherwise); ■ a landform consistent with the surrounding environment; ■ stable free draining landform able to support proposed vegetation, Ecological biodiversity is promoted.
Community / General	Safety risks are eliminated as far as is practical. Minimise the adverse socio-economic effects associated with mine closure. Ensure that cultural heritage is not impacted and is appropriately managed.

Rehabilitation objectives have been further broken down into short, medium or long term. Each category is summarised as follows:

- Short term rehabilitation objectives:
  - Progressively reshape and stabilise disturbed areas.
  - Provide structural erosion control measures.
  - Ameliorate spoils and soils to address physical, chemical and biological constraints to revegetation and erosion stability.
  - Establish species which will out compete potential weed species and provide rapid soil surface cover.
  - Refine rehabilitation methods.
- Medium term rehabilitation objectives:
  - Establishment of the structural dominant species from the relevant native vegetation communities.
  - Demonstrating rehabilitation succession in comparison with analogue sites.
  - Reducing reliance on structural drainage and erosion control methods.

- Long term rehabilitation objectives:
  - Monitoring rehabilitation areas to ensure stable and sustainable rehabilitation including succession of planted native vegetation toward analogue native vegetation communities.
  - Applying adaptive management measures if natural succession is not occurring.
  - Demonstrating rehabilitation performance.
  - Encouraging fauna movement across the leard state forest through the establishment of a regional wildlife corridor.

6.3 Domain rehabilitation objectives

Ten primary rehabilitation domains have been developed for the BCM. The rehabilitation domains define areas based on operational or functional purposes and geophysical similarities. Primary domains relate to land uses during mining. Secondary domains relate to land uses following mining. Domains cover areas within the BCM with a similar land use, rehabilitation outcome and closure criteria. The primary and secondary domains for the site are shown in Table 6-2 and on Plans 3A to 3E.

Table 6-2 Primary domain and landscape goal/secondary domain

Primary domain	Landscape goal / Secondary domain
Domain 1 –Overburden emplacement areas	A – Grassy woodland on fertile soils (Box Gum Woodland) B – Riverine woodland C – Shrubby woodland/Open forest on skeletal soils
Domain 2 –Active mining areas (including final void)	A – Grassy woodland on fertile soils (Box Gum Woodland) B – Riverine woodland E – Final void
Domain 3 – Rehabilitation	A – Grassy woodland on fertile soils (Box Gum Woodland) B – Riverine woodland C – Shrubby woodland/Open forest on skeletal soils
Domain 4 – Clean water management systems	B – Riverine woodland D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 5 – Dirty/contaminated water management systems	B – Riverine woodland D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 6 – Administration buildings, car parks, access roads	B – Riverine woodland D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 7 – Potentially contaminated areas	B – Riverine woodland C – Shrubby woodland/Open forest on skeletal soils D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 8 – Coal handling areas	B – Riverine woodland C – Shrubby woodland/Open forest on skeletal soils D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 9 – Haul roads, buffer zones and hardstand areas	A – Grassy woodland on fertile soils (Box Gum Woodland) B – Riverine woodland C – Shrubby woodland/Open forest on skeletal soils D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture
Domain 10 – Stockpiled material	A – Grassy woodland on fertile soils (Box Gum Woodland) C – Shrubby woodland/Open forest on skeletal soils D – Grassland/pasture with a mix of land capability classes III, IV and V for grazing pasture.

The following are common objectives for all domains:

- Safety risks are eliminated as far as reasonably practicable.
- The final landform is stable and fit for purpose.
- A stable free draining landform, capable of supporting pasture and/or sustainable ecosystems of native trees and shrubs.
- Land degradation and removal of existing vegetation is minimised in areas required for construction, operation or fire control.
- Manage water so that clean and dirty water are kept separate.
- Rehabilitate land as soon as is practicable to a level equal to or better than the original landscape.
- The site will not be a source of pollutants.
- Ecological diversity will be maintained or enhanced.
- Where possible rehabilitation works do not impact on sites/ areas of Aboriginal cultural heritage.
- The rehabilitated landscape will be enhanced using best available practices and materials.
- Promote biodiversity through weed and feral animal control programs.
- The agriculture value of the lands will be sustained or enhanced in a manner consistent with the mining plans.
- Limit soil compaction and the spread of weeds by minimising site access by vehicles.

6.4 Rehabilitation phases

BCOPL is committed to implementing a program of progressive rehabilitation to be undertaken when disturbed areas are available for rehabilitation. The BCOPL rehabilitation program will focus on rehabilitation in the following key areas:

- Rehabilitation of overburden emplacement areas from open-cut mining.
- Temporary rehabilitation of disturbed areas within the mine infrastructure area.
- Habitat enhancement and management of offset areas.

Rehabilitation will be assessed and reported annually as part of the Annual Review.

Progressive rehabilitation that will be undertaken during the MOP term is shown on Plan No's 3A-3E in Section 12. Progressive rehabilitation activities associated with open cut mining will focus on shaped overburden emplacement areas. Phases for rehabilitation activities undertaken at BCM are described in Table 6-3. These have been developed in accordance with the ESG3 MOP Guidelines (DRE, 2013). Rehabilitation phases applicable to each domain are identified in Table 6-3.

Table 6-3 Rehabilitation phases

Phase	Description
Active Mining Area	The process of undertaking mining and associated activities
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 contour ripping, placing and spreading soil and applying ameliorants.
Ecosystem and land use establishment	The process of seeding, planting and transplanting plant species.
Ecosystem and land use 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.
Relinquished lands	Land that has been deemed to have met the post-mining land use completion criteria and has been relinquished from the mining lease(s).
Functioning regional wildlife corridor	The unrestricted movement of wildlife across a specific area

Table 6-4 shows the relevant rehabilitation phases for each domain, based on the post-mining land use.

Table 6-4 Rehabilitation phases by primary domain

Rehabilitation Phase \ Domain	Overburden emplacement areas	Active mining areas	Rehabilitation	Clean water management systems	Dirty/contaminated water management systems	Administration buildings, car parks, access roads	Potentially contaminated areas	Coal handling area	Haul roads, buffer zones and hardstand area	Topsoil stockpile
Phase 1: Decommissioning		X		X	X	X		X	X	
Phase 2: Landform establishment	X	X	X	X	X	X		X	X	
Phase 3: Growth medium development	X	X	X	X	X	X			X	X
Phase 4: Ecosystem and land use establishment	X	X	X	X	X	X				
Phase 5: Ecosystem and land use sustainability	X	X	X	X	X	X	X	X		
Phase 6: Functioning regional wildlife corridor	X	X	X	X	X	X	X	X	X	

X	**Active rehabilitation phases during term of MOP**
X	Inactive rehabilitation phases during term of MOP

7. Performance indicators, and completion / relinquishment criteria

Detailed rehabilitation performance and closure criteria have been developed for each domain. These are described in the rehabilitation tables in Appendix D, which have been developed in accordance with the recommended structure in the ESG3 MOP Guidelines (DRE, 2013). The domain rehabilitation tables detail regulatory requirements, rehabilitation objectives, indicators and completion criteria for each rehabilitation phase of all rehabilitation domains.

The rates of rehabilitation and disturbance for the duration of this MOP term are summarised below in Table 7-1.

Table 7-1 Rehabilitation and disturbance rates during the life of the MOP

Year	Boggabri Coal Mine		
	Rehabilitation[1] (ha)	Disturbance (ha)	Rehabilitation disturbance (ha)
Pre-MOP (2019)	263.7	1157.4	0
2020	302.9	1196.5	0
2021	342.4	1174.3	0
2022	412.8	1121.3	0
2023	462.9	1087.6	0
2024	523	1042.6	0
Total[2]	**259.3**	**-114.9**	0

(1) excludes temporary rehabilitation

(2) total refers to total gain or loss in area during the MOP term

8. Rehabilitation implementation

8.1 Status at MOP commencement

At the commencement of the MOP term, approximately 263.7 ha of overburden emplacement area had been rehabilitated in accordance with the following requirements:

- Shaping surfaces to a maximum slope of 10 degrees.
- Covering areas to be rehabilitated with a minimum depth of 150 mm topsoil.
- Planting native vegetation as outlined in section 8.3.7.

This existing rehabilitation is shown on Plan 2 in section 12. Information pertaining to the status of the domains at the commencement of the MOP term is shown in Table 8-1 and Table 8-2.

Table 8-1 Status of primary domains at MOP commencement

Primary domain	Code	Status
Overburden emplacement areas	1	Active
Active Mining Areas	2	Active
Rehabilitation	3	Active
Clean water management systems	4	Active
Dirty/contaminated water management systems	5	Active
Administration buildings, car parks, access roads	6	Active
Potentially contaminated areas	7	Active
Coal handling areas	8	Active
Haul roads, buffer zones and hardstand areas	9	Active
Topsoil stockpile	10	Active

Table 8-2 Status of secondary domains at MOP commencement

Secondary domain	Code	Status
Grassy woodland on fertile soils (Box Gum Woodland)	A	Not Active
Riverine Woodland	B	Not Active
Shrubby woodland/Open Forest skeletal soils	C	Active
Grassland/pasture	D	Not Active
Final void	E	Not Active

8.2 Proposed rehabilitation activities the MOP term

Areas proposed to be rehabilitated during the MOP term are illustrated on Plan no's 3A-3E (refer to Section 12). Methods that will be implemented to achieve this rehabilitation are described in the following subsections.

Rehabilitation undertaken during the MOP term is summarised in Table 8-3.

Table 8-3 Summary of rehabilitation during the MOP term

Year	Boggabri Coal Mine			
	Disturbance (ha)	Rehabilitation (ha)*	Cumulative rehabilitation area (ha)	Comments
Pre-MOP	1157.4	n/a	263.7	Rehabilitation activities included: surface preparation topsoil salvage and placement, tube stock planting, fertilising and tree watering.
2020 Plan 3A	1196.5	39.2	302.9	Rehabilitation activities will include: surface preparation topsoil salvage and placement, tube stock planting, fertilising and irrigation.
2021 Plan 3B	1174.3	39.5	342.4	Rehabilitation activities will include: surface preparation topsoil salvage and placement, tube stock planting, fertilising and irrigation.
2022 Plan 3C	1121.3	70.4	412.8	Rehabilitation activities will include: surface preparation topsoil salvage and placement, tube stock planting, fertilising and irrigation.
2023 Plan 3D	1087.6	50.2	462.9	Rehabilitation activities will include: surface preparation topsoil salvage and placement, tube stock planting, fertilising and irrigation.
2024 Plan 3E	1042.6	60.1	523.0	Rehabilitation activities will include: surface preparation topsoil salvage and placement, tube stock planting, fertilising and irrigation.

Note: *area excludes temporary rehabilitation

Rehabilitation strategies will focus on the establishment of the Threatened Box-Gum Woodland community using native species common to the region. This includes the establishment of Box-Gum Woodland on mine rehabilitated areas and the restoration of Box-gum Woodland on extensive areas of derived native grassland. The rehabilitation will be integrated with the BOS to create the proposed regional east west wildlife corridor.

Re-grading of overburden dumps will be undertaken to produce slopes with angles, lengths and shapes that are compatible with proposed land capability classifications suitable for the proposed land use and have a low potential to erode at unacceptably high rates. The design profile and associated requirements are broadly consistent with rehabilitation techniques employed on parts of the existing rehabilitated overburden dumps. Integrated with this will be a drainage pattern which is capable of conveying runoff from the newly created catchments and integrates with surrounding catchments by sheeting water towards natural drainage lines of associated ephemeral creeks.

All soil conservation and erosion control drainage structures (graded banks, chutes and flumes) will be designed in accordance with the NSW Soil Conversation Service, Design Manual for Soil Conservation Works – Technical Handbook No. 5 (Aveyard, 1982). All sediment and/or pollution control facilities will be designed in accordance with Volume 1 and Volume 2E of Managing Urban Stormwater: Soils and Construction (Landcom, 2004; DECC, 2008 respectively).

8.2.1 Timing of decommissioning activities

There will be no decommissioning activities throughout the MOP term.

8.3 Rehabilitation methodology

8.3.1 Landform design

The landform design will optimise post-mining land capability, long-term stability and minimise the costs in achieving optimal land use.

The mine disturbance areas, in particular the overburden emplacement area and low walls, represent the largest area of rehabilitation landform at the BCM. A batter slope design has been modelled for the overburden emplacement areas and a final landform design will be modelled to confirm long-term stability of the final landform.

Water Erosion Prediction Project (WEPP) modelling of the current batter slope design (10° batter gradient and 20 m high lift) indicates that with adequately ameliorated soil and diversion banks, (which will be removed once target vegetation levels are achieved), it is possible to provide an erosional stable landform.

Amelioration of the overburden and topsoil will be undertaken in accordance with the SMP with the aim of increasing infiltration rates, and resistance to erosion to support vegetation communities and minimise surface runoff.

BCOPL will maintain a 250 m wide barrier between the BCM and the Maules Creek Coal Project to retain the vegetated buffer between the two mines in accordance with the requirements of Schedule 2, Condition 7 of the Project Approval.

8.3.2 Mine disturbance areas

The mine disturbance areas, in particular the overburden emplacement area and low walls, represent the largest area of rehabilitation landform at the BCM. A batter slope design has been modelled for the overburden emplacement areas and a final landform design will be modelled to confirm long-term stability of the final landform. Outcomes of the initial batter slope design modelling are documented in the Conceptual Landform Interim Report in Appendix G and summarised below.

WEPP modelling of the current batter slope design (10^{o} batter gradient and 20m high lift) indicates that with adequately ameliorated soil and diversion banks, (which will be removed once target vegetation levels are achieved), it is possible to provide an erosional stable landform with acceptable rates of erosion (<10t/ha/y).

The final landform design requires further investigation for the low wall and overburden emplacement slopes to develop a safe, stable and non-erosive final landform based on the final land use, climate, topography and soils, which incorporates:

- Batter slopes.
- Overburden emplacement height and footprint.
- Drainage.

- Landform evolution.
- Construction method.

Initial laboratory analysis has been undertaken to provide a basic material characterisation to enable further examination of erodibility parameters for three common materials including topsoil, topsoil/mulch and overburden. The WEPP model has been used to assess interactions between slope height and gradient for all three materials supplied. The key findings relating to the initial landform assessment include:

- The overburden is more saline than the topsoil materials assessed, though levels are unlikely to adversely affect plant growth.
- The overburden material is classified as sodic (ESP > 6%), but the topsoil samples are not.
- The topsoil materials, although not sodic, may be prone to dispersion as indicted in the Conceptual Landform Study (Landloch, 2012) and materials having an Electrochemical Stability Index (ESI) < 0.05. Gypsum will be incorporated into topsoil to reduce the potential for dispersion and surface crusting at rates described in the Soil Management Protocol.
- Vegetation is a crucial component of slope stability. Provided target levels of vegetation contact cover can be established, the current landforms being constructed have potential to be stable and sustainable which is confirmed by rehabilitation works undertaken to date.

8.3.3 High wall / final void

The final void will be in the northern section of the BCM. BCOPL have committed to reshaping the high wall to ensure it is safe, stable, non-erosive and revegetated as is practical. The long term stability of a high wall can be affected by a number of factors including:

- Structure and strength of the high wall and end walls.
- Resistance of the in situ sedimentary rock to rainfall-induced weathering processes.
- High wall and end wall drainage.
- Ponding of water in final void can cause rapid breakdown of sediments in contact with water and progressive back-cutting of the inundated strata leading to major wall failure.
- Extended saturation-softening of the base of the low-wall also has the potential to cause major failure.

A final high wall landform will be developed following assessment by geotechnical and erosion specialists to determine geotechnical and erosion parameters. This will be incorporated into the Final Void and Mine Closure Plan and completion criteria prior to the end of December 2025.

8.3.4 Contamination management during decommissioning

A number of areas of potential hydrocarbon contamination exist at the BCM. These areas are associated with maintenance workshops, designated storage areas and refuelling and filling points for:

- Diesel, bio-diesel.
- Hydraulic/ lubricating oils and waste oils.

BCOPL operates a bioremediation area for the storage and treatment of contaminated material produced at the workshop and wash pad pit.

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

8.3.5 Pre-clearing fauna and flora surveys

Pre-clearing vegetation surveys will be undertaken to establish the following factors of the donor sites:

- Species, including weeds, occurrence.
- Condition and type of vegetation community.
- Top soil and subsoil type.
- Amelioration rates.

The surveys will aim to identify and manage threat-listed flora within the clearing footprint and reduce the impacts of clearing on native fauna through relocation. Pre-clearing surveys will be undertaken in accordance with the CFMP. They will be undertaken by a suitably qualified ecologist.

Recourse recovery inspections will be undertaken during clearing to ensure available seed, topsoil, mulch and habitat logs are salvaged for use in the rehabilitation of disturbed areas, in accordance with the Clearing and Fauna Management Procedure (BMP Appendix B) and the SMP. These surveys will be undertaken by a suitably qualified ecologist.

The progress and effects of salvaging and reusing habitat resources will be monitored and reported annually in the Annual Review.

8.3.6 Soil management

The appropriate management of topsoil resources is a fundamental component of rehabilitation success. The management of topsoil resources is described in detail in the SMP and summarised in the following subsections.

The Soil Test and Inspection Plan contained in the SMP sets out the testing, witness and hold points requirements for each step of the soil management process.

Characteristics of emplacement and cover material

Some site soils and mine spoils are generally poor, have low organic carbon, are sodic and are dispersive. Soil testing will be undertaken to determine amelioration requirements and rates. Characterisation of topsoil, subsoil and spoil for erosion (primarily dispersion) and agronomic (pH, EC, CEC, OC, metals) parameters will be undertaken prior to stripping (topsoil and subsoil) and prior to respreading (spoil). Sampling will determine if the topsoil, subsoil and spoil is suitable for reuse or if it requires amelioration or selective handling and placement. Unsuitable subsoil and spoil parameters are shown below in Table 8-4.

Table 8-4 Unsuitable subsoil and spoil parameters

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

Following characterisation the suitable and unsuitable material will be able to be identified visually. If not able to be ameliorated, unsuitable spoil and subsoil will be capped with a minimum of 1.0 m of suitable spoil (compacted depth) or, more appropriately, capped to a depth greater than the minimum rooting depth of the vegetation. Capping spoil will need to be ameliorated and contour ripped prior to the placement of the ameliorated topsoil.

Ameliorants will be mixed in with the topsoil (when required) as part of the stripping operation, irrespective if the topsoil is to be placed in storage or directly applied to a rehabilitation area. Application of ameliorates as part of the topsoil stripping process is more cost effective, and also gives the ameliorants additional time to react and modify the soil and to assist in the maintenance of soil conditions suitable for plant development.

Mine soil and spoils will typically be ameliorated with agricultural gypsum to treat dispersion, and improve the calcium to magnesium ratio, structure, water holding capacity, compost to increase organic carbon levels (mulch can be used but is less desirable), water holding capacity, soil biota, fertiliser to improve nutrients levels and wetting agents for hydro-phobicity.

Where topsoil is unavailable or of insufficient quality, mine spoil may be ameliorated to form a suitable growing media.

Topsoil stripping and handling

BCOPL will mine through vegetation communities which are part of the Leard State Forest. Translocation of the topsoil and vegetative material containing an appropriate seed bank, plant nutrients and organic carbon sources will be used to rehabilitate areas to assist in the recreation of Box-Gum Woodland understorey. The appropriate management of this topsoil resource is a fundamental component of rehabilitation success.

Soil sampling will be undertaken to:

- Identify the soil resource prior to stripping.
- Assist with the preparation of a soil balance or inventory to assist with rehabilitation planning.
- Determine if the soil requires amelioration to ensure the soils' characteristics are within recommended ranges.

The process of soil stripping will also involve the continual evaluation of soil throughout the depths of the profile as areas and layers are exposed. Current topsoil reuse and stockpile management at BCM illustrates forest topsoil contains large amount of stored seeds. This an important reserve of indigenous plant seeds and soil micro flora, which will assist with the preservation of local genetic material and the reestablishment of a similar range and mix of species of the original vegetation in the rehabilitation area.

Management of soils and stripping depths during this process is dynamic and generally requires soil observations to be made on site on the day topsoil stripping is occurring. This enhances decision making and operational modifications can be adopted to best utilise the available soil resources available.

The depth of topsoil stripping is important for a number of reasons. Most native seeds are concentrated in the first few centimetres of the topsoil (there is no O horizon with these soils). Over-stripping can result in the stored seeds being buried too deep, which will reduce germination. It will be important to monitor topsoil stripping closely to ensure over stripping does not occur.

Topsoil stripped from each vegetation community will be used in areas identified for rehabilitation for the corresponding vegetation community. Where topsoil cannot be used for rehabilitation immediately it will be stockpiled. The following techniques will be used to prevent excessive soil deterioration:

- Topsoil will not be stripped during excessively wet or dry conditions.
- Where practical, stripped material will be placed directly onto reshaped overburden and spread immediately (if mining sequences, equipment scheduling and weather conditions permit) to avoid the requirement for stockpiling.
- As part of the planning process, sufficient area for stockpiling, placement or burial of topsoil will have been identified prior to stripping and these areas will be accessible.
- As part of the planning process, temporary drainage, erosion and sediment control measures will be employed to minimise erosion and pollution of waters if required.
- Grading or pushing soil into windrows with graders or dozers will be undertaken for later collection by front-end loaders/hydraulic excavators and dump trucks.
- Vegetation not salvaged for habitat relocation to rehabilitation areas will be stockpiled, chipped and then managed aerobically to form compost that is to be incorporated into the soil. The salvaging of commercial products (logs, fence posts and fire wood) will only occur if not to the detriment of the soil improved by the process involving wood chip incorporation.
- The vegetation remaining following salvaging of commercial products (logs, fence posts and fire wood) will be collected and stored for placement onto the rehabilitation areas following seeding, or tub ground and managed aerobically to form compost to be incorporated into the soil.
- A record will be kept of the nature and quantities of salvaged bush rocks, timber etc. To ensure the salvage of these items is maximised.
- Where possible, stockpiled material will be located in areas away from drainage lines and drainage will be diverted around stockpiles to prevent erosion.
- Sediment controls will be installed downstream from stockpiles to prevent contamination of clean water.
- More erodible materials will be placed on flatter areas to minimise the potential for erosion.
- The surface of soil stockpiles shall be contour scarified in order to promote infiltration and minimise erosion until vegetation is established.
- The duration of topsoil stockpiling will be minimised, as periods longer than three months may cause structural degradation and death of seeds and micro-organisms.
- Stockpiles will be seeded with cover crops to protect the stockpile from raindrop splash erosion, aerate the soil to reduce anaerobic conditions, enhance organic carbon levels and suppress weeds.
- Topsoil stockpile locations, volumes and date of soil stripping will be recorded a Soil Stripping and Placement Plan, as required by the SMP.

Topsoil spreading

Topsoil will be spread to a minimum depth of 150 mm on all regraded spoil. When required (based on soil sampling results) contour ripping of the topsoil will be undertaken to incorporate gypsum into the mine spoil and to encourage infiltration of water.

The respread topsoil surface will be scarified prior to, or during seeding. Where possible, ripping will be undertaken when the soil is moist and immediately prior to sowing. Contour scarification will

incorporate soil ameliorants into the plant rooting zone (to a depth of 100 mm). Scarification will also increase rainfall infiltration, reduce run-off and provide a micro-habitat allowing plants to germinate and establish.

Topsoil placement inspections will ensure topsoil is applied to the appropriate thickness and slope and in the predetermined location. These surveys will be undertaken by the BCPL Environment Superintendent (or delegate).

Erosion control

Drainage and sediment control structures will be designed in accordance with Table 6.1 of DECC (2008). Where practicable, sediment basins and other water storage devices will not be located on overburden dumps to reduce the potential for tunnel erosion

Erosion control will focus on treating dispersive soils and spoils, providing soil surface cover and minimising concentrated flow conditions. Erosion control works will include:

- Amelioration of dispersive spoil to minimise the risk of rill, gully and tunnel erosion and to allow the infiltration of surface water (reduce the amount and velocity of surface water).
- Contour scarification of compacted surfaces to encourage infiltration and surface roughness.
- Utilisation of cover crops including salt tolerant grasses and legumes to minimise raindrop and sheet erosion of reshaped areas.
- Engineered channel banks, slope drains and energy dissipaters in concentrated flow situations to reduce erosion. Drainage and sediment control structures will be designed in accordance with Table 6.1 of the Blue Book Volume 2E. Sediment Basins and other water storage devices will not be located on overburden dumps to reduce the potential for tunnel erosion.
- In the larger drainage systems such as clean water drains and modified natural drainage systems, redirective erosion control methods such as cross vanes, rock vanes and J-hook vanes will be used to provide channel bed and bank protection.
- Post disturbance regrading will be undertaken to produce slopes, angles and lengths and shapes that are compatible with the proposed land use and not prone to an unacceptable rate of erosion.
- Contoured furrows or contour banks will be constructed at intervals down the slope – to divide a long slope into a series of short slopes preventing runoff from reaching a depth or velocity that would cause erosion.
- Intercepted runoff will be diverted via engineering waterways using erosion blankets, ground-cover vegetation and/or rip rap to safely dispose of runoff down slope.
- Soils will, where possible, be stripped in a slightly moist condition (neither too dry nor wet) thus reducing dust generation and deterioration in topsoil quality.
- Topsoil will be stockpiled only when disturbed areas are not available for immediate rehabilitation.
- Soil stockpiles will be constructed to minimise the stockpile area in a discrete 3 metre high (maximum) pile, with a working face battered down at 30 degrees. Note: temporary stockpiles (less than 12 months) may be established at height greater than 3 metres if sufficient storage space is unavailable.
- Stockpiles will be trimmed, deep ripped to 500 millimetres, immediately sown with native species.
- Stormwater runoff will be diverted around any active or rehabilitated mining areas.

- Seedbed preparation will be undertaken to ensure optimum establishment of growth and vegetation.
- Mounds will be placed every 5 m down the slope for erosion control and moisture retention. Trees will be planted on the upslope side of the mounds.
- Contour cultivation will be undertaken with a tined implement to blend topsoil into the overburden or waste rock in preparation for sowing – this will leave the soil surface in a roughened condition creating a 'key' between the soil and the spoil.
- Preventing vehicles to enter topsoiled rehabilitation areas to prevent damage to vegetation and soil structure.

The management of erosion and sediment control for all mining and associated disturbance is described in detail in the SWMP and CFMP (Appendix B of the BMP).

8.3.7 Revegetation

Domains 1, 6, 7, 8 and 10

The key to successful rehabilitation of native species is the management of the topsoil seed resource. Where practicable topsoil will aim to be reused to rehabilitate areas with corresponding vegetation communities. Where direct placement is possible or the age of the stockpile is such that it contains limited viable seed resources, direct seeding will be undertaken where required to supplement the in-situ seed resources.

Where necessary, BCOPL supplements natural regeneration with tube stock planting. Seedlings are supplied from a reputable nursery to provide a mature tree density of 150 to 300 trees per hectare. The seedlings are propagated from seed sourced from the targeted vegetation communities within the local area (refer to section 8.3.7).

The methods used to rehabilitate the BCM will be determined by assessing progress against the completion criteria (Appendix D) and may require a combination of techniques to achieve the final rehabilitation objectives.

The seed mixes for each broad vegetation community types (grassy woodland, shrubby woodland / open forest, and riparian forest) including the threatened Box-Gum woodland community will need to contain species representative of these communities, details of which are provided in Table 8-6.

About 858 ha of shrubby woodland community is proposed to be rehabilitated on the steeper slopes of the final landform. Approximately 500 ha of grassy woodland on the lower slopes and the flat top areas will be rehabilitated and 150 ha of riverine woodland are proposed to be rehabilitated within the existing and proposed drainage lines.

Details of the target vegetation communities for rehabilitation within Domains 1, 6, 7, 8 and 10 are presented in Table 8-5.

Table 8-5 Target vegetation communities within mine disturbance areas

Vegetation community (Secondary Domain)	Revegetation for mine disturbance (ha)
Grassy Woodlands on fertile soils (Domain A)	
White box – white cypress pine grassy woodland	500
Riverine Woodlands on fertile soils (Domain B)	
Yellow Box - Blakely's Red Gum grassy woodland	150

Vegetation community (Secondary Domain)	Revegetation for mine disturbance (ha)
Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland	
Shrubby Woodland/Open Forest on skeletal soils (Domain C)	
Narrow-leaved Ironbark – White Cypress Pine Shrubby Open Forest	858
Total	**1508**

Revegetation works are aimed to be carried out in spring and autumn where practicable, and if needed will also be undertaken throughout the year to establish the vegetation communities. Direct seeding is aimed to be undertaken to establish groundcover vegetation to minimise the potential for soil erosion. Natural seed germination from soil seed bank will also assist with the direct seeding to establish vegetation. In areas of low success rates planting of tube stock may be used to assist in revegetating these areas. Fertilising tube stock will be undertaken at the time of planting.

Watering the rehabilitation areas may be required to assist plant germination in situ and to assist the supplementary stock planted. Watering (if required) will be undertaken in response to the prevailing weather conditions and monitoring of the plants.

Domain 9 haul road and rail spur corridor

The Biodiversity Offset Strategy provides for the restoration of the Regional East-West Wildlife Corridor, which is designed to enhance and link the remnant native vegetation patches within the region. The focus of restoration works will be to increase the current area of vegetation and enhance the existing patches of remnant vegetation with particular emphasis on restoration of the Box-Gum Woodland vegetation community. Within the rail haul corridor (Domain 9) areas adjoining and/or forming part of the identified corridor will be rehabilitated to the adjoining native vegetation.

The following are the general principles and strategies for the rehabilitation works within the corridor (Domain 9):

- Restoration works will aim to target derived native grassland where natural recruitment will likely be high.
- The vegetation types to be restored will aim to reflect the adjoining vegetation types occurring in the locality and on the appropriate soil types, particular emphasis will be placed on restoring the threatened Box-Gum Woodland.
- For non-infrastructure areas within the corridor the proposed restoration works are to generally rely on natural regeneration from the soil seed bank and active weed control, stock will be removed and areas which do not respond to natural regeneration will be supplemented with tube stock plantings and selective direct seeding.
- All propagules used for the restoration works will aim to be sourced from the local area to retain genetic integrity.
- Maintenance activities such as weed control, fencing, and replacement of plantings will aim to be conducted across the offsets over the life of the mine operations.
- Monitoring to detect the success/failure of the restoration works will aim to be undertaken within the biodiversity offset over the life of the mine.

Revegetation methods

The timing of rehabilitation works to achieve adequate vegetative contact cover prior to the commencement of the period of maximum erosion hazard is critical for reducing erosion during the establishment phase.

Rehabilitation works are undertaken throughout the year when land becomes available. Revegetation works aim to be completed prior to the spring/summer storm season to minimise the potential for erosion.

Where it is not practicable to complete native revegetation works, interim rehabilitation works such as temporary seeding with cover crops or the application of soil polymers may be undertaken to minimise soil erosion and degradation, and dust generation.

The timing of rehabilitation works to achieve adequate vegetative contact cover prior to the commencement of the period of maximum erosion hazard is critical for reducing erosion during the establishment phase. Rehabilitation works will aim to be completed by early September each year to allow sufficient time for appropriate levels of vegetation to establish before the period of high erosion hazard from December to February.

Topsoil will be reused to rehabilitate areas with corresponding vegetation communities. Topsoil from a corresponding vegetation community will be used in these Domains to utilise the stored seed in the topsoil.

BCOPL has demonstrated native vegetation can establish from the seed resources contained within the topsoil. This is demonstrated by the high level of diversity observed in rehabilitation trials to date (refer to Section 9.2).

BCOPL supplements natural regeneration with tube stock planting with seedlings supplied from the local Forests NSW nursery to provide a mature tree density of 150 to 300 trees per hectare. Seed is sourced on site.

Given the nature and scale of proposed future rehabilitation activities it will be necessary to consider direct seeding techniques, but not necessarily during the term of this MOP. Direct seeding trials will be undertaken to determine the optimum method for vegetation establishment. A combination of all three techniques is likely to be used.

The seed mixes for each of broad vegetation community types (grassy woodland, shrubby woodland/open forest, and riparian forest) including the Threatened Box-Gum woodland community will need to contain species which are representative of these communities, details of which are provided in the BMP.

In terms of native vegetation establishment, revegetation works will involve direct native seeding and/or supplementary tube stock planting. Revegetation works are best carried out in spring and autumn, when conditions are optimal. In the first instance groundcover vegetation should be established to prevent raindrop and sheet erosion from occurring. Natural seed germination from the soil seed bank will be assisted with direct seeding and where applicable seed will be treated to enhance germination rates. Planting of tubestock will supplement areas of low success rates from the natural regeneration through the seed bank and direct seeding.

Watering of the rehabilitation areas may be required to assist the germination of the plants in situ and to assist the supplementary stock planted. Watering (if required) will be undertaken in response to the prevailing weather conditions and monitoring of the plants.

Fertilising of tube stock will be undertaken at the time of planting by adding 100 g of DAP (di-ammonium phosphate) under the soil surface within 250 mm of the tube stock.

Seed collection

Seed collection is a rehabilitation technique undertaken prior to clearing of any native vegetation. Native seed collection will be undertaken to provide local provenance seed for direct broadcasting and raising of seedlings for planting. Seed collection will be undertaken throughout the mine lease and local areas consistent with the BMP.

Revegetation species

The revegetation works will aim to establish three broad native vegetation classes which existed at the BCM pre mining, including the threatened Box-Gum woodland community. In addition to the existing native vegetation types the species and habitat characteristics of derived native grassland community are also provided for the purpose of native pasture revegetation.

A summary of the indicative species and structures of these four broad vegetation types is provided in Table 8-6.

Table 8-6 Secondary domain structures

Vegetation type	Grassy Woodland on fertile soils (Box Gum Woodland)	Riverine Woodland	Shrubby Woodland/Open Forest on skeletal soils	Derived native grassland for pasture
Secondary Domain title	**A**	**B**	**C**	**D**
Photo				
Canopy	To 20 m in height and 15-30% cover dominated by *E. albens* with a sub-canopy of *Callitris glaucophylla.*	To 25 m in height and 25-35% cover dominated by *E. blakelyi* and occasional *E. melliodora.*	To 20 m in height and 30-65% cover dominated by *E. crebra, E. dwyeri, E. albens, E. melanophloia* and *Notelaea macrocarpa.*	Isolated paddock trees (<5% cover) of *Eucalyptus populnea subsp. bimbil* and *E. albens*.
Shrub layer	Generally sparse, however contains *Dodonaea* spp., *Cassinia* spp., and *Acacia* spp.	Moderately dense (20-30%) *cover containing Dodonaea* spp., and *Acacia deanei.*	Moderately dense (>30%) *cover containing Notelaea macrocarpa, Bursaria spinosa, Dodonaea* spp., *Cassinia* spp., and *Acacia* spp.	Generally sparse, however contains *Dodonaea* spp., *Cassinia* spp., and *Acacia* spp.

Vegetation type	Grassy Woodland on fertile soils (Box Gum Woodland)	Riverine Woodland	Shrubby Woodland/Open Forest on skeletal soils	Derived native grassland for pasture
Secondary Domain title	**A**	**B**	**C**	**D**
Ground layer	A diverse range of grasses forbs and sedges with >75% cover including; *Cyperus gracilis, Aristida ramosa, Cymbopogon refractus* and *Austrostipa scabra.*	A diverse range of grasses, forbs and sedges with 30-50% cover including; *Chloris truncata, Bothriochloa macra, Lomandra longifolia* and *Austrostipa verticillata.*	A diverse range of grasses forbs and sedges with 30-50% cover including; *Aristida ramosa, Austrodanthonia racemosa, Cheilanthes distans* and *Rostellularia adscendens.*	A diverse range of grasses, forbs and sedges with >75% cover including*: Enchylaena tomentosa, Einadia nutans subsp. linifolia, Aristida ramosa, Calotis cuneifolia Austrostipa scabra* subsp. *scabra, Austrostipa verticillata, Bothriochloa macra, Calotis cuneifolia, Vittadinia cervicularis* var. *cervicularis*.
Leaf litter	Leaf litter varied across this habitat but was generally 1-2 cm deep with a percent coverage ranging from 30 to 70%.		Leaf litter varied across this habitat but was generally <1 cm deep with a percent coverage ranging from 20 to 40%.	Leaf litter varied across this habitat but contained areas of dense grass clumps with a percent coverage ranging from 30 to 70%.
Fallen timber	A moderate amount of fallen timber was present in this habitat, with sizes ranging from 50 to 300 mm.	A sparse to moderate amount of fallen timber was present in this habitat, with sizes ranging from 50 to 300 mm.	A moderate amount of fallen timber was present in this habitat, with sizes ranging from 50 to 300 mm.	Generally absent.
Tree hollows and stags	Numerous small (<5-10 cm diameter), medium sized (10-20 cm diameter) and large sized (20->30 cm diameter) tree hollows were recorded within this habitat A sparse number of hollow-bearing stags were recorded within this habitat.	Numerous small (<5-10 cm diameter), medium sized (10-20 cm diameter) and large sized (20->30 cm diameter) tree hollows were recorded within this habitat.	Numerous small (<5-10 cm diameter) and medium sized (10-20 cm diameter) tree hollows were recorded within this habitat. Large tree hollows (20->30 cm diameter) were sparse except for survey site S9, which recorded 9. A sparse number of hollow-bearing stags were recorded within this habitat.	Generally absent

Habitat establishment

Rehabilitation of the BCM will require the provision of significant fauna habitat resources to encourage fauna use and functioning of the natural ecosystem representative of the analogue site. Concurrent with vegetation clearing, habitat logs will be collected and stockpiled for placement in rehabilitation areas in accordance with the CFMP (Appendix B of the BMP). Quantitative surveys of habitat resources within the clearing footprint will allow a comparison between the extent of existing and salvaged habitat features.

The following data will be recorded on the Clearing Extent and Site Feature Checklist as described in the BMP:

- Hollow-bearing trees.
- Abundance of hollows, categorised by size.
- Bush rocks (m^2).
- Fallen timber (m) – at least 5cm DBH and 1 m long.

Materials salvaged during construction, such as hollow bearing trees or stags will be used as part of the rehabilitation in a manner which does not place fauna in danger of injury (i.e. hollow bearing trees/stags should not be placed next to the haulage route). The progress and effects of salvaging and reusing habitat resources will be monitored as part of the Project's biodiversity monitoring program and reported annually in the Annual Review.

8.4 Summary of rehabilitation areas during the MOP term

Table 8-7 provides details of areas that will be rehabilitated during the MOP term. Rehabilitation will not be undertaken in some domains, such as Domain 6 – Administration buildings, car parks and access roads, until closure.

Table 8-7 Rehabilitation summary table

Domains	Total area at MOP commencement (ha)	Total area affected/rehabilitated at MOP completion (ha)
Domain 1 – Overburden emplacement areas		
Active	329.0 (a portion of this is landform establishment)	402.4 (a portion of this is landform establishment)
Decommissioning	n/a	n/a
Landform establishment	see above	see above
Domain 2 – Active mining areas		
Active	411.0	270.8
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 3 – Rehabilitation		
Short-term rehabilitation	n/a	n/a
Growth medium development	n/a	n/a
Ecosystem establishment	263.7 (a portion of this is ecosystem development)	523.0 (a portion of this is ecosystem development)
Ecosystem development	see above	see above
Functioning regional wildlife corridor	n/a	n/a

Domains	Total area at MOP commencement (ha)	Total area affected/rehabilitated at MOP completion (ha)
Domain 4 – Clean water management systems		
Active	2.2	2.2
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 5 – Dirty/contaminated water management systems		
Active	34.6	31.4
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 6 – Administration buildings, car parks, access roads		
Active	19.5	19.5
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 7 – Potentially contaminated areas		
Active	6.6	6.6
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 8 – Coal handling areas		
Active	150.8	133.2
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 9 – Haul road, buffer zones and hardstand areas		
Active	111.8	105.6
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a
Domain 10 – Stockpiled material		
Active	92.0	71.0
Decommissioning	n/a	n/a
Landform establishment	n/a	n/a

8.5 Relinquishment phase achieved during MOP term

No areas within the project boundary will be available for relinquishment at the completion of the MOP term.

9. Rehabilitation monitoring and research

9.1 Rehabilitation monitoring

Monitoring of rehabilitation areas and analogue sites will be undertaken by specialist independent consultants on an annual basis using a modified Landscape Function Analysis and include factors such as:

- Cover abundance of each species.
- Overall cover abundance of each stratum.
- Condition of vegetation.
- Soil stability.
- Soil moisture.
- Colonisation of rehabilitated areas with fauna.
- Stems per hectare of commercial forestry crops.
- Vegetation – species and weed diversity.
- Birds – species diversity and numbers.
- Bats – species diversity and numbers.
- Invertebrates – species diversity (Berger-Parker index).
- Other factors considered beneficial as a result of the research undertaken on the trial plots.

It is well documented that natural systems experience significant natural, spatial and temporal variability and, therefore, to be able to detect environment impact associated with anthropogenic disturbance, sampling designs must be capable of accounting for and explaining this variability.

Ecological rehabilitation monitoring will be undertaken at three replicate sites per each stage of rehabilitation on a 1:14000 scale to provide statistically valid data that can be used to guide rehabilitation maintenance activities and to demonstrate rehabilitation success.

The rehabilitation area survey will use a combination of stability and erosion assessments, soil analyses and various measurements of ecosystem diversity and habitat values (as described in the BMP) to assess against benchmark biodiversity data and key indicators of ecosystem function, including landscape organisation and soil surface condition to measure how the landscape retains and uses vital resources.

Individual observations of soil surface indicators allow an assessment of how the site is functioning in relation to the indices of stability, infiltration and nutrient cycling. Soil condition can also be compared directly with vegetation data to show a cause and effect understanding of the whole site.

Between two and six transects will be surveyed for each rehabilitated vegetation type site to account for the size of the rehabilitated vegetation community areas and slope variations. Sites will be surveyed yearly for the first five years with the frequency of surveys at each site to be reassessed following this period.

Two monitoring sites within rehabilitated areas have been monitored yearly for surveying flora, vertebrates and invertebrates as described above. Additional surveys will be undertaken with the next annual survey and additional rehabilitation survey sites will be added, based on progressive rehabilitation areas described in the MOP.

Soil testing and erosion monitoring will also be undertaken to assess the presence of active erosion and dispersive soil and spoil. The results of this testing will be used for comparison with domain completion criteria.

Flora, vertebrate and invertebrate monitoring described in the BMP will be used to determine progress towards, or achievement of the completion criteria, averaged data from each stratification within the monitoring sites will be compared with the averaged benchmark data (Table 9.4 of the BMP).

The results of the rehabilitation monitoring will be incorporated into continuously developing the species list and procedures for rehabilitation.

As a minimum, the long term rehabilitation monitoring program will allow for adaptive management by reviewing substandard performance from a rehabilitation area and evaluating the probability of an event occurring; evaluating the consequence; and using a risk based approach to determine trigger levels (both upper and lower) where response or action is required. A TARP will be implemented to respond in the event of poor rehabilitation performance or unexpected result (refer to section 10.1.1).

A summary of the monitoring results will be reported annually in the Annual Review.

9.2 Research and rehabilitation trials and use of analogue sites

Monitoring of flora and fauna communities within and beyond the surrounding Leard State Forest (analogist sites beyond the CL368 boundaries) is currently being conducted as part of the ongoing biodiversity monitoring program for the BCM. This monitoring program will continue and should be undertaken to provide comparative data for assessment of the success of the rehabilitation works. The analogue monitoring program will be updated to incorporate soil parameters to be measured. The findings of this work will drive the development of soil-based closure criteria. Soil monitoring at analogue sites will also be undertaken.

The data obtained from the analogue sites will provide a range of values from replicated examples of similar vegetation communities. Rehabilitation areas are compared to reference sites which best represent the final land use, vegetation community and management conditions to which they will be subjected.

These analogue sites will also provide detailed information on fauna assemblage (birds, bats and invertebrates), their habitats and utilisation within both the eastern and western portions of Leard State Forest. The analogue sites will allow rehabilitation monitoring to determine the successful establishment of fauna assemblages within the rehabilitation areas, their distribution across the rehabilitation areas and relative success of the proposed regional wildlife corridor identified within the BCOPL Biodiversity Offset Strategy (Parsons Brinckerhoff, 2010a).

In order to demonstrate rehabilitation success or succession toward rehabilitation success, specific indicators will be expected to equal or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend towards target values. Criteria will also be set for stages of rehabilitation to show progression towards rehabilitation success.

The rehabilitation monitoring program and reference sites has been expanded to include grassland areas. Domains 2 and 3 have a grazing post mining land use. Grazing rehabilitation assessments consider agricultural productivity parameters together with establishment of appropriate pasture species criteria.

The monitoring uses a combination of Landscape Function Analysis, soil analyses and various measurements of ecosystem diversity and habitat values (adapted from CSIRO Gibbons 2002) to assess key indicators of ecosystem function, including landscape organisation and soil surface condition as a measure of how well the landscape retains and uses vital resources.

In order to receive closure sign-off of rehabilitation, it will be necessary to demonstrate that the selected indicators (or criteria) have reached their established completion criteria or a satisfactory successional trajectory has been established which will result in a self-sustainable ecosystem. This approach can be broken down into five major stages of ecosystem development as demonstrated below, by which a set of indicators or criteria will need to be monitored and either be equivalent to or exceed those assessed for the reference sites.

1. Landform establishment
2. Growth medium development
3. Ecosystem establishment
4. Ecosystem development
5. Ecosystem sustainability.

In summary, rehabilitation monitoring will:

- Obtain data from reference sites to provide a range of values from replicated examples of similar vegetation communities.
- Compare rehabilitation areas to reference sites to best represent the final land use vegetation community and management conditions.
- Recognise the dynamic nature of ecosystems and be monitored simultaneously to the reference sites over time to account for changes in:
  - Seasonal variations.
  - Climatic conditions.
  - Management practices.
  - Unexpected disturbance events.

9.2.1 Rehabilitation trials

Rehabilitation trials have been undertaken to optimise rehabilitation techniques. These include assessments of fertilisers, plant species, water retention, runoff, optimal planting times, quality and quantity of topsoil and ripping mounding techniques (Boden and Associates, 2011). While the initial rehabilitation trials focused on the restoration of optimal commercial timbers for forestry, the current and future rehabilitation will be principally targeting biodiversity conservation and restoration of the Threatened Box Gum Woodland community and habitats for Threatened species.

Areas which have previously been rehabilitated are described below. Rehabilitation trials have been planted in 2008, 2009, 2010 and 2011 as follows:

- 2008 Species Trial – Three trial areas the Upper south, Upper west and Lower south trial areas, each comprising 15 species. The trials were used to test the interactions between the two aspects southerly (cool) and westerly (warm) and position in the slope.
- 2009 Plantings – A total of nine hectares were planted in April 2009. Three local species *E. crebra, E. pilligaensis and E. albens* were planted randomly within each plant line.
- 2010 Plantings – A further 8 hectares were planted in April 2010. Three local species i.e. *E. albens, E. crebra and E. pilligaensis* were planted separately in blocks each of two rows. A fertiliser trial was established in these plantings to quantify the response to various dosages of the MAP fertiliser.
- 2011 Plantings – A total was 15 hectares were planted in May-June 2011. Three local species i.e. *E. albens, E. crebra and E. pilligaensis* were planted separately in blocks each of two rows.

Ongoing rehabilitation inspections indicate that the previous rehabilitation plantings are largely reflective of a transition vegetation community within existing analogue sites of the undisturbed Lead State Forest and that they will be compatible with the proposed rehabilitation.

In general, observations of the natural regeneration within the rehabilitation area reveal a healthy development of native flora species germinating from topsoil (Boden & Associates 2011; Parsons Brinckerhoff 2011). Recent biodiversity monitoring (Parsons Brinckerhoff, 2015) indicates that vegetation within the rehabilitation area has a moderate to high diversity of native species, with approximately 69% of the flora species occurring at the analog site within the Leard State Forest having also been found within the rehabilitation monitoring plots. The diversity of native flora species has generally increased over time. All of the monitoring plots have a relatively high number of species that are characteristic of the critically endangered community of White Box Yellow Box Blakely's Red Gum Grassy Woodland and derived native grassland as listed under the EPBC Act.

9.2.2 Growth Medium Suitability

In early 2016, BCOPL commissioned a preliminary evaluation of growth media within the 2008 to 2014 rehabilitation areas (Landloch, 2016). The assessment was conducted in accordance with the procedure detailed in the SMP. Samples were subject to soil surface descriptions, morphological descriptions, field tests and laboratory analysis.

The analysis concluded that there were no major limitations to plant growth. In general terms, the growth media were considered adequate to support vegetation and are clearly able to support the growth of tubestock planted.

Nutritional differences in topsoil materials between rehabilitation sites and analogue sites were identified, however it was noted that these could be easily rectified with fertiliser application. Erosion was also noted across rehabilitation areas which may be improved through incorporation of gypsum. Overburden substrate alkalinity was observed to be high but did not appear to be impacting growth of seedlings. It was recommended that further analysis be undertaken and growth media criteria be revised. Further routine monitoring will be undertaken during the MOP term. The growth media criteria have been revised in the SMP, which forms Appendix H of the approved BMP dated October, 2018.

10. Intervention and adaptive management

Outcomes of the annual rehabilitation monitoring will be recorded and any mitigation actions implemented as required. Where necessary, rehabilitation procedures will be amended accordingly with the aim to continually improve rehabilitation standards.

The monitoring program will:

- Compare results against rehabilitation objectives and targets (analogue sites).
- Identify possible trends and continuous improvement.
- Link to records of rehabilitation to determine causes and explain results.
- Assess effectiveness of environment controls implemented.
- Where required, identify modifications required for the monitoring program, rehabilitation practices or areas requiring research.
- Compare flora species present against original seed mix and/or analogue sites.
- Assess vegetation health.
- Assess vegetation structure (i.e. upper, mid and lower storey).
- Where applicable, assess native fauna species diversity and the effectiveness of habitat creation for target fauna species.

If rehabilitation failure has occurred further investigation to establish a cause and appropriate remediation strategy(s) will be undertaken. The issues to consider will include the following:

- Nutrient availability.
- pH, salinity and metal toxicity.
- Shallow root depth.
- Other soil limitations.
- Insect attack.
- Lack of N-fixing legumes.
- Lack of organisms involved in litter breakdown (i.e. fungal fruiting bodies) and nutrient cycling (i.e. puff balls).
- Excessive grazing.
- Predation.
- Evidence of drought effects or storm damage.
- Poor soil preparation.
- Weed competition.

As a minimum, the long term rehabilitation monitoring program will allow for adaptive management by reviewing substandard performance from a rehabilitation area and evaluate the probability of an event occurring; evaluating the consequence; and using a risk-based approach to determine trigger levels (both upper and lower) where response or action is required. A TARP will be implemented to respond in the event of poor rehabilitation performance or an unexpected result (refer to Section 10.1.1).

10.1 Threats to rehabilitation

Specific risks associated with rehabilitation activities were identified during the MOP risk assessment. Each of the extreme and high risks identified in the rehabilitation risk assessment process have been addressed. A summary of triggers and actions that will be implemented to address these risk is provided in Table 10-1.

Table 10-1 Rehabilitation risks, triggers and mitigation measures

Issue/Risk	Trigger	Summary of mitigation measures
Off-site release of contaminants from mined materials requiring long-term management or treatment	Data obtained from compliance monitoring program indicates exceedance	▪ Management of surface water in accordance with the SWMP ▪ Water monitoring program ▪ Water Quality Monitoring and Reporting protocol ▪ Coordinated approach to water management ▪ Rehabilitation methodology (section 8.3) ▪ Conceptual Landform Interim Report ▪ Rehabilitation TARP
Inadequate or insufficient landform shaping to achieve a free draining surface	Identification of ponding areas during daily inspections of surface positioning	▪ Rehabilitation methodology ▪ Conceptual Landform Interim Report ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP (section 0)
Inadequate or insufficient topsoil to create/enhance the desired ecological communities	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity/distribution Soil analysis indicates soil parameters are not compatible to post mining vegetation community	▪ SMP ▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP
Failure to achieve a stable drainage system/landform	Monitoring or vegetation assessments indicate poor vegetation cover or soil instability	▪ Rehabilitation methodology (section 8.3) ▪ Conceptual Landform Interim Report ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP ▪ Maintenance and contingency measures (section 10.1.1)
Impact of weeds and/or invertebrate pest animal leading to wide spread failure of revegetation ecosystems	Monitoring and vegetation assessments identify increased weed competition or degradation by pest animal species	▪ Management of weeds and pest animals in accordance with the BMP ▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP
Poor vegetation establishment success	Monitoring data indicates non-conformance with compliance criteria in terms of landscape function, biodiversity and pasture productivity.	▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Maintenance and contingency measures (section 10.1.1)
Asset Protection Zone (APZ) is not maintained in context of bushfire risk	Site assessment of APZ shows unacceptable fuel levels	▪ Management of bushfire through BMP. ▪ Active encouragement of staff involvement with the Rural Fire Services
Major storm event resulting in flooding, geotechnical instability, major erosion and/or widespread damage to rehabilitation areas	Weather warnings relate to severe storms and localised flooding Monitoring program indicates lack of appropriate ground cover	▪ SMP ▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP
Severe or prolonged drought leading to widespread failure of revegetation	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity/distribution	▪ SMP ▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP

Issue/Risk	Trigger	Summary of mitigation measures
Changing climate leading to failure of rehabilitation, failure of environmental management controls and/or inability to attain completion criteria	Monitoring and vegetation assessments highlight inadequate ground cover and or paucity in species diversity/distribution Soil analysis indicates soil parameters are not compatible to post mining vegetation community	▪ Regular consultation with regulators ▪ Rehabilitation methodology (section 8.3) ▪ Rehabilitation monitoring (section 9) ▪ Rehabilitation TARP
New regulatory requirements or evolving community expectations leading to difficulties negotiating or attaining completion criteria	Changing regulatory expectation, legislation and/or requirements	▪ Regular consultation with regulators and CCC. ▪ Review and update of management plans in accordance with Project Approval requirements.

10.1.1 Maintenance/contingency

Maintenance/contingency works in the rehabilitation areas will be completed as required to address any issues of concern or unpredicted impact identified during monitoring.

Maintenance/contingency activities may include a range of activities including:

- Supplementary seeding of vegetated areas.
- Weed and pest control.
- Application of soil ameliorants.
- Repair of any eroded areas.

Supplementary seeding

Direct seeding is aimed to be undertaken to establish groundcover vegetation to minimise the potential for soil erosion. Natural seed germination from soil seed bank will also assist with the direct seeding to establish vegetation. In areas of low success rates planting of tube stock may be used to assist in revegetating these areas.

- Supplementary seed broadcasting may be undertaken in areas where native regeneration is considered insufficient following monitoring, seed for broadcasting will be treated where necessary prior to broadcasting to maximise germination rates.
- Supplementary seed broadcasting will focus on the desired vegetation density and diversity to be established in the rehabilitation areas.

Weeds and pest control

Weed and pest control management is described in the WPMS, which is in Appendix C of the BMP.

Priority weeds within the project boundary will be controlled in accordance with the requirements of the *Biosecurity Act 2015*. The implementation of the monitoring, inspection and reporting program detailed within the BMP will reduce the potential for weed introduction and spread, and allow for monitoring and control. Pest animals will be identified and controlled as part of the monitoring, inspection and reporting program.

BCOPL will aim to minimise the introduction and spread of weed species by complying with the CFMP (outlined within the BMP) during clearing activities, restricting access to areas of native vegetation.

Weed infestations and pest animals may also be identified and reported by all personnel, however the Environment Superintendent is responsible for routine environment inspections and arranging for treatment of weed infestations as per the WPMS or appropriate controls and treatment for pest animals that will be undertaken with reference to the appropriate model codes of practice and standard operating procedures.

Erosion repair

Additional stabilisation works may be undertaken as required and include reshaping, the installation of grade stabilisation structures, and amelioration of dispersive soil, revegetation, fencing and de-silting.

Stabilisation works are inspected annually as part of the annual rehabilitation inspection and where required works will be monitored as part of the formal rehabilitation monitoring program.

Trigger action response plan

If rehabilitation failure has occurred further investigation to establish a cause and appropriate remediation strategy(s) will be undertaken. The rehabilitation monitoring program allows for adaptive management by reviewing substandard performance from a rehabilitation area and evaluate the probability of an event occurring; evaluating the consequence; and using a risk-based approach to determine trigger levels (both upper and lower) where response or action is required.

The TARP provided in Appendix F outlines the management actions to be implemented in the event of poor rehabilitation performance or expected results. The TARP identifies a range of triggers for a number of key rehabilitation activities and provides an action response. The trigger values reflect a trend or change which may affect rehabilitation outcomes and the ability to meet completion criteria for successful rehabilitation.

This TARP will be reviewed and may be revised as conditions at BCM change or new risks to rehabilitation are identified.

11. Reporting

The key mechanism for reporting compliance with the MOP is the Annual Review. Additionally, ad hoc reporting may be undertaken in the event of an environmental incident occurring that is related to mine rehabilitation or other environmental issues discussed in this MOP. Summaries of these two methods of reporting are provided in the following subsections.

11.1 Annual Review

BCOPL prepares and submits an Annual Review which outlines the environmental performance of the project over the preceding 12-month period. Generally the Annual Review must be submitted within 90 days of the end of the reporting period. The Annual Review for BCOPL will discuss rehabilitation management issues and performance for BCOPL and its contractors.

This reporting will include:

- Results of ongoing monitoring.
- A quantitative and qualitative assessment of the rehabilitation progress.
- Identification of and reporting on the progress of non-conformance issues and corrective action requests identified during periodic audits or from community complaints.
- The performance of rehabilitation.
- The implementation and effectiveness of the rehabilitation controls and conditions specifically relating to the development.
- Results against the criteria set out in the rehabilitation tables in Appendix D of this MOP.
- Key trends in monitoring results and progression towards achievement of rehabilitation objectives and completion/relinquishment criteria.
- Reporting on discrepancies between the predicted and actual results.
- Reporting of where a TARP has been implemented to counter poor/unpredicted rehabilitation results or environmental impacts.
- Results of the rehabilitation trials.
- Details of any incidents and non-compliances.

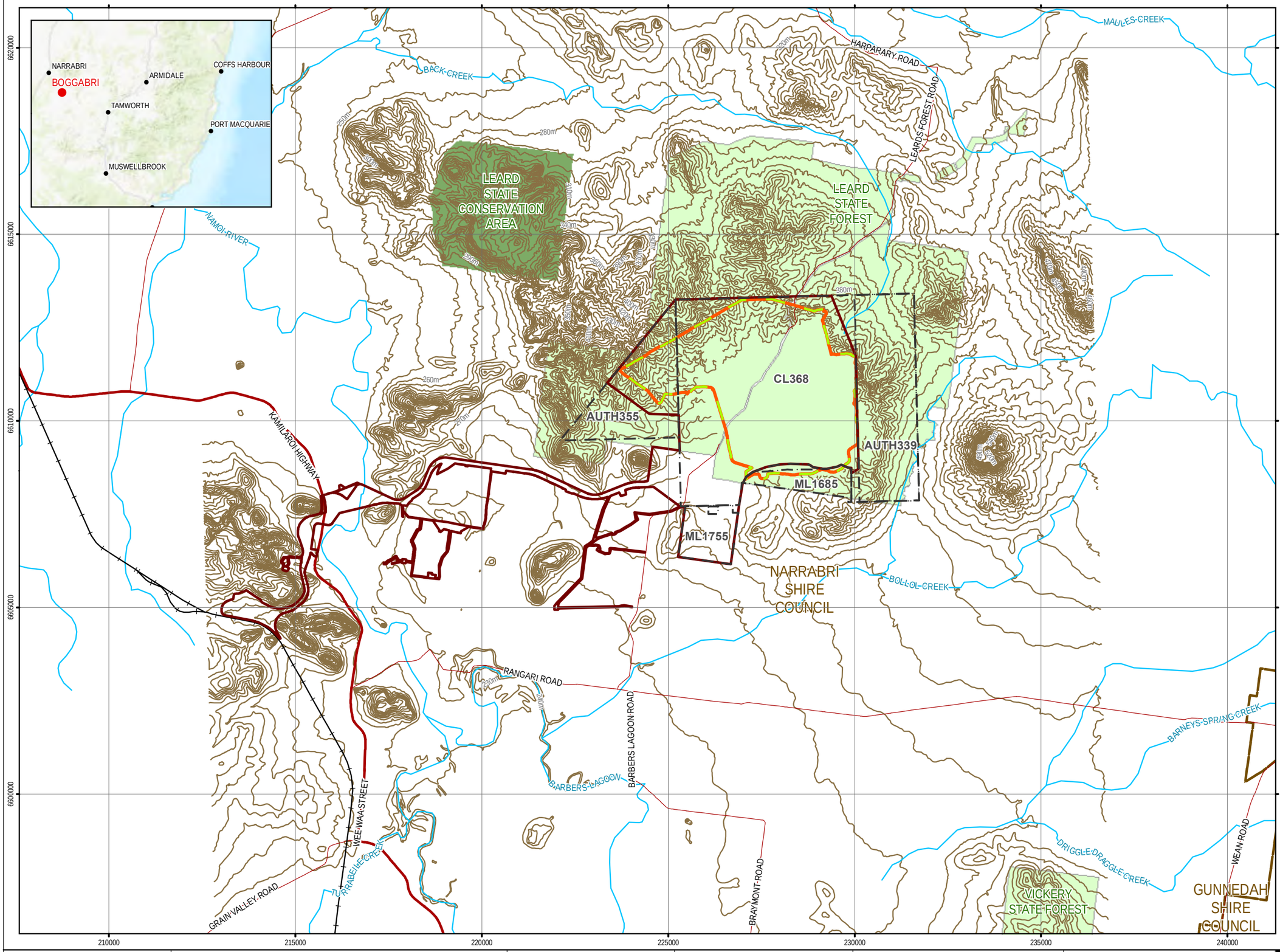
Annual monitoring reports will be made publically available on the BCOPL website (www.idemitsu.com.au/boggabri).

11.2 Environment incident reports

All environment incidents will be managed in accordance with BCOPL's Incident Management Procedure. Reporting of environment incidents by the contractor(s) to the BCOPL Environment Superintendent shall be undertaken as soon as practically possible, but not later than 24 hours following the incident. In accordance with the Project Approval and the EPL, BCOPL is required to provide verbal and written notification to the appropriate regulatory authorities of any incident that has caused, or threatens to cause, material harm to the environment. Relevant contractors will also be notified immediately of any non-compliant activities that present a risk of causing material environmental harm in the area that they are working.

Following an incident, corrective actions will be identified and agreed on with relevant personnel (and regulators if required) prior to implementation. Corrective actions may include a review of any relevant plans and procedures following identification of a non-conformance. Where the non-conformance issue is associated with an inspection, audit or monitoring event, the actions will be linked to the record of the event. Incident reports will be reviewed on a regular basis to ensure actions are progressed appropriately.

12. Plans



- Highway
- Road
- Existing Railway
- Waterway
- 10m contour (AHD)
- Mine tenement
- Project Approval Area
- Federal Approval Limit
- LGA Boundary
- State Conservation Area
- State Forest

0 0.5 1 1.5 2 KM

Scale 1:100,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data Source: LPI 2010 DTDB and DCDB;Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.
MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 10/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.

PLAN NO. 1A

TITLE. PRE-MINING ENVIRONMENT - PROJECT LOCALITY

Boggabri Coal Operations Pty Ltd

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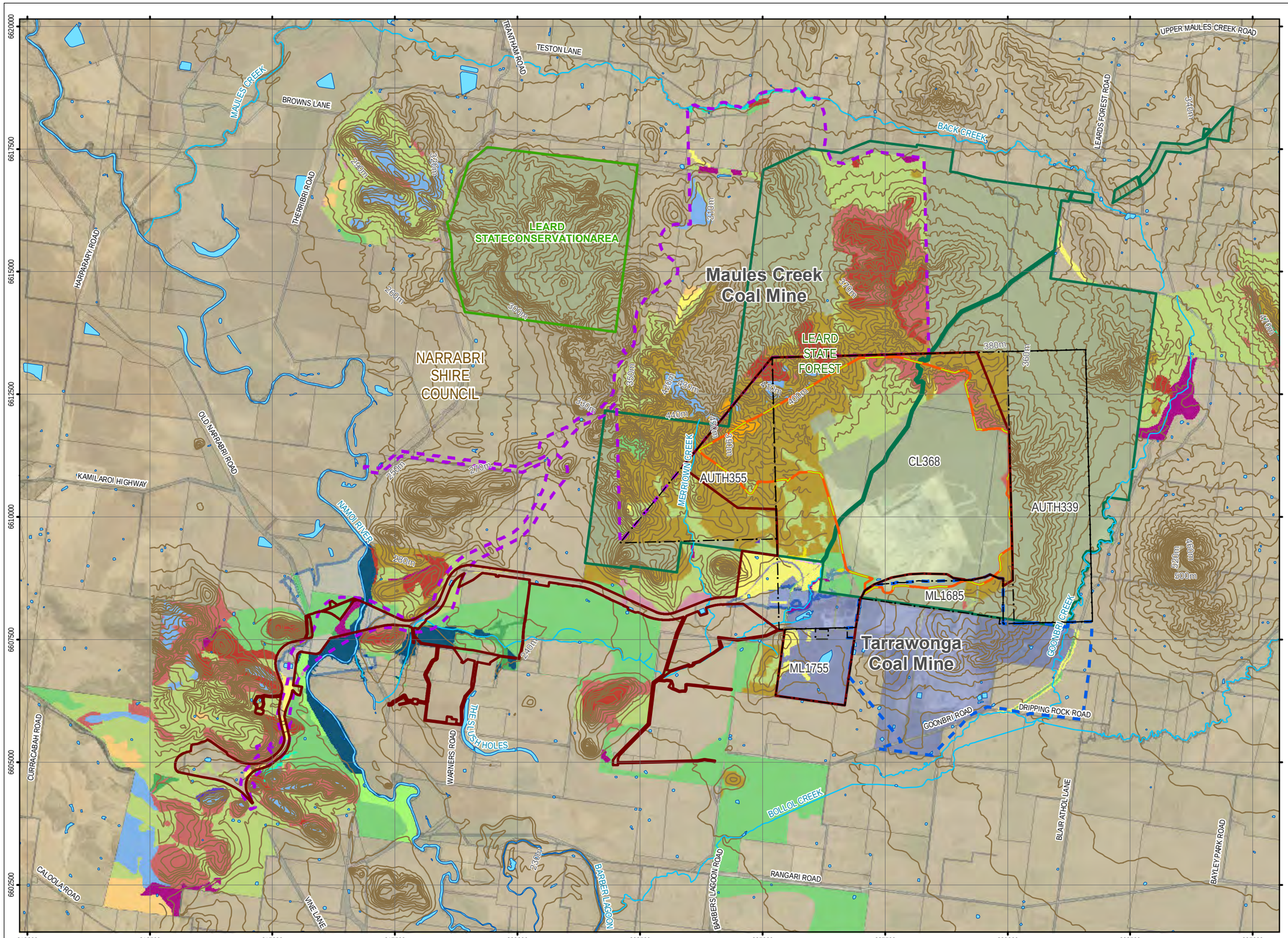

Waterway
Pre-mining Contours (AHD)
Mine tenement
Boggabri Project Approval
Maules Creek Project Approval Area
Tarrawonga mine lease area
Federal Approval
Waterbody
Leard State Forest
Leard State Conservation Area

Native vegetation

- PCT not defined
- PCT102 - Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion
- PCT1118 - Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
- PCT1307 - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
- PCT1313 - White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion
- PCT1329 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion
- PCT1380 - Narrow-leaved Ironbark - pine - Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion
- PCT1381 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion
- PCT1383 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- PCT27 - Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
- PCT438 - River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion
- PCT511 - Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
- PCT55 - Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region
- PCT599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT610 - Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range
- PCT78 - River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- PCT84 - River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions
- PCT88 - Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion

N W E S

0 0.5 1 1.5 2 KM

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Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (2014,2015,2016, 2017),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.	PLAN NO. 1B
MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR	TITLE. PRE-MINING ENVIRONMENT - NATURAL ENVIRONMENT
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 10/12/2019	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.	

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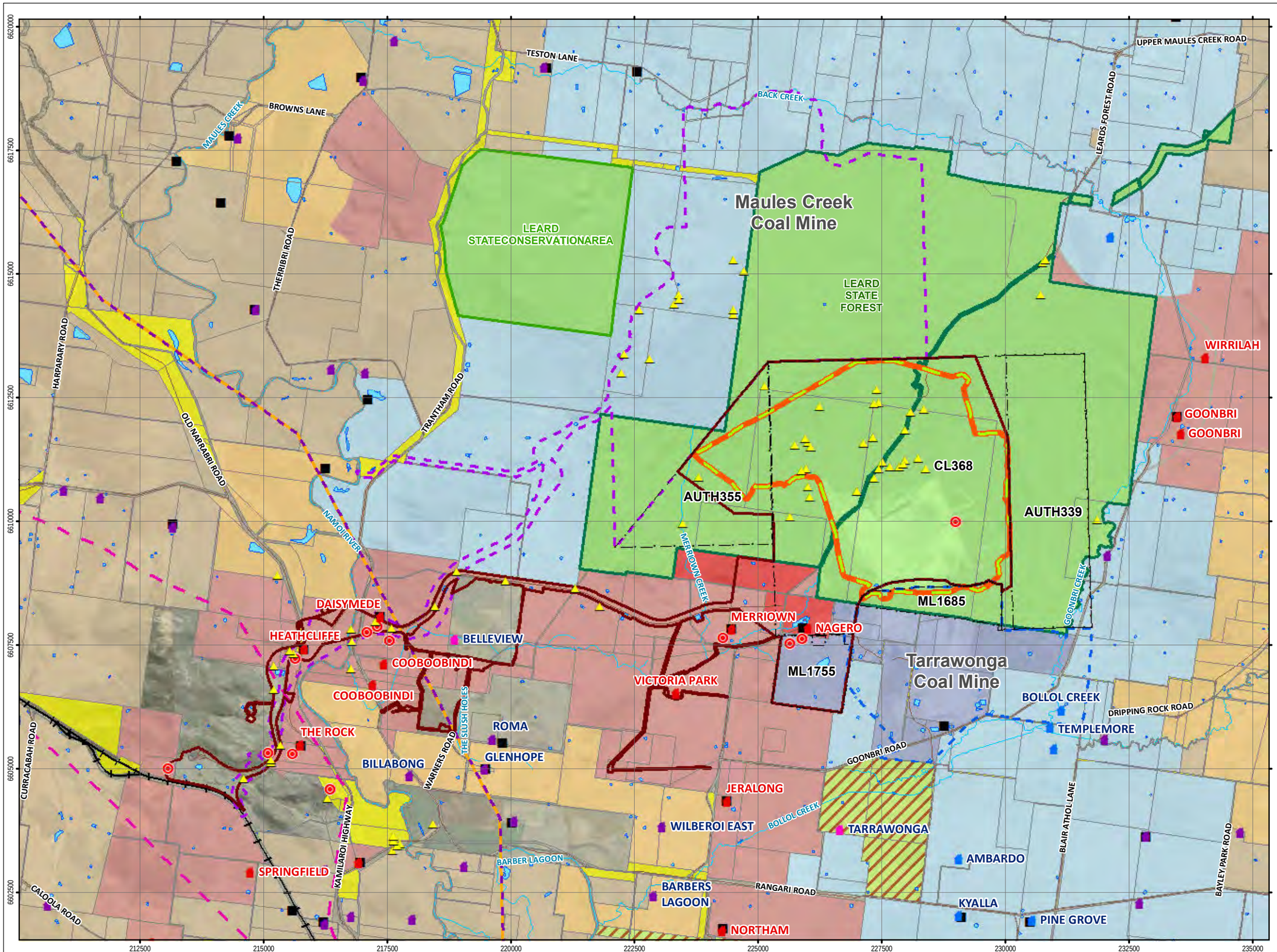

Surrounding residences
- Boggabri Coal owned
- Whitehaven Coal property
- Mine joint owned
- Private

Heritage items
- Cultural heritage item
- European Heritage Item
- Homestead/Community complex

- Existing railway
- Gas pipeline
- Transmission line
- Waterway
- Dam/waterbody
- Mine tenement
- Boggabri Project Approval Area
- Maules Creek Project Approval Area
- Tarrawonga mine lease area
- Federal Approval Limit
- Leard State Forest
- Leard State Conservation Area
- Cadastre

Boggabri owned properties
- Agriculture
- Mining

Whitehaven Coal owned properties
- Agriculture
- Mining

Mine jointly owned properties
- Agriculture

Crown land
- Agriculture

Other properties
- Agriculture (Private ownership)
- Agriculture (unspecified)
- State Forest / Nature Reserve
- Land use/owner unspecified

N W E S

0 0.5 1 1.5 2 KM

Scale 1:75,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (2014,2015,2016,2017),

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MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 10/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.

PLAN NO. 1C

TITLE. PRE-MINING ENVIRONMENT - BUILT ENVIRONMENT

Boggabri Coal Operations Pty Ltd

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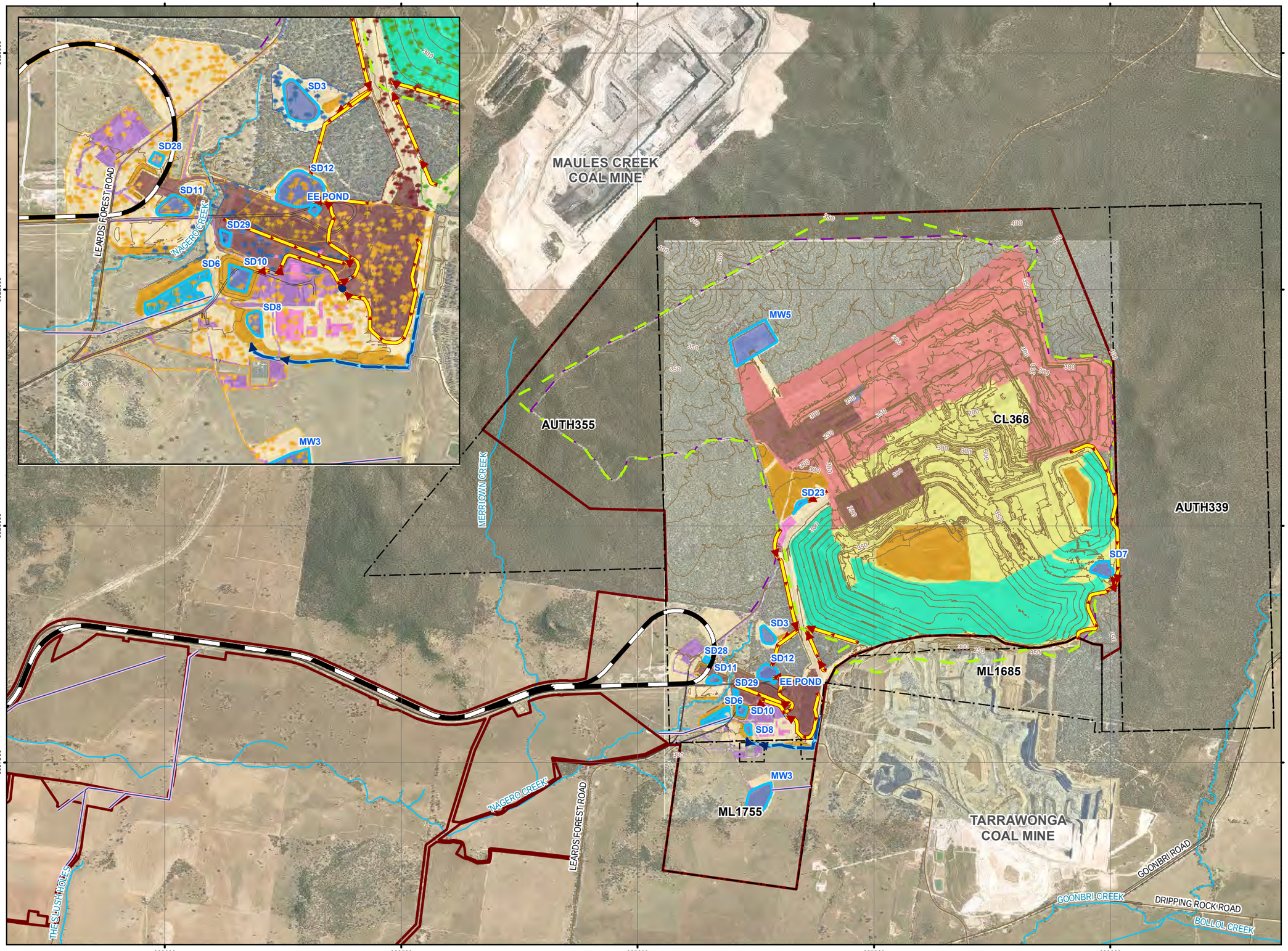

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land
- Water storage
- Rail Loop
- Fence
- Local roads
- Existing pipeline
- Waterway
- Mine tenement
- Project Approval
- Federal Approval Limit

Water management

- Clean water drain
- Dirty water drain
- Culvert
- 10m contour (AHD)

0 0.25 0.5 0.75 1 KM

Scale 1:40,000

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Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

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Imagery source: BCPL (July 2017), BCPL (January 2015),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT.	NAME.	NAME.	PLAN NO. 2
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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 10/12/2019	SIGNATURE.	SIGNATURE.	
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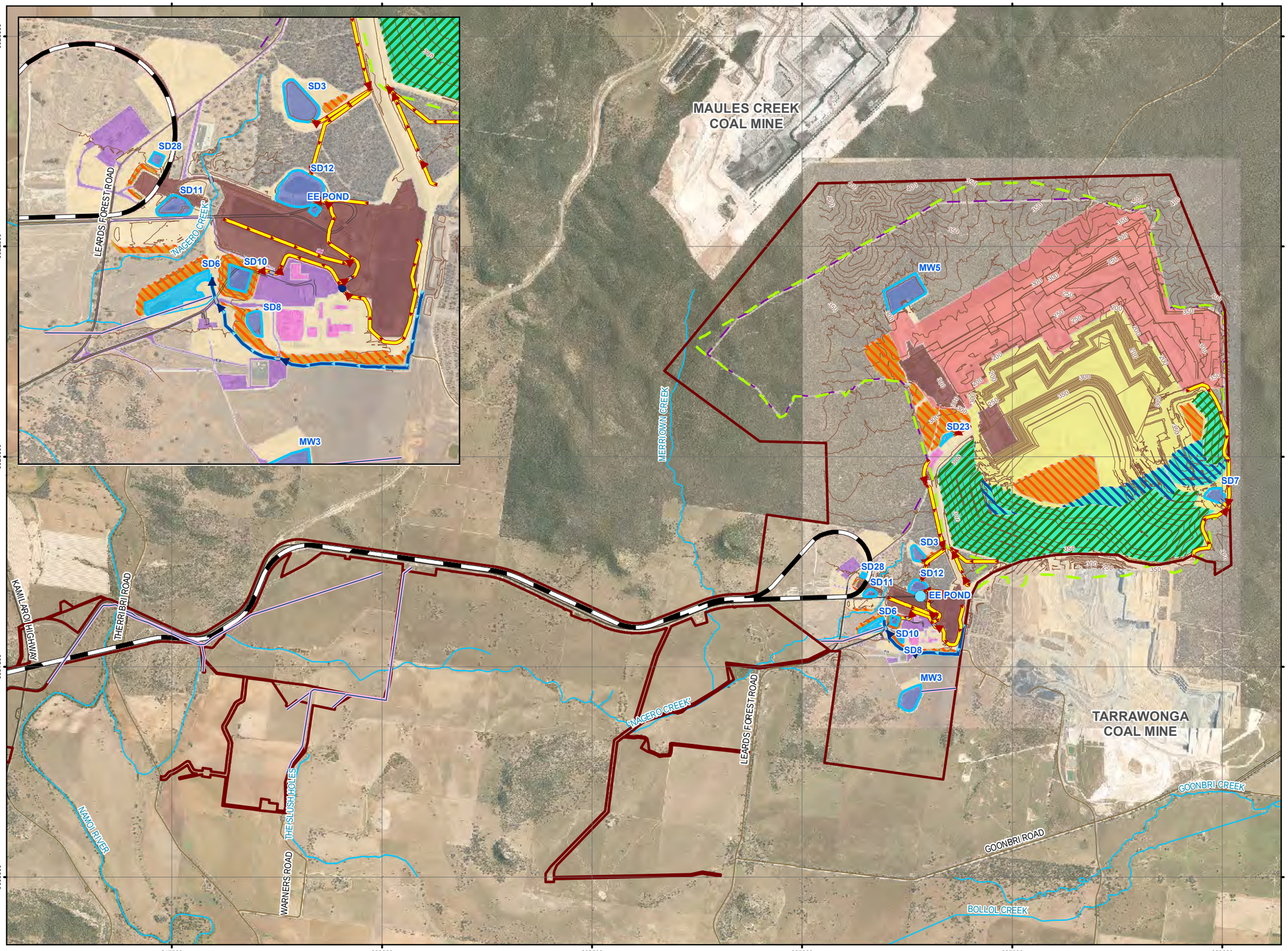

Emergency tailings facility
Water storage
Rail Loop
Fence
Local roads
Waterway
Project Approval
Federal Approval

Water

Clean water drain
Dirty water drain
Culvert
2020 10m contour

Rehabilitation phases

Rehabilitation establishment
Rehabiltation sustainability
Temporay rehabilitation

Primary domains

Active mining area
Overburden emplacement area
Coal handling area
Stockpile material
Rehabilitation
Clean water management system
Dirty/contaminated water management system
Haul road/hardstand area
Adminstration buildings, car parks, access roads
Potential contaminated land

0 0.25 0.5 0.75 1 KM

Scale 1:45,000

Projection: Transverse Mercator
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Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 19/03/2020	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. SuansriR	DATE.	DATE.

PLAN NO. 3A

TITLE. MINING AND REHABILITATION 2020

Boggabri Coal Operations Pty Ltd

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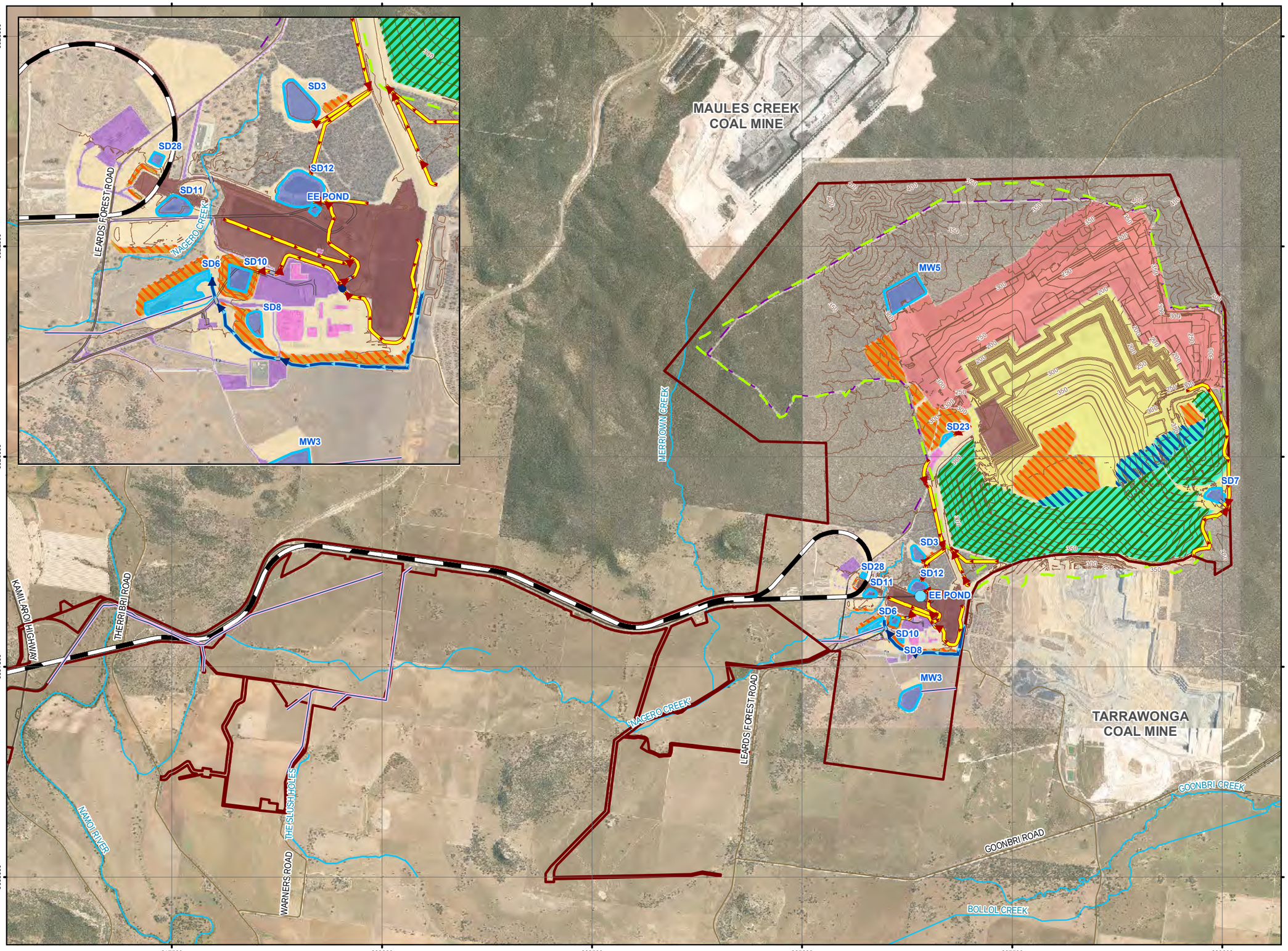

- Emergency tailings facility
- Water storage
- Rail Loop
- Fence
- Local roads
- Waterway
- Project Approval
- Federal Approval
- 2021 10m contour

Rehabilitation phases

- Rehabilitation establishment
- Rehabiltation sustainability
- Temporay rehabilitation

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

0 0.25 0.5 0.75 1 KM

Scale 1:45,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (July 2017), BCPL (January 2015),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT.	NAME.	NAME.
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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 19/03/2020	SIGNATURE.	SIGNATURE.
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PLAN NO. 3B

TITLE. MINING AND REHABILITATION 2021

Boggabri Coal Operations Pty Ltd

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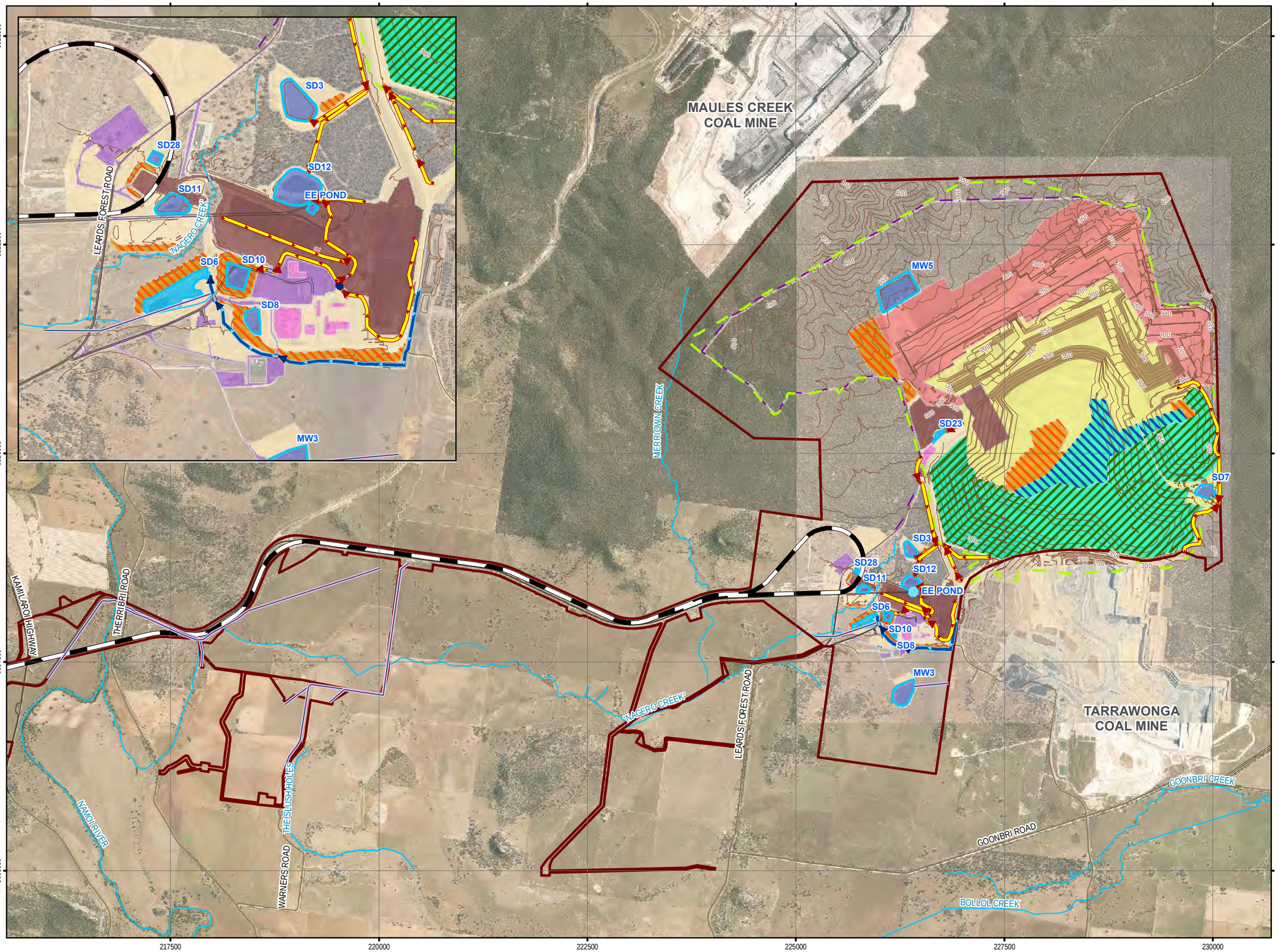

- Water storage
- Emergency tailings facility
- Rail Loop
- Fence
- Local roads
- Waterway
- Project Approval
- Federal Approval
- 2022 10m contour

Rehabilitation phases

- Rehabilitation establishment
- Rehabiltation sustainability
- Temporay rehabilitation

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

0 0.25 0.5 0.75 1 KM

Scale 1:45,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 19/03/2020	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. SuansriR	DATE.	DATE.	

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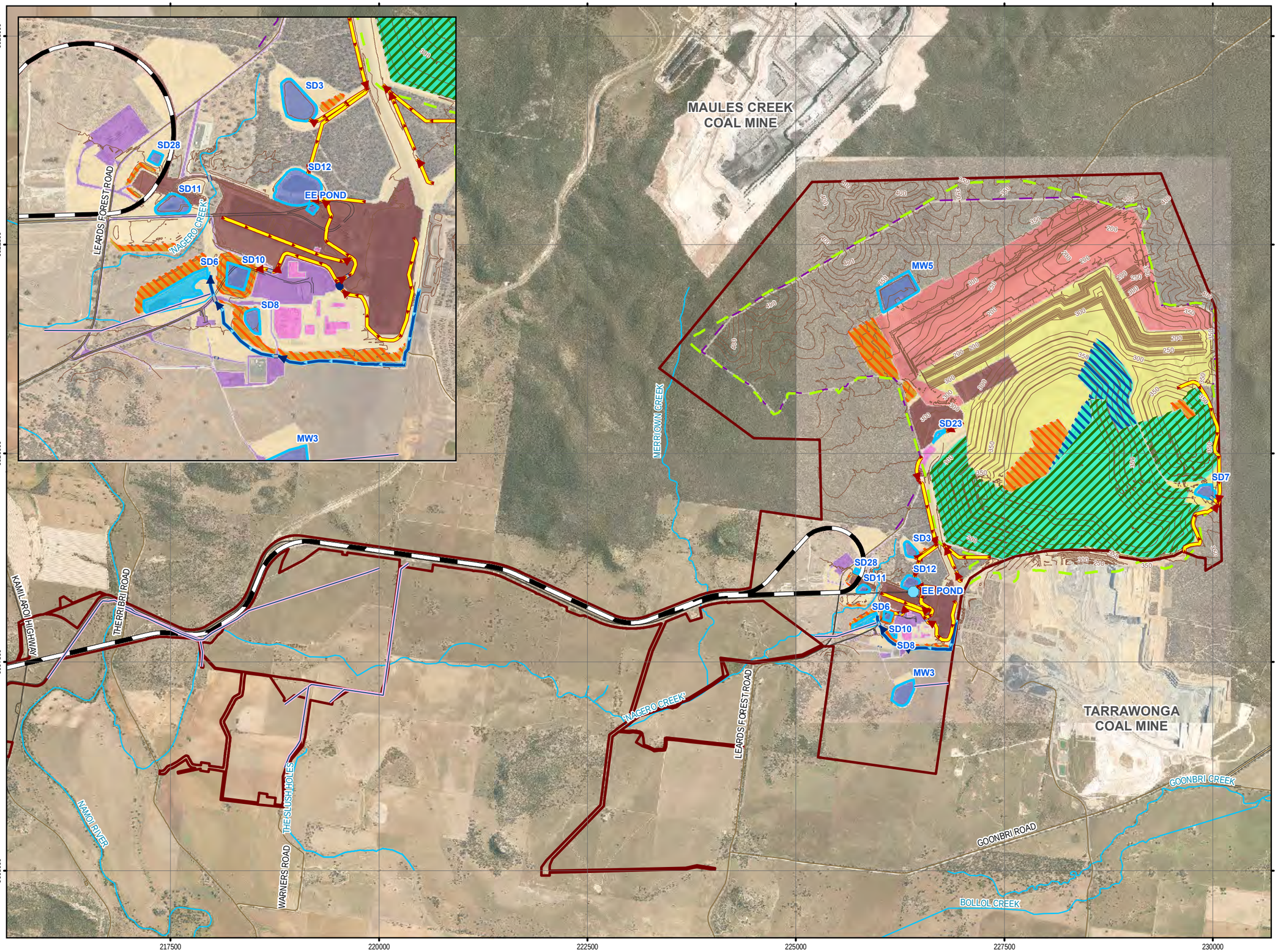

- Emergency tailings facility
- Water storage
- Rail Loop
- Fence
- Local roads
- Waterway
- Project Approval
- Federal Approval
- 2023 10m contour

Rehabilitation phases

- Rehabilitation establishment
- Rehabiltation sustainability
- Temporay rehabilitation

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

0 0.25 0.5 0.75 1 KM

Scale 1:45,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (July 2017), BCPL (January 2015),

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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 19/03/2020	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. SuansriR	DATE.	DATE.	

Boggabri Coal Operations Pty Ltd

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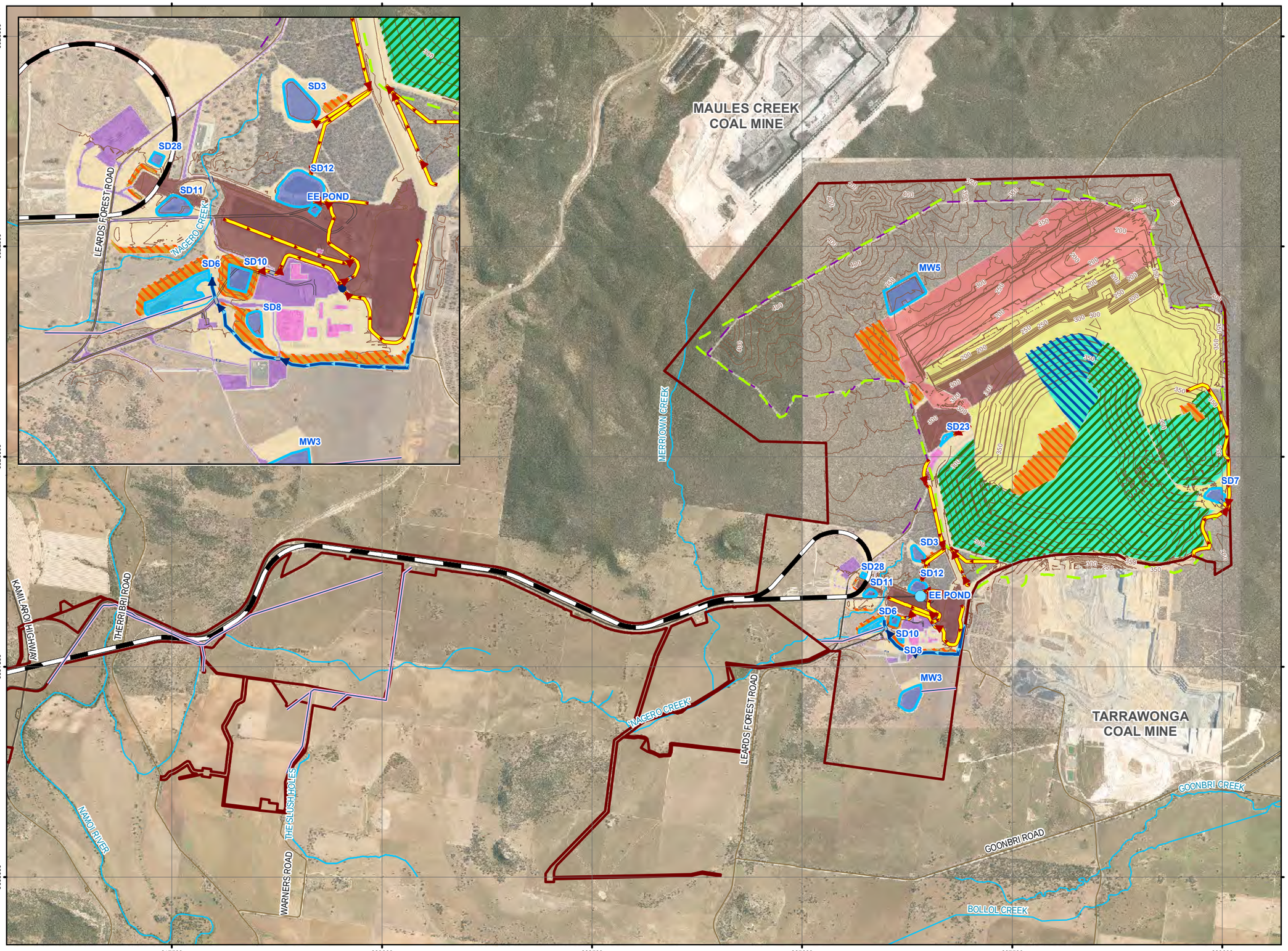

- Emergency tailings facility
- Water storage
- Rail Loop
- Fence
- Local roads
- Waterway
- Project Approval
- 2024 10m contour
- Federal Approval

Rehabilitation phases

- Rehabilitation establishment
- Rehabiltation sustainability
- Temporay rehabilitation

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

N W E S

0 0.25 0.5 0.75 1 KM

Scale 1:45,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (July 2017), BCPL (January 2015),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT.	NAME.	NAME.	PLAN NO. 3E
MINE TITLE. CL0368	MOP COMPLETION.	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR	TITLE. MINING AND REHABILITATION 2024
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 19/03/2020	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. SuansriR	DATE.	DATE.	

Boggabri Coal Operations Pty Ltd

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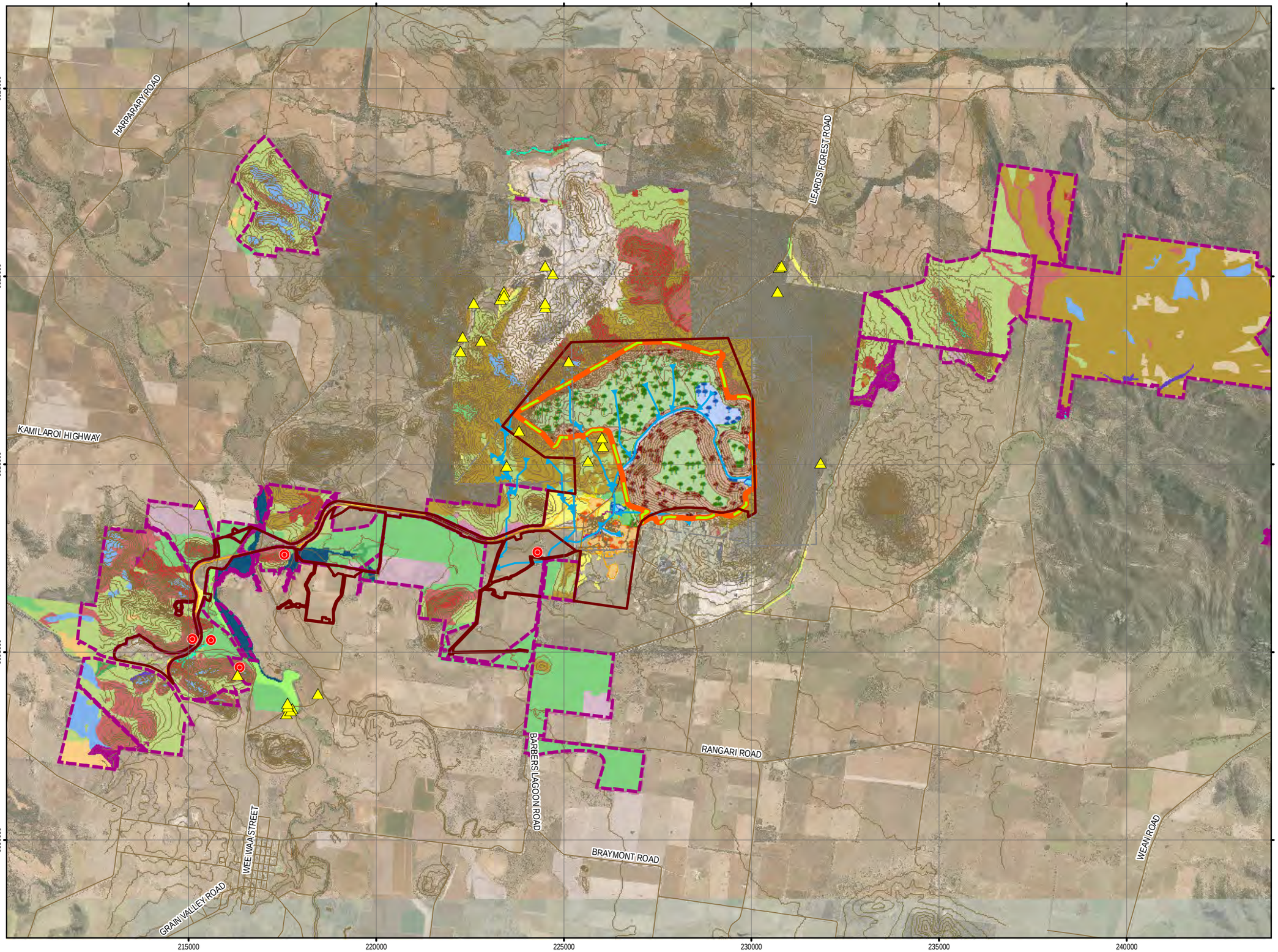

Culture Heritage Site
European Heritage Item
Final Water Storages
Mine tenement

Secondary domain

Riverine woodland
Shrubby woodland
Grassland / Pasture
Grassy woodland
Project Approval
BestImageryDates

Native vegetation (post-mining)

PCT not defined
PCT102 - Liverpool Plains grassland mainly on basaltic black earth soils, Brigalow Belt South Bioregion
PCT1118 - Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion
PCT1307 - White Cypress Pine - Silver-leaved Ironbark shrubby open forest of the Nandewar Bioregion
PCT1313 - White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion
PCT1329 - Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion
PCT1380 - Narrow-leaved Ironbark - pine - Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion
PCT1381 - Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion
PCT1383 - White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion
PCT27 - Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
PCT427 - Cypress pine - Tumbledown Red Gum low open woodland to grassland on rocky benches, mainly in the Nandewar Bioregion
PCT438 - River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion
PCT511 - Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion
PCT55 - Belah Woodland on alluvial plains and low rises in the central NSW wheat belt to Pilliga and Liverpool Plains region
PCT599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
PCT610 - Black Cypress Pine Dwyer's Red Gum low woodland/open forest on rocky ridges mainly on the Nandewar Range
PCT78 - River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
PCT84 - River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions
PCT88 - Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion

N
W E
S
0 1 2 3 KM
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Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data source: LPI2014 DTDB and DCDB
Imagery source: BCPL (July 2017), BCPL (January 2015), Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.
MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 10/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. SuansriR	DATE.	DATE.

PLAN NO. 4

TITLE. FINAL REHABILITATION AND POST-MINING LAND USE AT END OF PLANNING APPROVAL (2034)

Boggabri Coal Operations Pty Ltd

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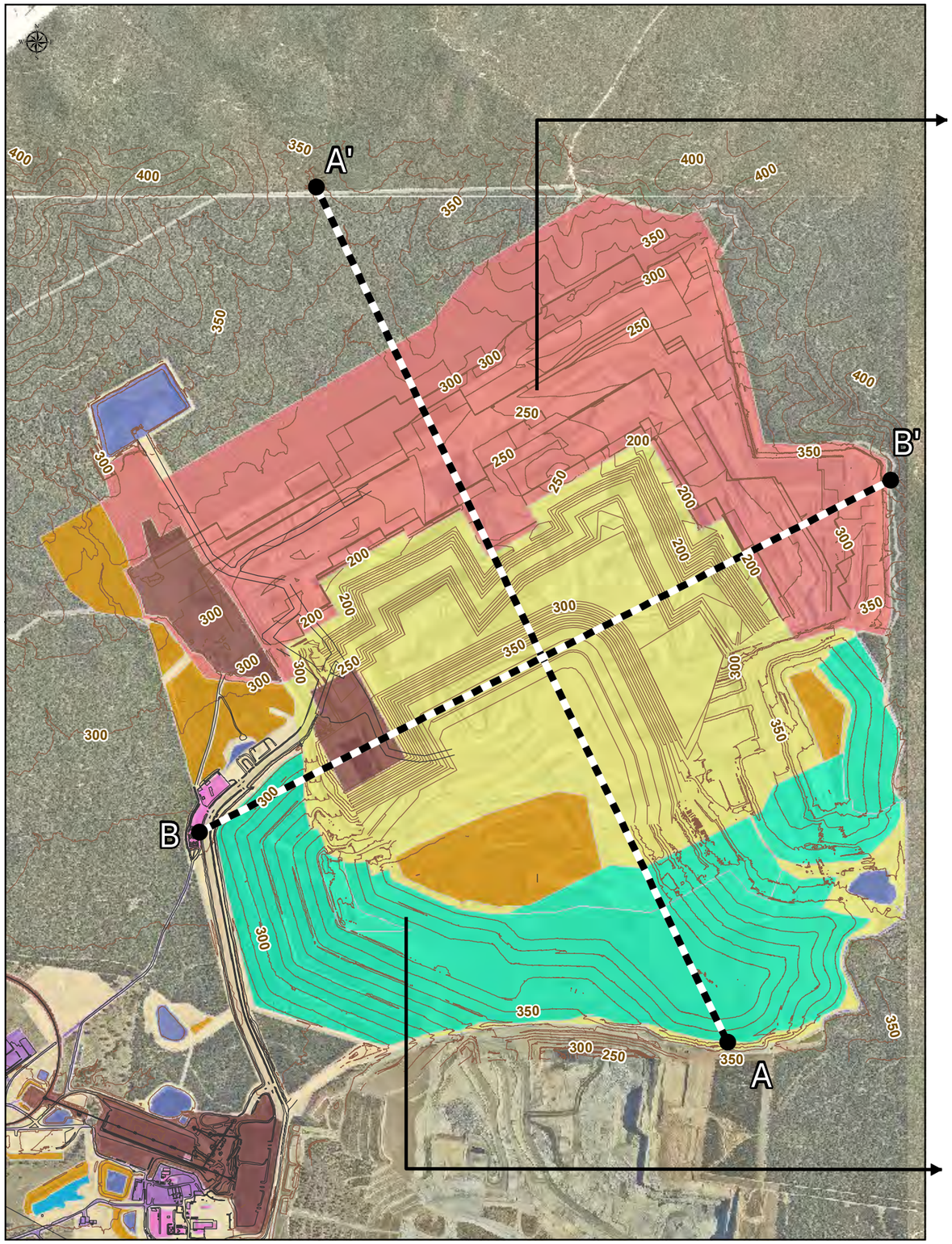

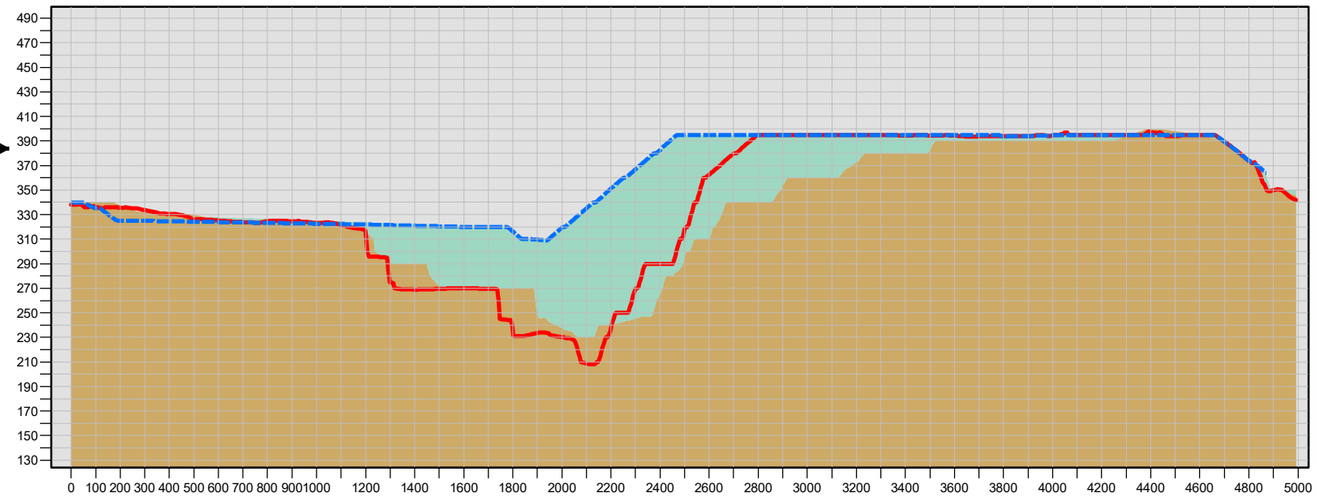

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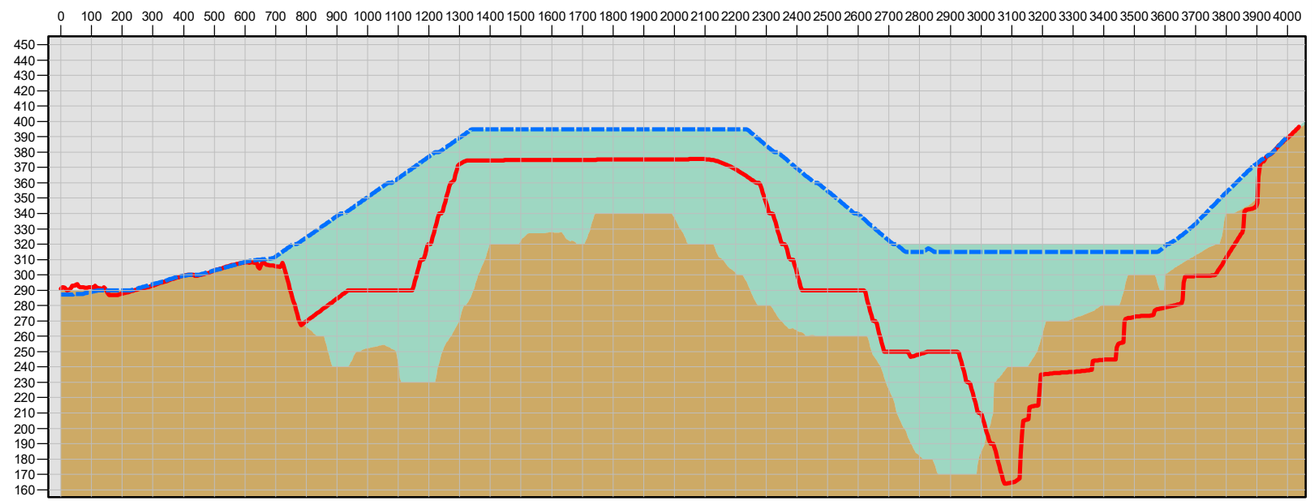

SECTION BB'
Vertical exaggeration: 5

Mine infrastructure

Cross section profile line

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

Cross section

- Final landform profile
- Mine pit profile
- Existing surface
- Final landform

Overview 1:25,000 0 100 200 300 400 M

Section AA' 1:25,000 0 100 200 300 400 M

Section BB' 1:20,000 0 100 200 300 M

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data Source: LPI DTDB and DCDB 2014
Imagery source: BCPL (July 2017),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.
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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 12/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.

PLAN NO. 5A

TITLE. FINAL REHABILITATION AND MINE PIT SECTION 2020

Boggabri Coal Operations Pty Ltd

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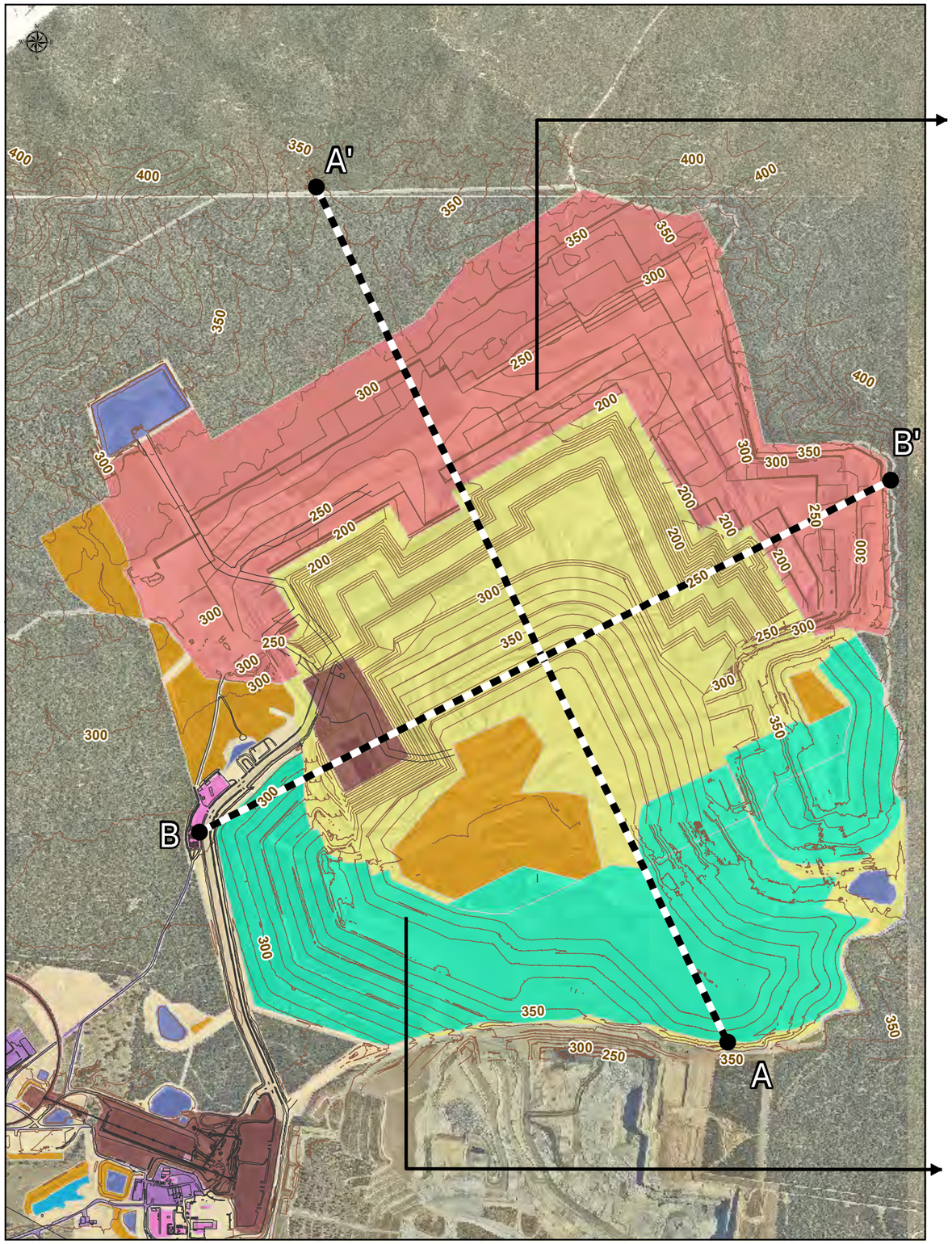

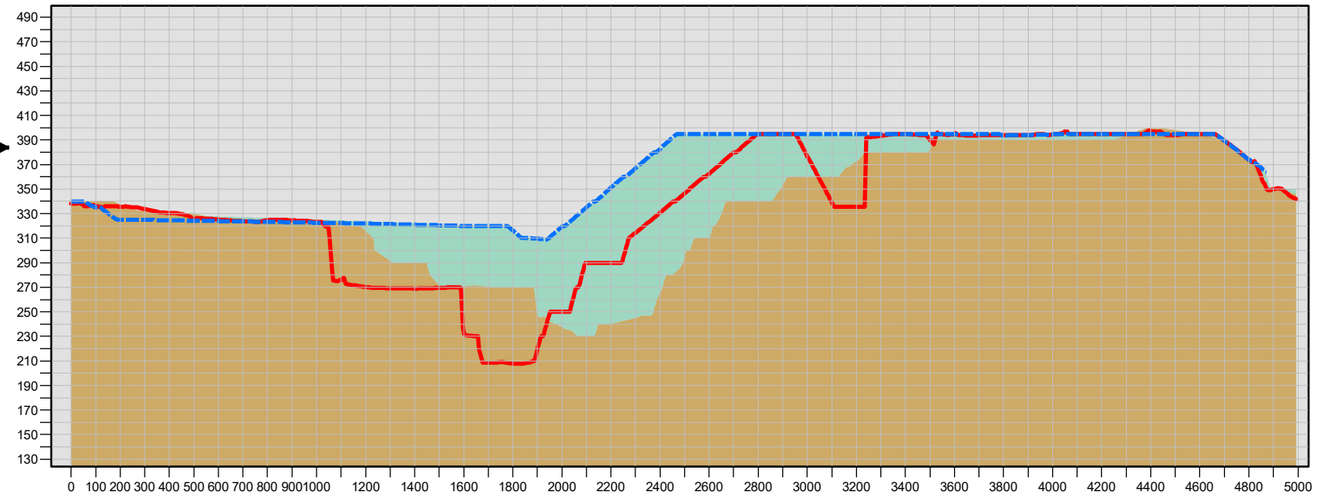

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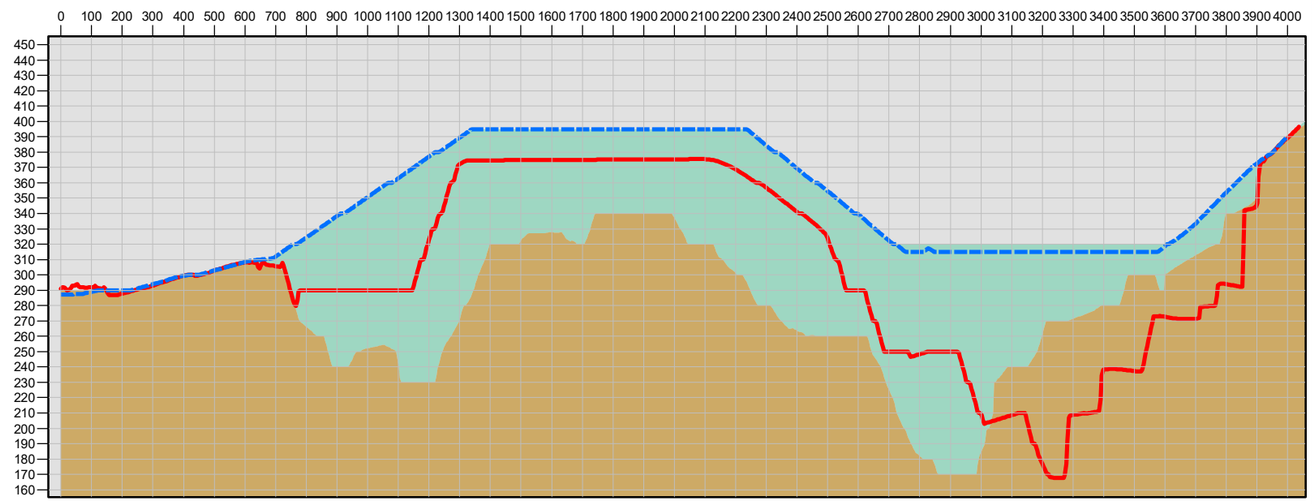

SECTION BB'
Vertical exaggeration: 5

Mine infrastructure

Cross section profile line

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

Cross section

- Final landform profile
- Mine pit profile
- Existing surface
- Final landform

Overview 1:25,000 — 0 100 200 300 400 M

Section AA' 1:25,000 — 0 100 200 300 400 M

Section BB' 1:20,000 — 0 100 200 300 M

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Data Source: LPI DTDB and DCDB 2014
Imagery source: BCPL (July 2017),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.
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LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 12/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.

PLAN NO. 5B

TITLE. FINAL REHABILITATION AND MINE PIT SECTION 2021

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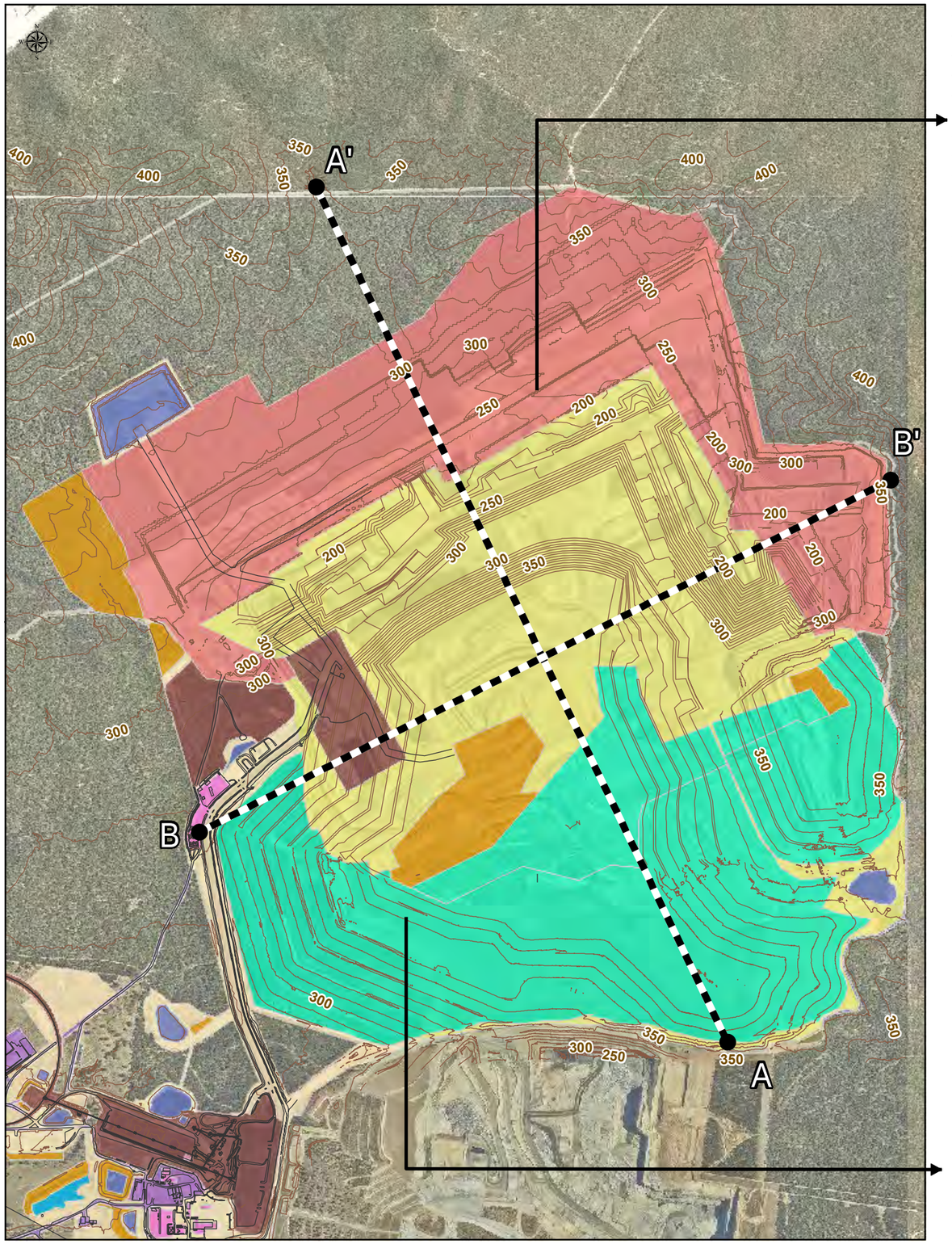

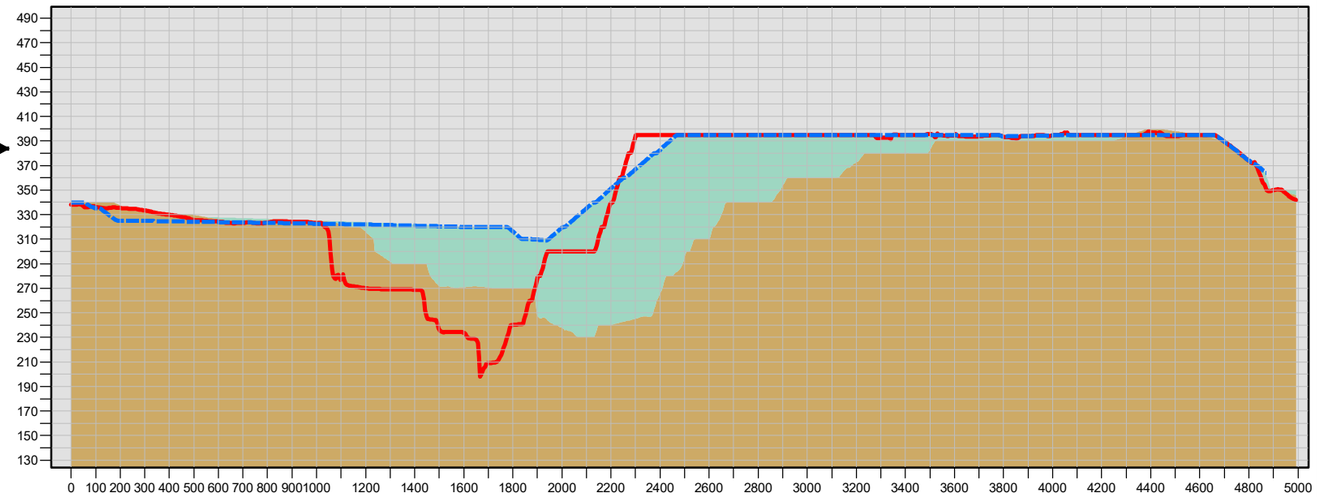

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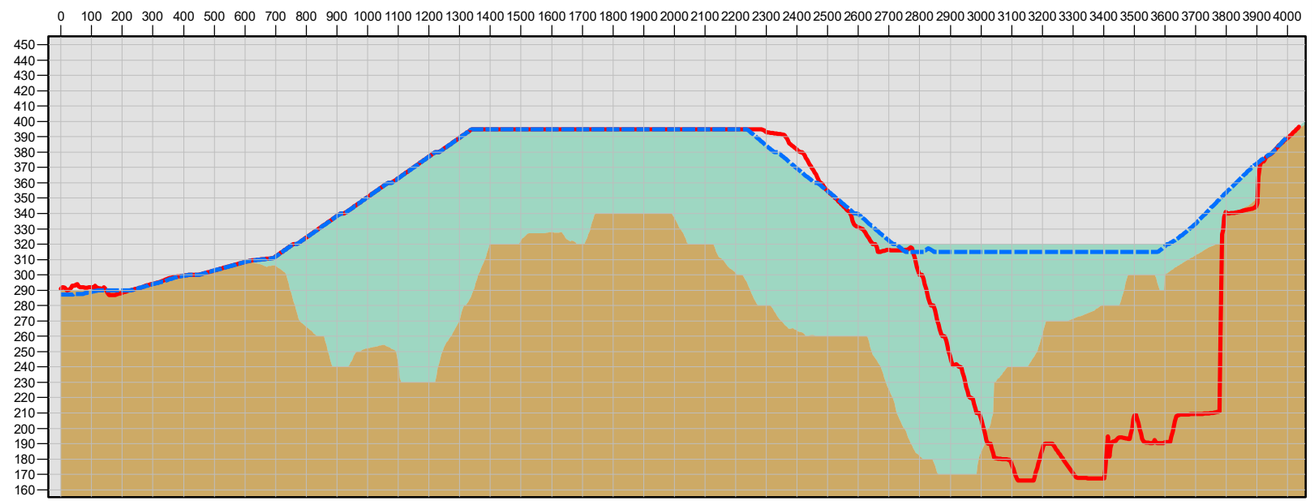


SECTION BB'
Vertical exaggeration: 5

Mine infrastructure

Cross section profile line

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

Cross section

- Final landform profile
- Mine pit profile
- Existing surface
- Final landform

Overview 1:25,000 0 100 200 300 400 M

Section AA' 1:25,000 0 100 200 300 400 M

Section BB' 1:20,000 0 100 200 300 M

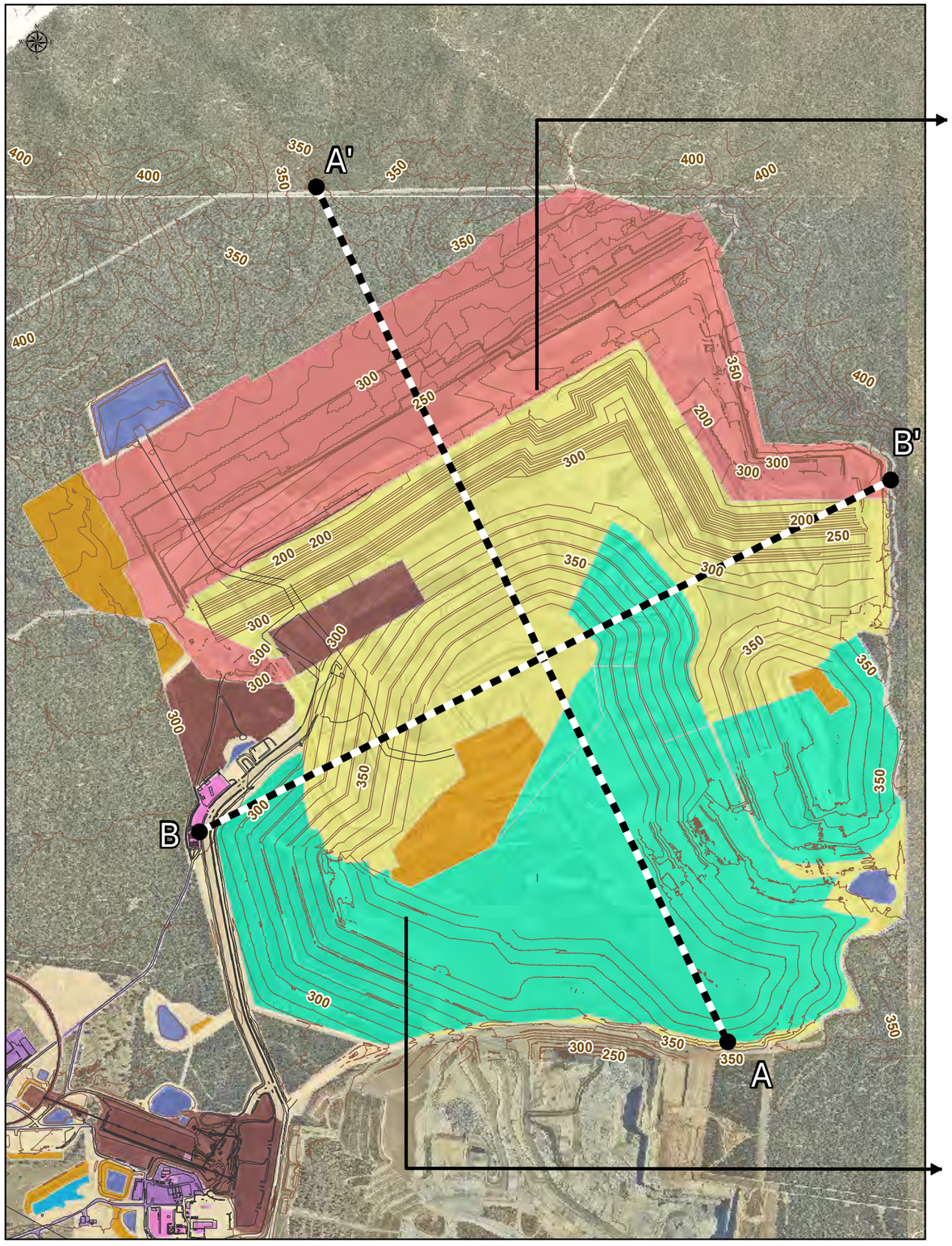
Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

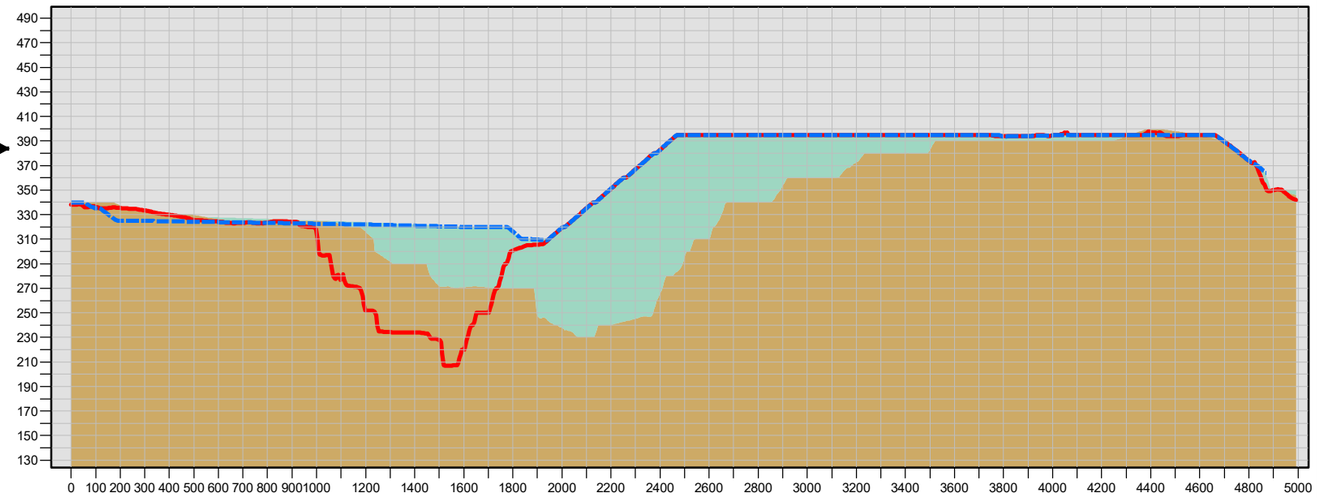
Data Source: LPI DTDB and DCDB 2014
Imagery source: BCPL (July 2017),

MINE NAME. BOGGABRI COAL MINE	MOP COMMENCEMENT. 1/01/2020	NAME.	NAME.
MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 12/12/2019	SIGNATURE.	SIGNATURE.
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.

PLAN NO. 5C

TITLE. FINAL REHABILITATION AND MINE PIT SECTION 2022





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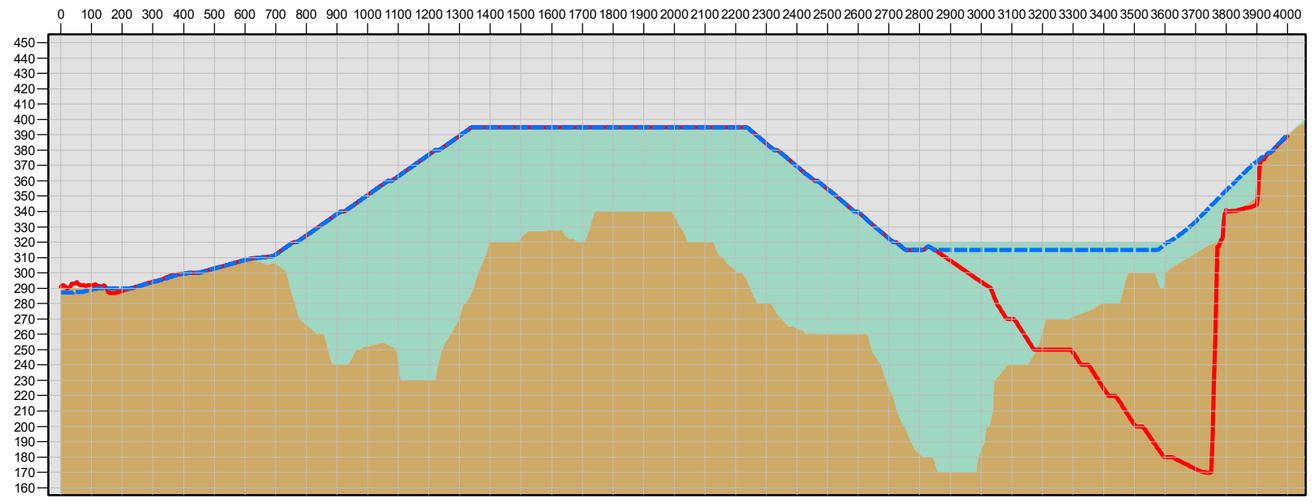

SECTION BB'
Vertical exaggeration: 5

Mine infrastructure

Cross section profile line

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
- Haul road/hardstand area
- Adminstration buildings, car parks, access roads
- Potential contaminated land

Cross section

- Final landform profile
- Mine pit profile
- Existing surface
- Final landform

Overview 1:25,000 — 0 100 200 300 400 M

Section AA' 1:25,000 — 0 100 200 300 400 M

Section BB' 1:20,000 — 0 100 200 300 M

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

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Imagery source: BCPL (July 2017),

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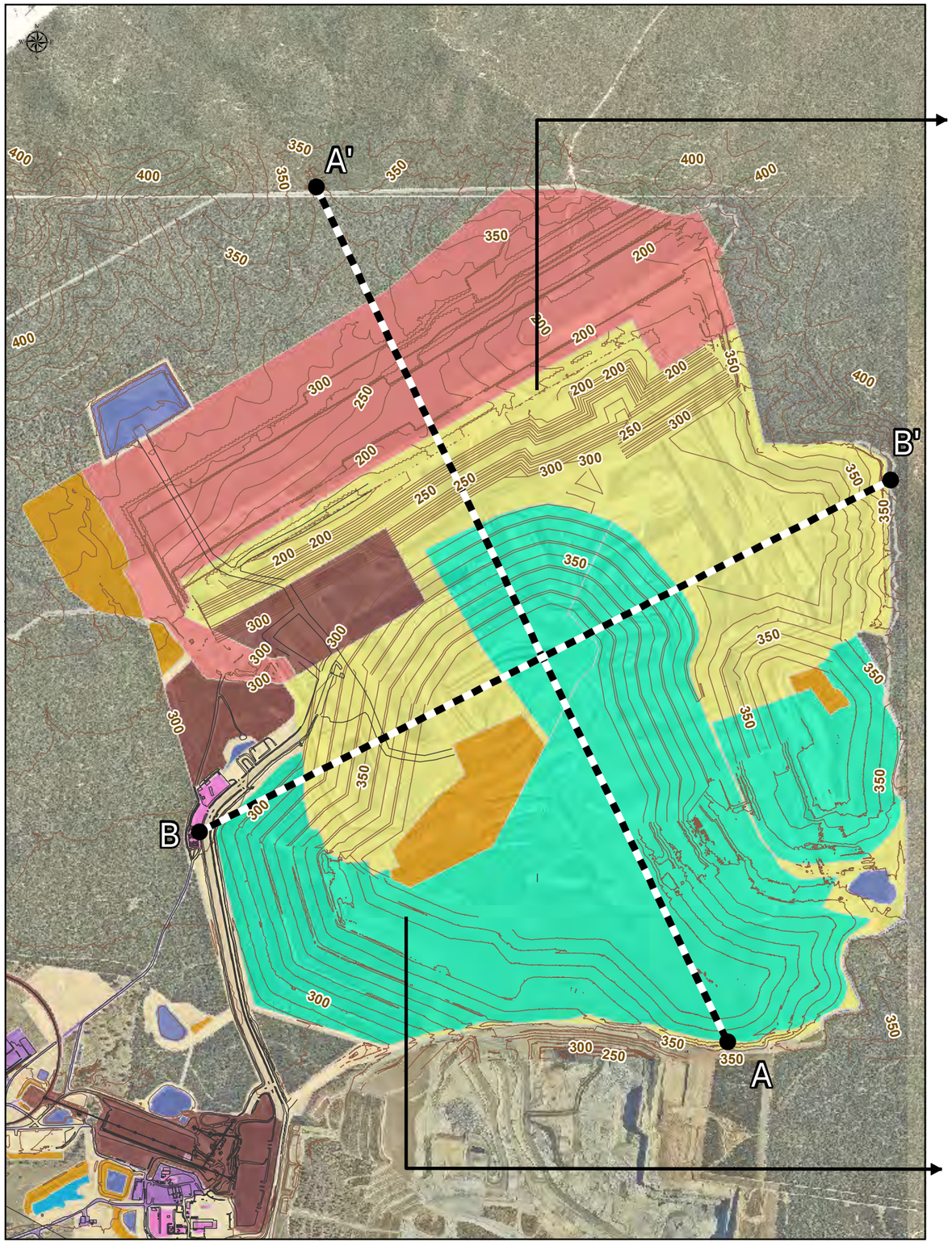
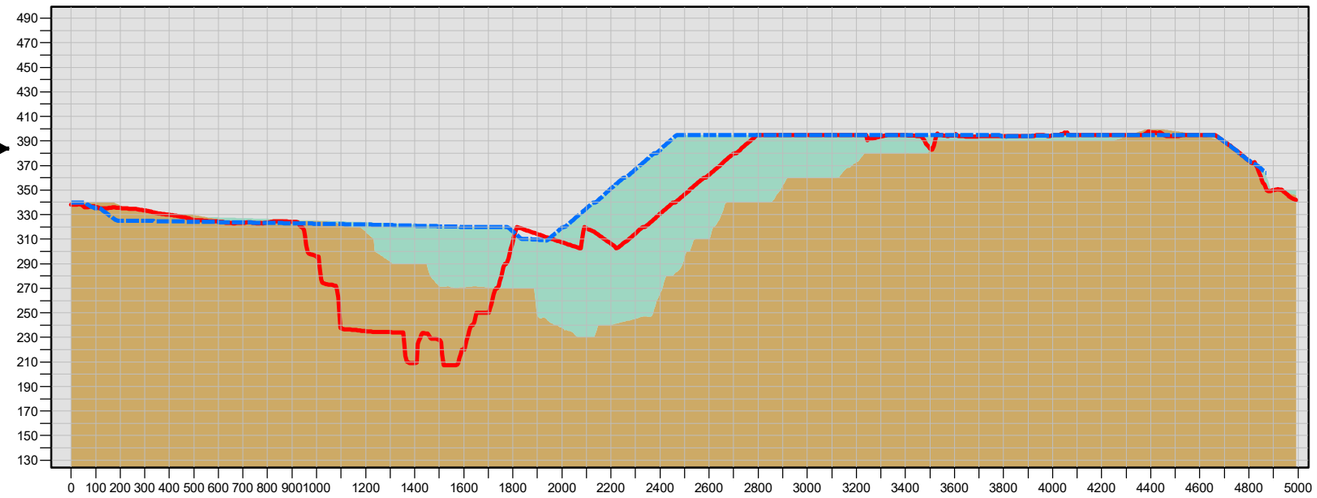
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 12/12/2019	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.	





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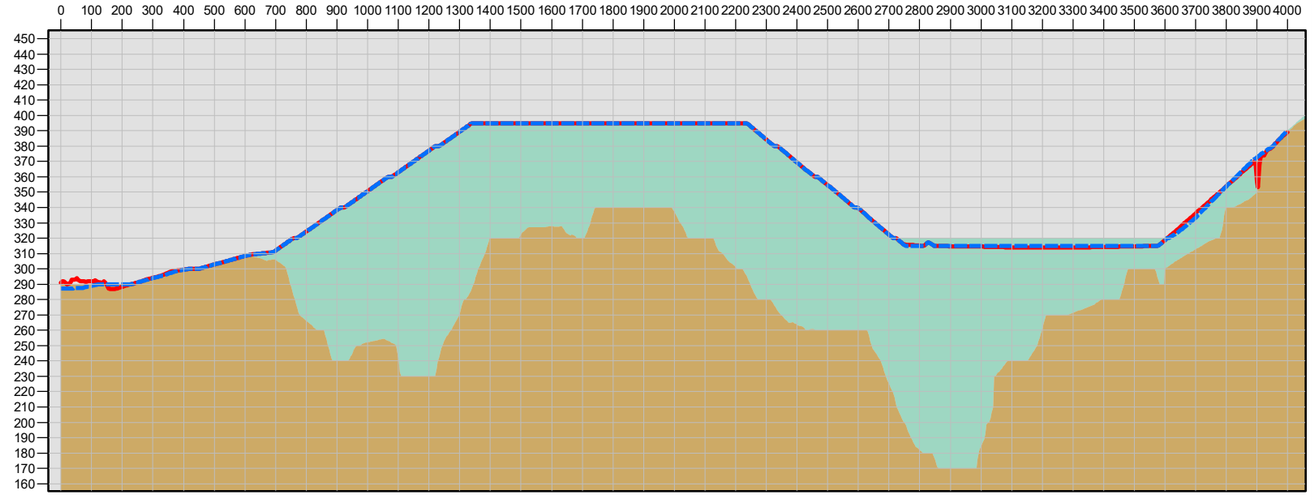

SECTION BB'
Vertical exaggeration: 5

Mine infrastructure

Cross section profile line

Primary domains

- Active mining area
- Overburden emplacement area
- Coal handling area
- Stockpile material
- Rehabilitation
- Clean water management system
- Dirty/contaminated water management system
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Data Source: LPI DTDB and DCDB 2014
Imagery source: BCPL (July 2017),

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MINE TITLE. CL0368	MOP COMPLETION. 31/12/2024	TITLE. GENERAL MANAGER BOGGABRI COAL OPERATIONS PTY LTD	TITLE. STATUTORY SURVEYOR	TITLE. FINAL REHABILITATION AND MINE PIT SECTION 2024
LEASE HOLDER. BOGGABRI COAL OPERATIONS PTY. LTD.	DATE. 12/12/2019	SIGNATURE.	SIGNATURE.	
MINE OPERATOR. BGC CONTRACTING	AUTHOR. suansrir	DATE.	DATE.	

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13. Comparison of MOP activities and BCM approvals

During agency consultation for development of the MOP (as described in Section 1.4), a request was made by the Resources Regulator to provide additional information within this document to demonstrate that the activities proposed within the term of the MOP are generally in accordance with those approved under Boggabri Coal's Federal and State approvals for the project. As such, Boggabri Coal has completed a review of relevant conditions contained within the EPBC approval (EPBC 2009/5256), Project Approval (PA 09_0812) and relevant EA commitments (Hansen Bailey, 2010), to compare approval requirements with proposed MOP activities and demonstrate compliance. The results of this comparison are presented in the following subsections. Where necessary, explanations and justifications regarding potential inconsistencies are also provided.

13.1 Progressive disturbance

13.1.1 Progressive disturbance requirements

Condition 6 of EPBC Approval 2009/5256 requires Boggabri Coal to submit to the Commonwealth Department of Environment and Energy (DoEE) for approval a Disturbance Limit Approach outlining progressive disturbance limits during Year 5, 10, 15 and 21 of operations. Boggabri Coal must ensure that progressive disturbance in advance of mining activities remains within the limits outlined in the Disturbance Limit Approach.

The latest Disturbance Limit Approach was submitted to DoEE in December 2019. The progressive disturbance proposed during the MOP term, excluding exploration drilling, is wholly within the disturbance footprint documented in the Disturbance Limit Approach.

13.2 Landform

13.2.1 Landform requirements

Landform requirements are outlined in Schedule 2, Condition 2 of the Project Approval. They have been reproduced as follows:

The Proponent shall carry out the project:

(a) Generally in accordance with the EA; and

(b) In accordance with the statement of commitments and the conditions of this approval.

Notes: The general layout of the project is shown in Appendix 1 and Appendix 2; and the Statement of Commitments reproduced in Appendix 5.

Conceptual landforms for Year 10 (2023) and Year 15 (2028) of operations, and the Conceptual Final Landform (2033) are outlined in the EA (Hansen Bailey, 2010). The Conceptual Final Landform is also reproduced in Appendix 9 of the Project Approval.

13.2.2 Consistency with landform requirements

The extent of mining, overburden emplacement and rehabilitation proposed during the MOP term is generally consistent with the corresponding conceptual mine plan outlined in the EA for the equivalent year of operations. Activities proposed in 2022 correspond with the Year 10 Mine Plan in the EA (i.e. Year 10 of operations since both the Project Approval and EPBC Approval 2009/5256 were granted).

Excerpts of the conceptual Year 10 Mine Plan from the EA and activities proposed during 2023 under the MOP are shown in Figure 13-1 and Figure 13-2 respectively. Key similarities and differences are summarised in Table 13-1.

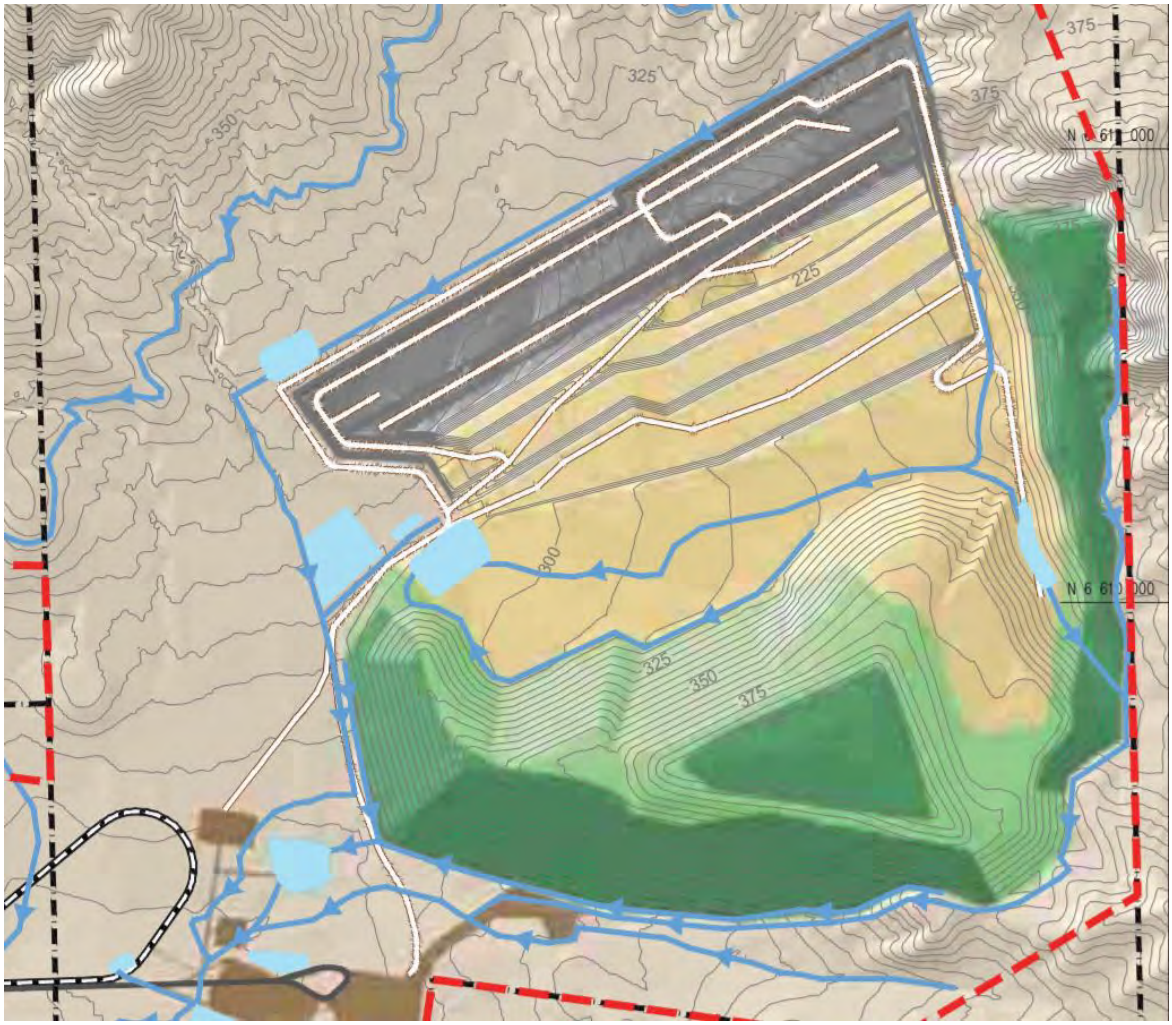

Figure 13-1 Conceptual year 10 mine plan from EA (Hansen Bailey, 2010)

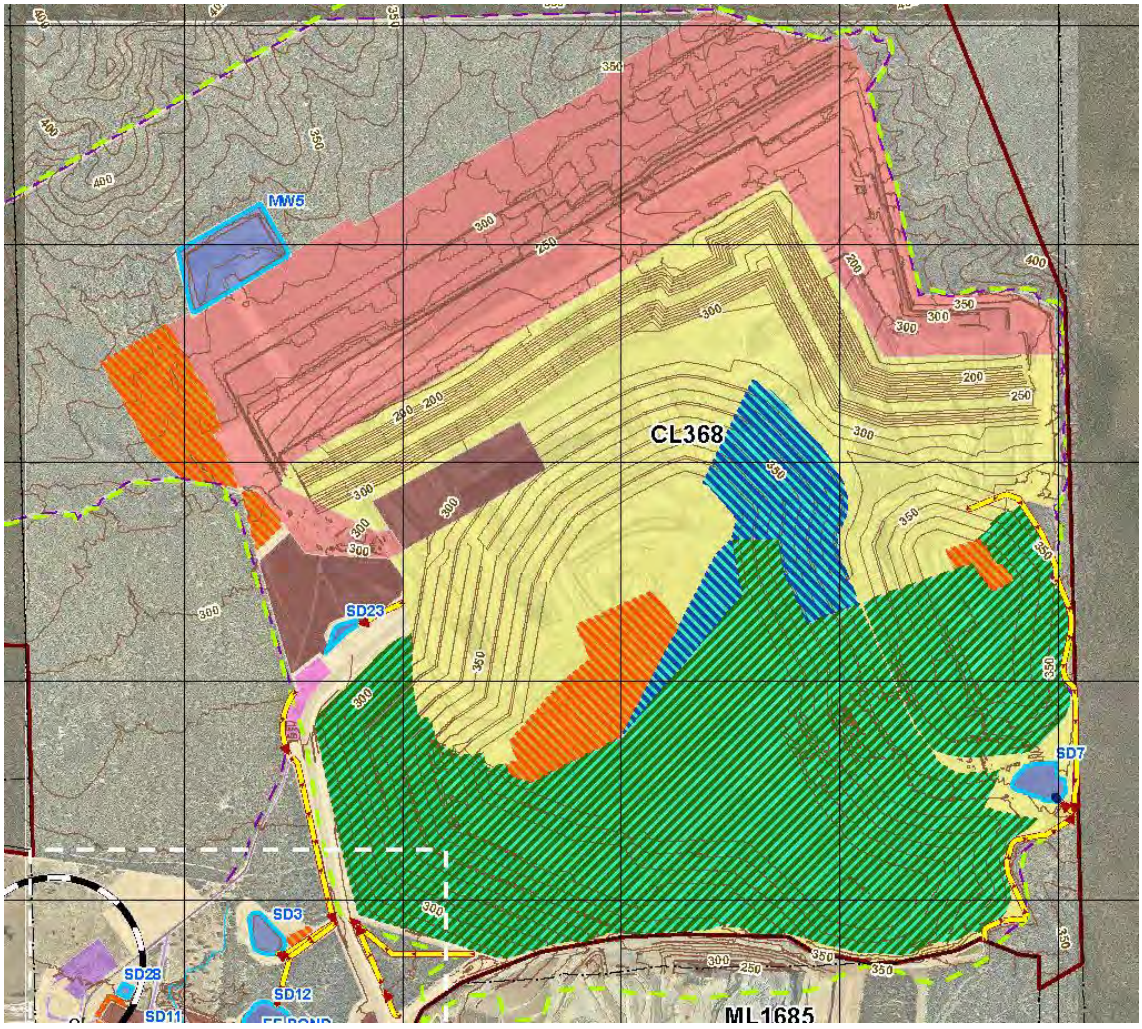

Figure 13-2 2023 Landform as per Plan 3D of MOP

Table 13-1 Comparison of conceptual year 10 mine plan and 2023 MOP landform

Aspect	Similarity	Difference
Active mining	Mining is generally progressing to the north	▪ The active mining area has progressed approximately 500 m further north-west on MOP Plan 3D compared with the conceptual Year 10 landform figure. ▪ On MOP Plan 3D, mining is still being undertaken in the E pit towards the east. Additional economic reserves have been identified within the project boundary in this area and will be recovered through the course of the MOP term while being progressively back filled. ▪ The north-western limit of the active mining area shown in MOP Plan 3D is located approximately 400 m further to the north-west than the limit of mining shown in the conceptual Year 10 Mine Plan.
Overburden emplacement	▪ The overburden emplacement area is shaped such that the final landform will be able to be constructed with a central drainage line that will be able to be rehabilitated with riparian woodland consistent with the target post-mining ecological community. ▪ The overburden emplacement is generally characterised by a raised area to the south and east, intersected by the central drainage line.	▪ On MOP Plan 3D, overburden emplacement has not been progressed to facilitate construction of the central drainage line in readiness for rehabilitation. ▪ Overburden emplacement on MOP Plan 3D would also shift the central drainage line slightly to the north of the central drainage line shown in the conceptual Year 10 landform figure. This would have little to no impact on the ability of the site to establish a safe, stable, self-sustaining rehabilitated drainage line, as the slope lengths would be similar and the channel gradient would remain within the required limit (less than or equal to 1 degree slope).
Rehabilitated landform	▪ Rehabilitation along the southern slope of the western and southern overburden emplacement area has been completed. ▪ The final rehabilitated landform is at a maximum RL of 395m.	▪ Rehabilitation along the eastern emplacement has not been as far progressed to the north on MOP Plan 3D compared with the conceptual Year 10 landform figure. This is due to the extraction of coal in the eastern portion of the active mining area. ▪ The area of land at an RL of 395m is slightly larger and located further to the north and west under on MOP Plan 3D compared with the conceptual year 10 landform. This has little impact on the ability of BCOPL being able to establish the target vegetation communities within the rehabilitation area. .

13.3 Final void

13.3.1 Final void requirements

Final void requirements are outlined under Schedule 3, Condition 72 of the Project Approval. These requirements are reproduced as follows:

Schedule 3, Condition 72

The Proponent shall prepare and implement an updated Final Void and Mine Closure Plan (as a component of the overall Rehabilitation Management Plan required under Condition 71 of Schedule 3) to the satisfaction of Resources Regulator. This plan must:

(a) be submitted to Resources Regulator by the end of December 2025;

(b) address future stability of the proposed landforms, long term groundwater recovery and void groundwater quality characteristics;

(c) include a detailed assessment of the hydrochemistry, hydrogeology and hydrology components of the final void and landform design that has been subject to independent review and verification by suitably qualified, experienced and independent person/s whose appointment has been approved by the Secretary;

(d) demonstrate that:

(i) The long term landform will not generate a pit lake;

(ii) Emplaced spoil has the capacity to drain to the natural environment; and

(iii) Drained waters do not adversely affect the downstream environment

(e) identify opportunities for integrated mine planning with adjoining mines to minimise environmental impacts of the final landform.

13.3.2 Consistency with final void requirements

The revised conceptual final landform illustrated in MOP Plan 4 (refer to Section 12) has been developed with consideration of the mining and overburden emplacement activities proposed during the MOP term. As mining progresses, this conceptual final landform will continue to be modified to account for the inherent variability in the mine plan. Nonetheless, the key requirements of the final void, as stated above in Section 13.3.1, will continue to underpin future iterations of the landform to ensure they are able to be met.

The mining and overburden emplacement activities proposed within this MOP term are unlikely to substantially alter the characteristics of the final void shown in the conceptual final landform figure in the EA and Project Approval. This is due to the following:

- The orientation of mining activities at the end of the proposed MOP term remains generally consistent with what is described in the EA
- The eastern and western limits of the extraction area remain generally consistent with those described in the EA.
- The target coal seams are consistent with those described in the EA.

- The overburden emplacement and rehabilitation activities proposed within the term of the MOP are not within the final void area shown on the conceptual final landform figure in the EA.
- Following the cessation of mining activities, dewatering of the open pit will not be required and a slow recovery in groundwater levels will occur.
- The final landform will be free draining.
- The final void will be backfilled to an RL of 285 m, where the ground surface will be above the pre-mining groundwater level of approximately RL 283 m. This backfilling will prevent the surface pooling of groundwater in the void as the reshaped ground surface will be above the groundwater level. A depression will remain in the area of the final void after backfilling, which may accumulate some runoff; however, this will have very limited connectivity to the underlying aquifer.

The conceptual final landform is shown below in Figure 13-3. This landform is also presented in cross-section in Figure 13-4.

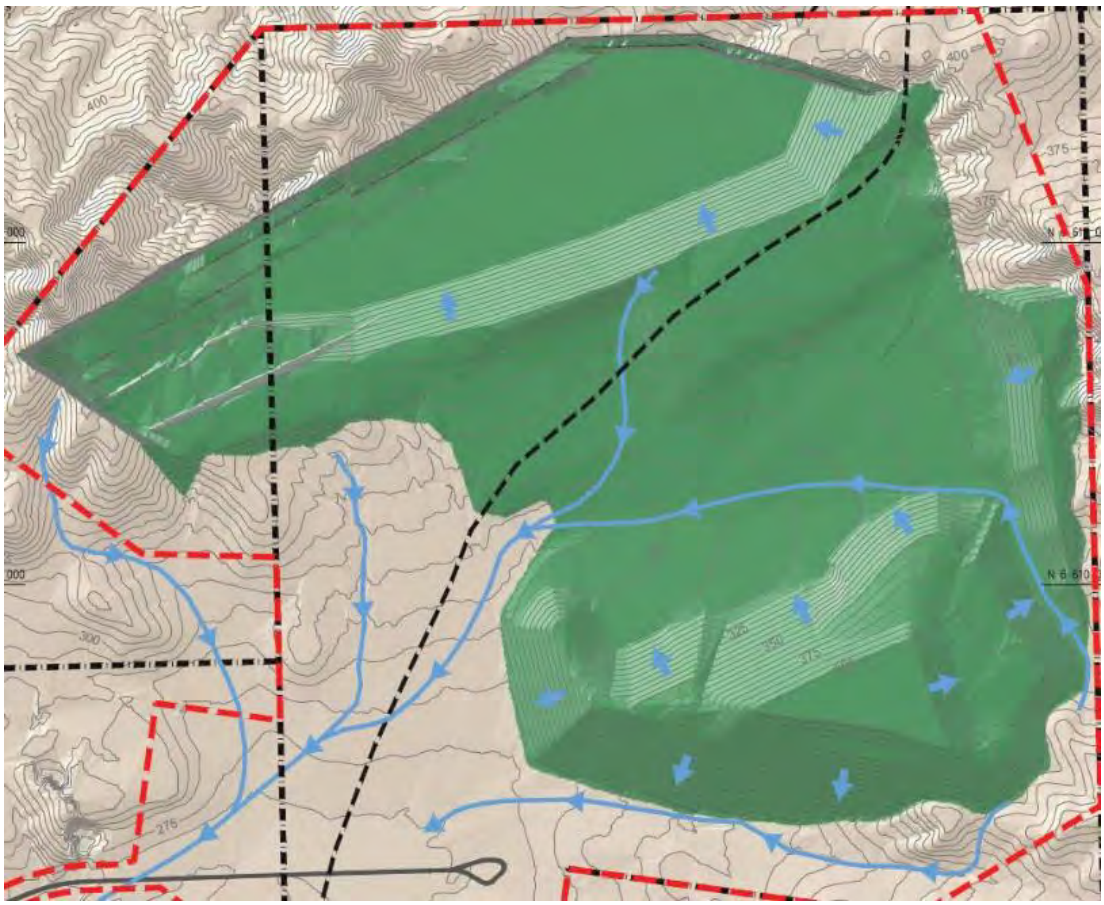

Figure 13-3 Conceptual Final Landform from EA (Hansen Bailey, 2010)

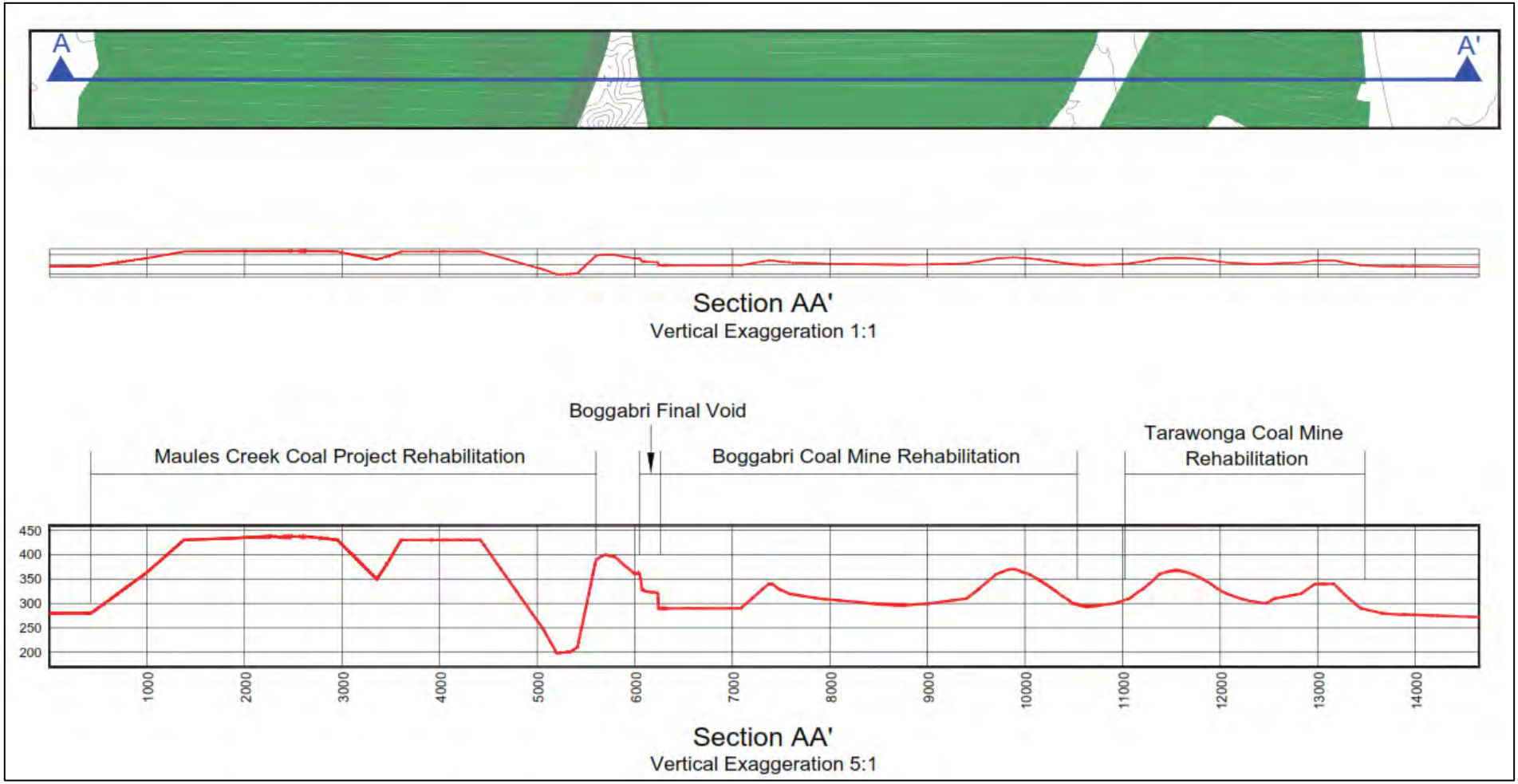

Figure 13-4 Cross-section of Maules Creek, Boggabri and Tarrawonga Coal Mine Final Landforms (Hansen Bailey, 2010)

13.4 Water management

13.4.1 Water management requirements

General requirements for water management are outlined in Schedule 3 Condition 35 of the Project Approval. This condition is reproduced as follows:

Schedule 3, Condition 35

The Proponent shall ensure that all surface water discharges from the site comply with the discharge limits (both volume and quality) set for the project in any EPL.

13.4.2 Consistency with water management requirements

The activities proposed within the MOP term are unlikely to influence the likelihood of unlicenced discharges from site occurring compared with the pre-MOP environment. The proposed landform changes will not significantly influence the size of catchments reporting to existing sediment dams.

Surface water quality is expected to remain within the range of historical pollutant concentrations. All in-pit ROM stockpiles will be located in areas where runoff reports back into the active mining area (i.e. coal-contact water catchments) and runoff from dirty water catchments will be from areas containing material of a similar physico-chemical characteristics to what is currently on site.

Similarly, the proposed landform changes within the MOP term are expected to have a negligible impact on the current and forecast site water balance. There will be an increase in pit-water make as a result of the progression of mining activities; however, this increase is commensurate with long-term predictions. There may also be a negligible increase in runoff as a result of increased gradients in some areas of the overburden emplacement area which are associated with the landform variations described above in Section 13.2.

Impacts to groundwater are expected to remain within the range of predictions made in the EA. This is due to the following:

- Target coal seams are consistent with those assessed in the EA.
- Proposed disturbance is within the footprint described in the EA.
- Groundwater management activities will continue to be as per those described in the GMP.

13.5 Rehabilitation

13.5.1 Rehabilitation requirements

Schedule 3, Condition 39, Condition 69, and Condition 70 of the Project Approval and additional commitments made in the EA (Hansen Bailey, 2010) outline the general requirements for rehabilitation of the BCM. These are reproduced as follows:

Schedule 3, Condition 39

The proponent shall implement the Biodiversity Offset Strategy described in the EA, summarised in Table 15 and shown conceptually in Appendix 7, to the satisfaction of the Secretary.

Table 15: Summary of the Biodiversity Offset Strategy

Area	***Offset Type***	***Min. Size (ha)***
Rehabilitation Area	*Except for the area of the final void, pre-mining native vegetation communities are to be re-established for a biodiversity conservation land use object, with the area subject to finalisation of the rehabilitation management plan as required under this approval.* *Note: the final mix and area of native vegetation communities is subject to the approved Biodiversity Management Plan and Rehabilitation Management Plan.*	*1,508*

Schedule 3, Condition 69

The Proponent shall rehabilitate the site to the satisfaction of Resources Regulator. This rehabilitation must be generally consistent with the proposed Rehabilitation Strategy described in the EA (and depicted conceptually in Appendix 9) and comply with the objectives in Table 16.

Table 16: Rehabilitation Objectives

Feature	***Objective***
Mine site (as a whole), including the final void.	*Safe, stable and non-polluting* *Minimise the size and depth of the final void as far as is reasonable and feasible and ensure that the void contains no retained surface water (i.e. no pit lake).* *Constructed landforms drain to the natural environment.*
Surface infrastructure	*To be decommissioned and removed, unless the Resources Regulator agrees otherwise.*
Other land	*Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of:* • *Local native plan species (unless Resources Regulator agrees otherwise); and* • *A landform consistent with the surrounding environment.*
Community	*Ensure public safety* *Minimise the adverse socio-economic effects associated with mine closure.*

Schedule 3, Condition 70

The Proponent shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies shall be imployed when areas prone to dust generation cannot yet be permanently rehabilitated.

Note: It is accepted that some parts of the site that are progressively rehabilitated may be subject to further disturbance at some later stage of the development.

EA Commitments

Approximately 437 ha of shrubby woodland community is proposed to be rehabilitated on the steeper slopes of the final landform. Approximately 1,019 ha of grassy woodland on the lower slopes and the flat top areas will be rehabilitated and 52 ha of riverine woodland are proposed to be rehabilitated within the existing and proposed drainage lines.

The EA also outlines conceptual cumulative rehabilitation targets for Year 1, Year 5, Year 10 and Year 21 of operations, as follows:

- Year 1 – 77 ha.
- Year 5 – 138 ha.
- Year 10 – 414 ha.
- Year 21 – 1166 ha.

13.5.2 Consistency with rehabilitation requirements

Rehabilitation targets

A comparison of EA and MOP vegetation communities and progressive cumulative rehabilitation targets is presented in Table 13-2.

Table 13-2 Comparison of EA commitments and MOP rehabilitation targets

Rehabilitation Target	Year 10 (2023)		Year 21* (2033)	
	MOP	EA	MOP*	EA
Cumulative Rehabilitation	462.9	414	1508	1,508
Shrubby Woodland	317.3	379	458	437
Grassy Woodland	131.3	35	900	1,019
Riverine Woodland	14.3	0	150	52

**Year 21 is beyond the term of the MOP.*

Target cumulative rehabilitation

The rehabilitation proposed during the MOP term will ensure the total rehabilitation area of 1508 hectares within the mining disturbance area (as required by Schedule 3, Condition 39 of the Project Approval) will remain achievable over the life of the mine. The progression of cumulative rehabilitation during the MOP term will also be generally consistent with the conceptual cumulative rehabilitation targets outlined in the EA (Hansen Bailey, 2010). As indicated above in Table 13-2, the progressive cumulative rehabilitation target for Year 10 of operations was 414 hectares in the EA. The cumulative rehabilitation target for Year 10 of operations (i.e. 2023) under the MOP is 462.9 hectares, which is 48.9 hectares greater than the conceptual target in the EA. Given the EA only outlined conceptual rehabilitation targets for Year 1, Year 5, Year 10 and Year 21 of operations, and the MOP term does not extend beyond 2024 (i.e. which represents Year 11 of operations) further direct comparison of proposed cumulative rehabilitation between the EA and MOP is not possible.

Target vegetation communities

The pre-mining vegetation communities referred to in the Project Approval will continue to be established. However, the relative proportions of each vegetation community are expected to change from those outlined in the EA. The EA outlined approximate revegetation targets of 437 hectares for Shrubby Woodland, 1,019 hectares for Grassy Woodland and 52 hectares for Riverine Woodland. Under the MOP, the target post-mining vegetation communities are 458 hectares of Shrubby Woodland, 900 hectares of Grassy Woodland, and 150 hectares of Riverine Woodland. This variance is due to the adaptive management practices that have been implemented at the BCM. The revised revegetation targets have been developed with consideration of the most suitable landform characteristics for each vegetation community and the landform variations that have occurred within the mining disturbance footprint since the EA (Hansen Bailey, 2010) was produced. The Shrubby Woodland communities will be established on the steeper upper slopes, the Grassy Woodland communities will be established on the gentle lower slopes, and the Riverine Woodland communities will be established within the existing and proposed drainage lines in the final landform.

Rehabilitated landform

Rehabilitation over the life of the mine will involve the creation of a safe, stable, non-polluting site, with a final void of minimal size and depth that contains no retained surface water. The final rehabilitated landform will be free draining and integrate with the surrounding catchments. Batter slope modelling indicates that the current design of a linear batter gradient of 10° (17.5%) and lift to a height of 20 m, initially constructed with diversion banks (berms), which are removed once target vegetation cover levels are achieved, is possible to provide a stable landform. The rehabilitated landform that will be established during the MOP term will meet all of these criteria.

The final landform will be progressively formed in the overburden emplacement area as described in the MOP and be shaped in a manner consistent with the landform design. Furthermore, BCOPL will work with adjoining mines to identify opportunities for integrated mine planning to minimise environmental impacts of the final landform.

13.6 Visual Amenity

13.6.1 Visual amenity requirements

Requirements for the management of visual amenity at the BCM are contained under Schedule 3, Condition 65 of the Project Approval and within the EA (Hansen Bailey, 2010). These requirements are reproduced as follows:

Schedule 3, Condition 65

The Proponent shall:

(a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the project;

(b) ensure no outdoor lights shine above the horizontal;

(c) wherever possible, ensure that mobile equipment is appropriately designed and/or retrofitted to prevent light being directed above the horizontal;

(d) ensure that all external lighting associated with the project complies with Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting or its latest version;

(e) provide for the establishment of trees and shrubs and/or the construction of mounding or bunding:

along the access road to the mine site;

along the private haul road;

along the Boggabri Rail Spur Line;

around the water storage dams; and

at other areas identified as necessary for the maintenance of satisfactory visual amenity;

(f) ensure that the visual appearance of all buildings, structures (including the rail spur bridge over the Namoi river floodplain and Kamilaroi highway), facilities or works (including paint colours and specifications) is aimed at blending as far as possible with the surrounding landscape.

to the satisfaction of the Secretary.

EA Commitments

Boggabri Coal will progressively rehabilitate the mining and OEAs to minimise visual impact.

13.6.2 Consistency with visual amenity requirements

The visibility of the BCM's mining operation is very limited. To the north, east and west the BCM is screened by the forested ridges of the Willow Tree Range. A number of prominent topographical features help screen the operation to the south-east and south-west. There are some limited views of the BCM from the Kamilaroi Highway, roadside rest area at Gins Leap, rural residents and some views from local roads. The mining void will not be visible to external views except from the sky.

The EA (Hansen Bailey, 2010) determined that visual impacts would be created predominantly by the establishment of the southern overburden emplacement area. Only the outer slopes of the southern overburden emplacement area were expected to be visible to some southern viewing locations with progressive rehabilitation reducing the visual effect. Visual effects on receivers were expected to eventually be reduced to low as rehabilitation progressed. Exposed areas of pre-rehabilitated overburden emplacement area were assessed as having a high contrast and low integration, however they were not expected to exceed 2.5% of the primary view, resulting in a moderate visual effect. If this level was exceeded, a high visual effect was expected to temporarily occur until rehabilitation was complete and the visual effect would subsequently reduce to low. The RL of 395 m for the southern overburden emplacement area was not considered visually significant due to its proximity to sensitive receptors and shielding from surrounding topography.

The landform proposed under the MOP involves a slight westward shift (by approximately 500 m) of the crest of the southern overburden emplacement area, with the maximum RL of the rehabilitated landform remaining at 395 m. Given the outer slopes of the southern overburden emplacement area will have been rehabilitated at the end of the MOP term, long-term visual amenity effects can be expected to remain as low. There may be some temporary moderate visual effects during the MOP term as rehabilitation is progressed. However, these can also be excepted to be limited to a small number of viewpoints to the south-west of the operation due to the screening provided by the Tarrawonga Coal Mine overburden emplacement area, which is located immediately to the south of the BCM's southern overburden emplacement area (refer to Plans 3A to 3E in Section 12). Furthermore, given the crest of the emplacement has shifted further to the north-west, those viewpoints located to the south of the operation can be expected to experience a slight decrease in visual amenity impacts due to the increased distance between them and the highest point of the overburden emplacement area.

13.7 Other potential impacts

During agency consultation in February 2017 for the previous MOP (covering activities from 2017 to 2021), DPE and Resources Regulator sought assurance that noise and air quality impacts during the MOP term would remain within the operational criteria for the project at relevant sensitive receptor locations. This assurance was sought in light of the proposed overburden emplacement activities during that MOP term and the potential for the resultant landform to influence air quality and noise impacts.

Similarly, the landform to be established during the 2020 to 2024 MOP term involves a shift in the crest of the dump to the north-west of the crest indicated in the Conceptual Final Landform figure in the EA (Hansen Bailey, 2010). As such, BCOPL has completed a desktop review of the sensitive receptors that could be impacted by the modified landform to provide Resources Regulator with the necessary assurance that noise and air quality impacts can be expected to remain within the operational criteria.

The majority of privately owned properties within the zones of affectation for noise and air quality impacts have been acquired by BCOPL or other mining companies within the BTM Complex. The nearest air quality and noise sensitive receptor in the direction of the proposed dump crest (the Roma property) is located at a distance of over 8 km from the BCM overburden emplacement area. At this distance, any increases in the magnitude of air quality and noise impacts at the sensitive receptor location can expected to be negligible. Furthermore, exceedances of noise or air quality criteria have never been recorded at that particular location. Monitoring activities undertaken over the past 12 months have indicated that impacts are typically negligible. If exceedances were to be recorded, the owners would have the right to request that BCOPL acquire their land in accordance with the relevant conditions of the Project Approval.

The remainder of noise and air quality sensitive receptors in proximity to the BCM overburden emplacement area are located to the east of the mining operation. Shifting the crest of the dump to the north-west would therefore increase the distance between overburden emplacement activities and each sensitive receptor location, which would likely reduce the magnitude of noise and air quality impacts.

The above assertions lead BCOPL to conclude that the activities proposed during the MOP term are unlikely to increase the magnitude of noise and air quality impacts at sensitive receptor locations in proximity to the BCM.

14. Review and implementation of the MOP

14.1 Independent audit

An audit will be commissioned by the BCOPL Environment Superintendent or delegate to ensure implementation of the MOP as a whole. Non-conformance issues and corrective action requests will be identified and formally documented in the audit process.

14.2 Review of the MOP

Review of the BCOPL MOP may be triggered by any of the following:

- Changes to construction methodologies, mining operations, equipment or design.
- A hazard, near miss, or incident.
- Outcomes of an internal or external audit.
- Changes to legislation or guidelines.
- Modifications to the Project Approval, mining leases, EPL or other relevant approvals.
- Impending expiration of the MOP term.

14.3 Implementation

Key management personnel and their relevant roles and responsibilities with regard to implementation of this MOP are detailed below in Table 14-1.

Table 14-1 Roles and responsibilities for implementation of the MOP

Role	Responsibility
BCOPL General Manager	Providing sufficient environment resources to ensure the effective implementation of environment management requirements, as outlined in this MOP.
BCOPL Mining Manager	Ensuring mining and rehabilitation activities are undertaken in accordance with the commitments in this MOP
BCOPL Health, Safety and Environment Manager	▪ Liaising with regulatory authorities regarding BCOPL's mining and rehabilitation management obligations as detailed in this MOP. ▪ Reviewing and updating all environment management documents referred to in this MOP. ▪ Ensuring all employees and contractors are aware of their environment management obligations in accordance with this MOP. ▪ Engaging specialist to undertake specific monitoring and environmental management activities in accordance with the commitments outlined in this MOP. ▪ Communicating the mining and rehabilitation requirements outlined in this MOP to all affected parties at BCM.
BCOPL Environmental Superintendent	Undertaking environmental management activities to facilitate compliance with this MOP as directed and instructed by the BCOPL Health, Safety and Environment Manager.
Mining Operator	▪ Implementing environment management obligations in accordance with the documents referred to in this MOP. ▪ Developing and implementing specific procedures for the employees and subcontractors under their responsibility as required to facilitate compliance with the documents referred to in this MOP. ▪ Ensuring all employees and subcontractors under their responsibility are aware of their environment management obligations. ▪ Providing relevant environment data to assist BCOPL with environment reporting.

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